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Report of the

"Study of the Biodiversity of Indian Institute of Technology Bombay Campus"

by

World Wide Fund for Nature -India,
Maharashtra State Office, Mumbai.

October, 2009.

Project Proponent
Dr. Goldin Quadros

Co- Investigator
Ms. Gauri Gurav

Field Coordinator
Mr. Kaustubh Bhagat

Field Team
Mr. Alok Chorghe, Mr. Aniruddha Dhamorikar, Ms. Kashmira Khot,
Mr. Manoj Nagarkar (Phase II & III)
Ms. Urvi Shah (Phase I)

Study commissioned by
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Abbreviations used in this report

Campus : Indian Institute of Technology - Bombay campus.
CL: Climbers
cm : centimeters
EP: Epiphytes
GR : Grasses
IIT-Bombay : Indian Institute of Technology - Bombay
IUCN: International Union for Conservation of Nature
m : meters
MSO : Maharashtra State Office
NT : Near Threatened
P1 : Phase one
PII : Phase two
PIII: Phase three
SH: Shrubs
SS: Scandent Shrubs
TR: Trees
TS: Tree saplings
U: Urban sector
U-1, U2, U3 : Urban Sub sectors
V: Vegetated sector
V-1, V2, V3, V4, V5 : Vegetated Sub sectors
WC: Woody Climbers
WPA,1972: Wildlife (Protection) Act 1972
WWF-India : World Wide Fund for Nature- India

The photographs used in this report have been contributed by the following individuals mentioned in alphabetical order.
Adesh Shivkar, Alok Chorghe, Amol Patwardhan, Aniruddha Dhamorikar, Bhavin Joshi, Gauri Gurav, Goldin Quadros, Kaustubh Bhagat, Ketan Phunguskar, Kamini Thakur, Manoj Nagarkar, Ninad Raut, Sameer Gurav, Sudhir Agashe, Urvi Shah.

A few photographs have been sourced through the free sites on the Internet.

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Acknowledgements

The study of the Biodiversity of IIT-Bombay campus has been a memorable experience which has helped me in reliving my research acumen while trying my bit at education, awareness and conservation. This apart from the innumerable findings about the campus diversity, would not have been possible if I was not encouraged and supported either directly or indirectly by many along the way. To begin with I would like to thank Prof. M.B. Patil who attended one of our Nature trails and suggested my then colleague Mr. Ninad Raut if WWF-India would help in studying the campus biodiversity. Surely, their enthusiasm and perseverance paid and WWF-India landed with the project getting consent from the IIT-Bombay Director Prof. A.Mishra; Dean Planning Prof. R. Mallik & Prof. Dr. K.V.K. Rao and the IIT-Bombay Environment Advisory Committee. The members of the EAC team were always cooperative, informative and also forgiving me for being late for most of the meetings. Here I would like to specially thank Prof. R. Manchanda for providing us with his wild life observations on the campus, and Prof. Inamdar for gladly sparing a clinometer which was of great help on the field till Prof. Patil provided us with the Garmin GPS.

The field work was a test of endurance for my entire team including the subject experts at times, however this experience was an enriching one because of the cooperation by the PRO - Ms.Jaya Joshi and the Campus Security team. During the study period the interaction with the UNESCO team also helped in looking into certain aspects of the campus biodiversity. I was also lucky to get help from unexpected quarters when I and my team were stuck up on the identification of Grasses. My Colleague from Kolahapur Mr. Suhas Waingankar introduced me to Dr. S. R. Yadav a member of the National Board for grasses, who along with his students from Kolhapur University went an extra mile and identified the grasses of the campus. My team member Alok also received invaluable help from the Blatter Herberium of St. Xavier's College. Mr. David Raju a friend of Aniruddha, was a generous resource providing the keys to the Odonates. Ms. Preeti Chogale of the CEC was always helpful in providing us references when I and my team were pushed to the wall. There are definitely many more who need to be thanked and with my short memory are unfortunately not getting a mention on this page, but I do apologise and request pardon.

To continue for a few more lines, this learning and growing experience would not have been possible if I was not encouraged by my organisations SG & CEO Mr. Ravi Singh who would always enquire on the status of the study and its findings, eager to learn of the study. I also thank my colleagues Ms. Prochie Gonda and Mr. Sridhar. Kadam for being available whenever help was sighted. I would be failing in my duty if I did not acknowledge my team members Ms. Gauri Gurav, Mr. Kaustubh Bhagat, Mr. Alok Chorghe, Mr. Aniruddha Dhamorikar, Ms. Kashmira Khot, Mr. Manoj Nagarkar and Ms. Urvi Shah for painstakingly collecting the field data at all odd hours. In addition Kaustubh continued and committed himself with dedication till the completion of the report. Most important are the family members of each team member who always trusted me on the job that I assigned to their ward. I am grateful to the subject experts who always contributed and went out of their way to complete the study. Lastly I would thank my family who supported me like always in this venture too.

Dr. Goldin Quadros
Education Officer &
Interim State Director.
WWF-India, MSO.

Synopsis

The studies of biodiversity have now assumed greater significance as ecologists try desperately to document global biodiversity in the face of unprecedented perturbations, habitat loss and extinction rates. With advances in science and technology, we are on the verge of understanding the natural world while at the same time in real danger of destroying it. The environment is larger and much more complex than any man-made machinery, and the consequences of system failure are thus more disastrous. Every human activity has some effect on the natural environment as a whole, and over the past few decades, there has been a growing recognition and concern that increasing economic activity and development carry environmental costs. Environmental trends such as urban congestion; increasing waste production and inadequacies of waste disposal; erosion; global warming and climate change; and pollution and ozone depletion—with consequent deterioration of landscape quality, loss of biodiversity and habitats and over-exploitation and depletion of resources—are all symptoms of environmental deterioration. Biodiversity is intrinsically valuable as a means of improving our understanding of the structure and functioning of ecological communities.

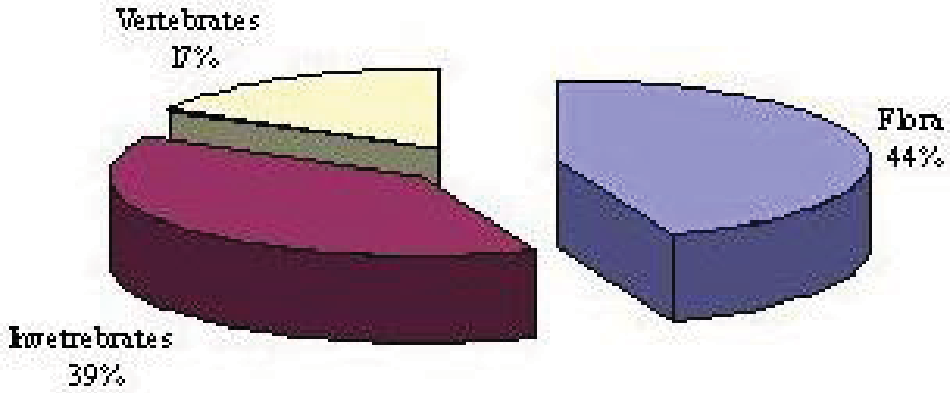
The IIT Bombay campus has rich and diverse ecological communities performing a variety of functions. This diversity has been modified at times and has tried to sustain it self in changing circumstances. Documentation of the biological diversity was lacking which prompted this study. The outcome of the study can be used constructively in planning sustainability of both man and natural environment.

The Study of biodiversity of IIT Bombay campus was conducted for a period of six months from September 2008 till February 2009. The study involved seasonal documentation of the flora and fauna for its abundance and distribution. The study involved 140 days of field visits to the campus covering an area of 566 acres. The Campus was divided into two main sectors viz. urbanized sector and vegetated sector. The Urbanized sector was further divided into three sub sectors based on the degree of construction work, while the Vegetated Sector was further divided into five sub sectors.

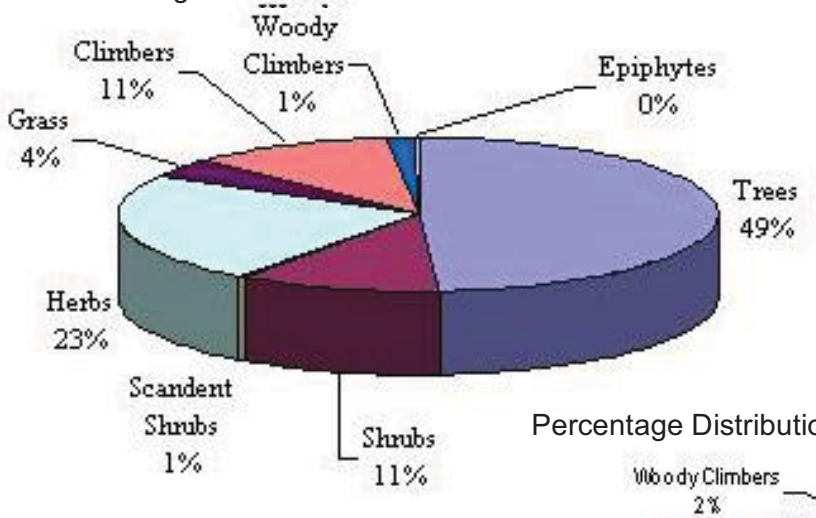
The total number of species observed during the period of study was 843; 44 % of which comprised of flora, 39% of invertebrate fauna and 17% vertebrate fauna. Among the flora the trees were dominant, while the insects and birds were the dominant invertebrate and vertebrate fauna. The comparison between the urban and vegetated sector revealed that the vegetated sector was more balanced than the urban sector. The campus has 84 alien species of which 17 are invasive species, most of whom were observed in the urban sector indicating their introduction in the campus. The campus also has 100 species of flora and fauna that are accorded protection status as per the different wild life laws. All these observations indicated that the campus has a rich biodiversity that is vulnerable to the human intrusion. In the six month duration of the study it was observed that out of 149 quadrants plotted to study flora, 30 quadrants measuring 10 x 10 m were cleared, while 34 (of 2 x 2 m) out of 178 faunal quadrants were cleared.

The IIT-Bombay campus is important not only from education point of view but also as a green lung. The campus being adjacent to the Sanjay Gandhi National Park was known to have several mega fauna visiting it but with fragmentation of habitat the visits have become sporadic. The campus can still support a lot of biodiversity but implementing conservation measures is the immediate need. Development is a necessary evil and will take place with time but one needs to recognize the potential of the campus as a green lung and carbon sink; if absolutely needed sustainability of the natural wealth should be given due consideration.

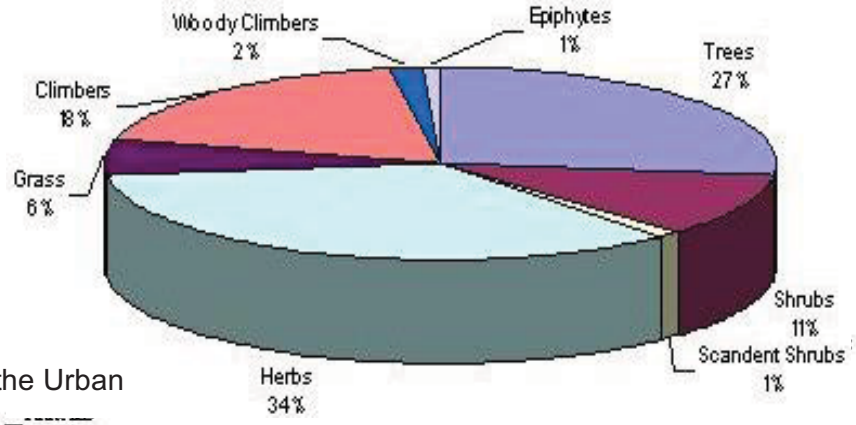
Percentage distribution of types of flora and fauna in the IIT-Bombay Campus.



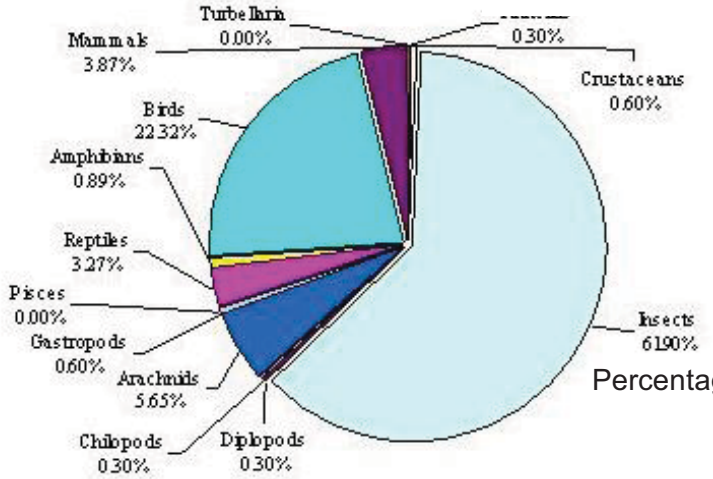
Percentage Distribution of Flora in the Urban Sector



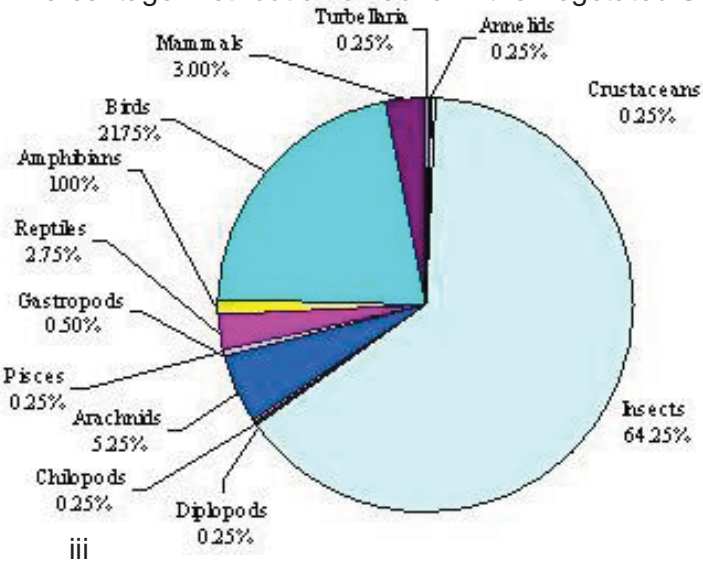
Percentage Distribution of Flora in the Vegetated Sector



Percentage Distribution of Fauna in the Urban



Percentage Distribution of fauna in the Vegetated Sector



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"Study of the Biodiversity of Indian Institute of Technology Bombay Campus"

INTRODUCTION

The Indian Institute of Technology – Bombay (IIT-Bombay) is situated on the lowest of slopes of the Western Ghats that is seen as a hillock. The IIT-Bombay is located about 25 kms from the Mumbai city and the landmark Powai lake is on the west side of the Institute. With a campus of over 566 acres, IIT – Bombay is considered as one of the Green educational institutes in Mumbai with a rich floral and faunal diversity.

The IIT-Bombay campus at Powai was the second of the institutes to be set up in the year 1958 extends over 200 hectares. It is situated in picturesque surroundings adjacent to the Sanjay Gandhi National Park, with Vihar and Powai lakes on either sides and green hills strewn around. The campus is now quite clean, green and has much less pollution compared to the rest of the city. The campus does claim to have maintained and increased its green cover than what it had 50 years ago in 1958.

The campus is frequently visited by several nature enthusiasts to observe the birds in the campus as well as the adjacent Powai Lake. Several academicians have found the campus a very informative and practical laboratory to study several floral aspects. However the drawback is the lack of proper documentation of the several components of the natural history on the campus. Although, there have been innumerable newspaper reports on the occurrence of several reptile, bird and mammal species, the findings have never been a part of any study report. To understand the significance of the existing biodiversity it is necessary to understand what is valued of the place and what are the benefits it provides and its relevance for the future. Biodiversity does influence the rates or nature of ecosystem processes, and a majority of studies have found that a reduction in biodiversity does have a negative effect on ecosystem function. Biodiversity provides a useful measure of the quality of the environment and of the probability of sustainability on which man depends.

The need to document and conserve the biodiversity of the campus prompted the IIT-Bombay' environment committee to commission the study of biodiversity of its campus to The World Wide Fund for Nature – India, Maharashtra State Office (WWF-India, MSO).

WORK METHODOLOGY

WWF-India, MSO conducted the "Study of biodiversity of IIT Bombay campus" for a period of six months from September 2008 till February 2009. The study involved seasonal documentation of the flora and fauna for its abundance and distribution. The study involved 140 days of field visits and the methodology undertaken to document is detailed below.

Area of Study:

The entire IIT- Bombay campus covers an area of 566 acres. The Powai Lake was not considered in the scope of study as it is not within the purview of IIT- Bombay. The Campus has been divided into two main sectors viz. urbanized sector and vegetated sector for the study (Plate 1).

The Urbanized sector is further divided into three sub sectors based on the degree of construction work. The three sub sectors are as follows:

1. **Highly Urbanized Area (U1):** This includes Academic Area, IIT Hospital, Institute Guest House, most part of Residential Area
2. **Devi Temple (U2):** This includes area from main gate up to Institute guest house including the Devi Temple and road along the Lake.
3. **Less Urbanized Area (U3):** This includes Hostel area, Hill side Colony and Sameer.

The Vegetated Sector is further divided into five sub sectors viz.

Soneri Baug (V1), Koldongri (V2), Hill Side (V3), Along pipeline (V4), Near Sameer (V5):

Methodology:

1. **Flora**:
   - **i.** **Trees**: The trees in the Urbanized Sector were enumerated by direct counting using census method. In the vegetated sector quadrant method (using 50m x 50m quadrant) was followed.
   - **ii.** **Herbs, shrubs, creepers, bryophytes and pteridophytes:** The study was carried out by

using quadrants of 10m x 10m size in the entire campus.

iii. The flora outside the quadrant were also listed for frequency of occurrence.

2. Fauna:

i. **Mammals**: The mammals in the campus were listed along with the frequency of occurrence for sighting, calls, scats/ fecal matter, track marks or other indirect signs as well as road kills along the transects as well as quadrant.

ii. **Birds**: The birds on the Campus were studied by frequency of occurrence for sighting, calls as well as other indirect signs and road kills along sectors.

iii. **Reptiles and Amphibians:** The reptiles and amphibians were studied by direct sighting and indirect signs like molts as road kills along transects as well as quadrants.

iv. **Insects**: The insects were studied using quadrant method using quadrants of size of 2m x 2m.
The Lepidopterons were noted for frequency of occurrence not only quadrants but also along transects.
The light trap method was used to study moths as wells as other nocturnal insects.
The other observations such as activity, habitat, various life stages as well as indirect evidences like molts were also noted.

v. **Spiders:** The spiders were studied using quadrant of size 2m x 2m as well as along transects.
The other observations such as activity, habitat, various life stages as well as indirect evidences like molts were also noted.

Other organisms (Crustaceans, Mollusks, Gastropods, other Arachnids and Arthropods): These were noted for frequency of occurrence not only quadrants but also along transects. The other observations such as activity, habitat, various life stages as well as indirect evidences like molts were also studied.

The quadrants marked to study the flora and fauna was kept fixed and marked by using **Garmin GPS 60**.

The north part of the campus beyond the pipeline could not be studied due to security reasons and lack of time.

Observations

Floral diversity

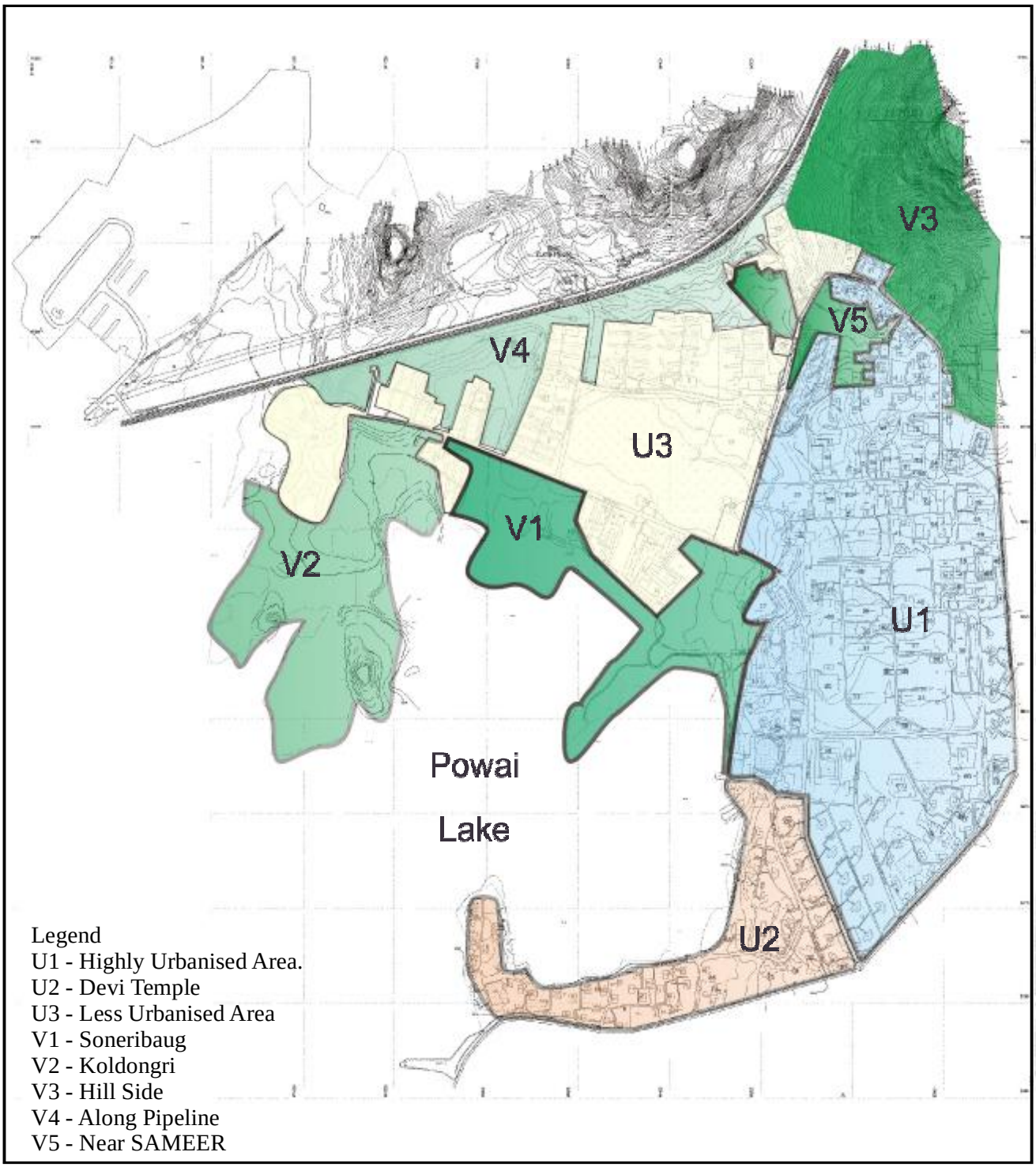
Life probably began on this planet about 3.5 thousand million years ago, it was not until about 450 million years ago that the first organisms colonized land. These were the earliest plants. Plants are autotrophic eucaryotes which have become adapted for life on land the only other autotrophic eucaryotes are algae which are specialised for life in water. The land based plants are of two types the seed bearing and non-seed bearing plants.

The non seed bearing plants are basically pioneers and include the non vascular (i.e. bryophytes, mosses, lichens, etc.) and vascular plants (pteridophytes). These plants are mostly found around moist habitats and reproduce through spores. The nonvascular plants are the ancestors of vascular plants and are the first land plants.

Most of the non-flowering seed plants, or gymnosperms, are conifers which include the world's tallest plant, the redwood, which attain heights of up to 117 meters and trunk diameters in excess of 11 meters. They also include the pines, firs, and hemlocks. The seeds of conifers are borne in cones. The cyads are palm-like in appearance and have typically large seeds that are also borne in cones. Cyads are found mainly in tropical and subtropical regions and may reach heights of 18 meters or more. One of the most dramatic innovations to arise during the evolution of plants was the seed. The survival value of the seed is probably responsible for the dominance of seed plants in today's flora. Seeds contain stored food, and can survive the ravages of time and many environments.

The angiosperms, or flowering plants, are one of the major groups of extant seed plants and arguably the most diverse major extant plant group on the planet, with at least 260,000 living species classified in 453 families (Judd et al., 2002; APG II, 2003). They occupy every habitat on Earth except extreme environments such as the highest mountain tops, the regions immediately surrounding the poles, and the deepest oceans. They live as epiphytes (i.e., living on other plants), as floating and rooted aquatics in both

Map 1: Study Area of IIT-Bombay



freshwater and marine habitats, and as terrestrial plants that vary tremendously in size, longevity, and overall form. They can be small herbs, parasitic plants, shrubs, vines, lianas, or giant trees. Furthermore, angiosperms are crucial for human existence; the vast majority of the world's crops are angiosperms, as are most natural clothing fibers. Angiosperms are also sources for other important resources such as medicine and timber. From the total plant species found across the globe, IUCN's Red List suggests that only 3 percent of all described plant species risk extinction currently — but logically, about 70 percent of *evaluated* species are threatened.

India has only 2.4 per cent of the world's land area, its share of the global species diversity is an impressive 8.1 per cent. That is what makes our country one of the 12 mega diversity countries of the world. Nearly 47,000 species of flowering and non flowering plants have been recorded from India. It is generally estimated that over 6000 plants in India are in use in traditional, folk and herbal medicine, representing about 75% of the medicinal needs of the Third World countries. Of the 15,000 flowering plants 4780 species are found in the Western ghats.

Non seed bearing plants

Bryophytes

Bryophytes comprise over 23000 species the world over, while approximately 2800 species are recorded in India. They contribute significantly to net primary production and influence vegetation-atmosphere exchange, particularly of water. Of more significance is the importance of bryophytes in the economy of nature their role as rock breakers, aids in soil conservation, and as plants which play an important part in tile development of vegetation. They are known to be sensitive to microclimatic variations and are directly related to the air moisture. Bryophytes are more diverse and competitive in humid climates and disappear if the dry periods prolong.

During the present study the bryophytes were not investigated in details but two species belonging to two families were observed through out the campus.

Pteridophytes

These are the first of the vascular plants but do not bear seed, they depend on water for reproduction. Of the global flora approximately 12,000 species of pteridophytes are recorded while India has 1200 species. They are restricted to damp, shady habitats. Pteridophytes are common in tropical rain forest where temperature, light and humidity are favorable.

Four species of Pteridophytes were observed in the IIT-Bombay campus, two species are unidentified. None of the species were common in the campus, except that *Adiantum* species was recorded in large numbers in the V3 sub sector along the hilly gradient. *Pteris* species was restricted to the V5 sub sector only in the vegetated sector.

Table 1 : Distributionand abundance of Bryophytes and Pteridophytes in the IIT-Bombay campus.

Sr. No.	Family	Genus	Habit	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Anthocerotaceae	Antheceros	Bryophyte	0	0	0	**0**	0	0	0	100	0	100	**100**
2	Ricciaceae	Riccia	Bryophyte	0	0	0	**0**	0	0	0	8	0	8	**8**
3	Pteridaceae	Adiantum	Pteridophyte	4	0	4	**8**	0	0	1404	0	6	1410	**1418**
4	Pteridaceae	Pteris	Pteridophyte	0	0	0	**0**	0	0	0	0	5	5	**5**
5		Fern	Pteridophyte	43	0	0	**43**	0	0	0	28	0	28	**71**
6		Fern	Pteridophyte	0	0	1	**1**	0	0	0	6	0	6	**7**

Seed bearing plants – A general overview of the campus.

The biodiversity study in the IIT-Bombay campus revealed a wide ranging floral diversity. The plants belonging to several habits like Epiphytes, woody climbers, climbers, grasses, herbs, shrubs, and trees were recorded. The plants belonged to 91 different families and total of 374 species of flora was observed of which 15 species are yet to be identified Table 2. In the campus 372 species were Angiosperms while only two were Gymnosperms (i.e *Cycas circinalis* and *Araucaria sp.*) The trees were the most dominant floral habit with 150 tree species (six unidentified) followed by herbs that included 100 species (one

unidentified), 56 species of Climbers of which six are to be identified. The species that were the least abundant among the flora were the epiphytes, scandent shrubs and woody climbers. The family Fabaceae was represented by 36 species belonging to 22 genera. Plants belonging to fabaceae are distributed throughout the campus and had representatives in every habit except for the woody climbers and scandent shrubs.

A comparison between the urban and the vegetated sectors revealed that the urban sector had more species diversity i.e. 55 families with 135 species while the vegetated sector had only 85 species representing 35 families. However the urban sector had many exotic and introduced flora that out numbered the local flora which was well distributed in the vegetated sector. From the table it is clearly evident that the number of plant species was maximum in the U1 sub sector followed by U3 and U2. In the vegetated sector the V4 sub sector had more diversity followed by V3, V1, V5 and V2. It was also observed that 127 floral species were restricted in their distribution to a particular sub sector only. The total number of species that were restricted to a particular single sub sector was more in the Urban sector than the Vegetated sector. But the vegetated sector had more of the local flora with high diversity in the V3 and V1 sub sectors, while the U1 sub sector had the maximum introduced and exotic flora. Fabaceae was the dominant family in both the sectors with greater diversity in the vegetated sector (34 species representing 22 genera) compared to the Urban sector which had 22 species belonging to 16 genera.

Table 2 : Habitwise distribution of flora in the IIT-Bombay campus.

	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Trees	114 (5)	89	98 (1)	**141(5)**	29	19	21	48(1)	44	**65(1)**	**143(6)**
Tree Saplings*	36	6	17	**37**	17	17	17	22	14	**40**	**49**
Shrubs	24	17	18	**32**	19	13	11	15	15	**26**	**41**
Scandent Shrubs	2	1	2	**2**	1	2	1	2	2	**3**	**3**
Herbs	55	33(1)	51	**67(1)**	37	30	54	51	35	**85**	**99(1)**
Grass	8	2	8(1)	**12(1)**	7	3	9(1)	7(1)	6(1)	**14(1)**	**16(2)**
Climbers	15(1)	12(2)	16(2)	**30(2)**	16(2)	18(1)	22(4)	17(3)	13(2)	**39(6)**	**48(6)**
Woody Climbers	4	0	2	**4**	4	2	0	2	1	**4**	**4**
Epiphytes	1	1	1	**1**	1	1	1	2	1	**2**	**2**
Total	**223(6)**	**155(3)**	**196(4)**	**289(9)**	**114(2)**	**88(1)**	**119(5)**	**144(5)**	**117(3)**	**238(8)**	**356(15)**

*Species counted in trees hence not counted in total
The figures in the table are exclusive of the figures in the brackets ( ) indicating the unidentified flora.

Table 3: Flora restricted to particular subsector

Habit	U1	U2	U3	V1	V2	V3	V4	V5	Total
Trees	18(5)	6	8	1	0	1	1(1)	0	**35(6)**
Tree Saplings	5	0	2	1	2	3	1	0	**14***
Shrubs	6	3	2	4	0	1	1	1	**18**
Scandent Shrubs	0	0	0	0	0	0	0	1	**1**
Herbs	5	2(1)	3	3	5	13	4	0	**35(1)**
Grass	1	0	1	2	0	1	0	0	**5**
Climbers	3	2	3	3(1)	1	7(2)	0(1)	1	**20(4)**
Woody Climbers	0	0	0	0	0	0	0	0	**0**
Epiphytes	0	0	0	0	0	0	1	0	**1**
Total	**33(5)**	**13(1)**	**17**	**13(10)**	**6**	**23(2)**	**7(2)**	**3**	**115(11)**

*Species counted in trees hence not counted in total
The figures in the table are exclusive of the figures in the brackets ( ) indicating the unidentified flora.

Trees

Trees are the largest and the longest living organisms on earth. To grow tall, the trees display miraculous feats of engineering and a complex chemical factory. It has the ability to absorb water and salts from the earth and transport them up to the leaves, sometimes over 400ft above. By means of photosynthesis, the leaves then combine the water and salts with carbon dioxide from the air to produce the nutrients, which

serve as food for the tree. In this process, trees create wood, as well as many chemicals, seeds and fruit of great utility to man. Trees also remove carbon dioxide, the main greenhouse gas, from the air.
Trees are also important to other forms of life, as it provides food and shelter. However, the forested area of the earth is steadily being depleted, due to man's increasing unsustainable innovations. This in turn is leading to the degradation of the environment and the extinction of many species.

The IIT Bombay campus has 149 tree species belonging to 107 genera representing 46 families (Table 4). The urban sector has the maximum number of species diversity i.e. 145 species belonging to 107 genus representing the 46 families. However the vegetated sector had only 66 species belonging to 56 genera representing 30 families. The urban had a total of 7584 trees while the vegetated sector had 1573 trees. The comparison will not be fair in this aspect as all the trees in the urban sector were accessible and counted while the vegetated area was studied by plotting quadrats and hence show a representative number in the 10 acre area. In the urban sector *Polyalthia longifolia* was the most dominant species followed by the Mango species. The large number of trees in the urban sector was due to the introduced species, which were absent or sporadic in occurrence in the vegetated area. The vegetated sector was dominated by the *Tectona grandis, Morinda pubescens, Trema orientalis* and other local flora.
An interesting observation during the study was that of the 149 species of trees only five species belonging to four families were observed in the entire campus. The five species namely *Ficus Hispida, Streblus asper, Cordia dichotoma, Zizyphus mauritiana, Holoptelea integrifolia* are local plants with several commercial, medicinal and economic values.
From the trees that were exclusive to the urban sector 16 species of trees belonging to 12 families were observed in all the three sub sectors. However, only six of the species are of Indian origin, while the other ten are exotic in origin. The most dominant tree was the coconut tree followed by the Bottle palm and *Eucalyptus*. 37 species of trees (five unidentified) were observed in the urban sector that was restricted to just one sub sector i.e. either U1 or U2 or U3, with only 21 species indigenous to India. This clearly indicates that the local flora was replaced by the exotic ones. Of the plants exclusive to the vegetated sector none of the trees were common to each of the five sub sectors. However only four trees (one unidentified) were restricted to single sub sector, of which only one is exotic in origin and was very close to the Urban sector.
The measurement of tree growth in a forest over time provides important information about the dynamics of that ecosystem. Growth rates can reflect, among other things, differing availability of water, carbohydrates, or nutrients in different sites or from season to season or year to year. The measurements also provide the important information on the volume of timber and the carbon holding capacity of the forest. In the present study the height and girth of trees was measured and is presented in the **Table 5.** The girth of the trees varied between 10cm to 720cm (avg. 75.41cm ± 57.88cm) the tree with the maximum girth was *Mangifera indica*; while the height varied from 1m to 16m (avg. 5.91m ± 2.51m) the tree with the maximum height were *Borassus flabellifer* and *Sterculia foetida*. Trees above 200 cms girth are usually considered as mature, in the IIT campus from the total 9155 trees counted 361 (37 species representing 32 genera) belonging to 20 families measured over 200 cms in girth. However there could be many more trees that are old and did not reach up to the 200 cm girth.

Table 4 : Distribution and abundance of Trees in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1.	Anacardiaceae	*Anacardium*	*occidentale*	Kaju	4	2	2	**8**			1			**1**	9
2.		*Lannea*	*coromandelica*	Shemut	4		4	**8**		2	1	2		**5**	13
3.		*Mangifera*	*indica*	Mango	201	292	88	**581**	1			10	5	**16**	597
4.	Anonaceae	*Anona*	*reticulata*	Ramphal	1	32	2	**35**						**0**	35
5.			*squamosa*	Sitaphal	12	23	4	**39**					1	**1**	40
6.		*Artabotrys*	*hexapetalus*	Hirvachapha	1			**1**						**0**	1
7.		*Polyalthia*	*longifolia*	Asopalav	383	120	385	**888**	34			2		**36**	924
8.	Apocynaceae	*Alstonia*	*scholaris*	Saptaparni	1	2		**3**						**0**	3
9.		*Holarrhena*	*antidysenterica*	Kutaj	6			**6**			87	1	1	**89**	95
10.		*Nerium*	*oleander*	Kaner		1		**1**						**0**	1
11.		*Plumeria*	*acutifolia*	Dev Chapha		7		**7**						**0**	7
12.			*alba*	Dev Chapha		2		**2**						**0**	2
13.			*obtusa*	Dev Chapha	2			**2**						**0**	2
14.			*rubra*	Dev Chapha	1	34		**35**						**0**	35
15.			*sp.*	Dev Chapha	44	5	21	**70**						**0**	70
16.		*Thevetia*	*peruviana*	Bitti	32	12		**44**						**0**	44
17.		*Wrightia*	*tinctoria*	Kuda	4	3	1	**8**		1	16	4	5	**26**	34
18.	Araucariaceae	*Araucaria*		Christmas Tree		1	5	**6**						**0**	6

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
19	Arecaceae	*Areca*	*catechu*	Supari	46	30	24	**100**						**0**	100
20		*Borassus*	*flabellifer*	Taad	33	34	32	**99**	7	2		6	2	**17**	116
21		*Caryota*	*urens*	Fish tail palm	14	7	10	**31**	1				1	**2**	33
22		*Cocos*	*nucifera*	Coconut	140	92	51	**283**						**0**	283
23		*Phoenix*	*sylvestris*	Khajur	16	20	11	**47**	1			1	2	**4**	51
24		*Roystonea*	*regia*	Bottle Palm	46	79	1	**126**						**0**	126
25				Fan palm	2	1	13	**16**						**0**	16
26	Bignoniaceae	*Kigelia*	*pinnata*	Sausage Tree	1			**1**						**0**	1
27		*Millingtonia*	*hortensis*	Indian Cork Tee	11	8		**19**						**0**	19
28		*Oroxylum*	*indicum*	Tetu				**0**	15					**15**	15
29		*Spathodea*	*campanulata*	African Tulip Tree	81	15	10	**106**					2	**2**	108
30		*Tabebuia*	*rosea*		1		5	**6**						**0**	6
31	Bombacaceae	*Bombax*	*ceiba*	Katesawar	28	42	20	**90**		1	6	9	17	**33**	123
32		*Chorisia*		Pandhara Sawar	4			**4**						**0**	4
33	Boraginaceae	*Cordia*	*dichotoma*	Bhokar	14	39	7	**60**	5	3	1	10	2	**21**	81
34			*sebestena*	Scarlet cordia			2	**2**						**0**	2
35	Burseraceae	*Garuga*	*pinnata*	Kakad	1			**1**	1					**1**	2
36	Caesalpinaceae	*Bauhinia*	*racemosa*	Apta	10	9	4	**23**				3	3	**6**	29
37			*variegata*	Kanchan	21	18	4	**43**		8				**8**	51
38		*Cassia*	*fistula*	Bahava	3	17	2	**22**			3			**3**	25
39			*renigera*	Pink Cassia			3	**3**						**0**	3
40			*siamea*	Siamese Cassia	141	28	24	**193**				5	9	**14**	207
41		*Delonix*	*regia*	Gulmohar	96	110	57	**263**				2	3	**5**	268
42		*Peltophorum*	*pterocarpum*	Copper pod Tree	164	114	59	**337**	1			3		**4**	341
43		*Saraca*	*asoca*	Sita Ashok	2			**2**						**0**	2
44		*Tamarindus*	*indicus*	Tamarind	8	24	10	**42**	1	4		6	2	**13**	55
45	Capparaceae	*Crataeva*	*tapia*	Sacred Barna	1			**1**						**0**	1
46	Casuarinaceae	*Casuarina*	*equisetifolia*	Suru	84	11	50	**145**						**0**	145
47	Clusiaceae	*Garcinia*	*indica*	Kokam	1	13	3	**17**						**0**	17
48	Combretaceae	*Terminalia*	*arjuna*	Arjun	1			**1**						**0**	1
49			*catappa*	Desi badam	17	33	28	**78**				1	1	**2**	80
50			*paniculata*		1			**1**						**0**	1
51	Cycadaceae	*Cycas*	*circinalis*	Cycas	1			**1**						**0**	1
52	Ebaneaceae	*Diospyros*	*melanoxylon*	Tendupatta	5		2	**7**						**0**	7
53	Eleocarpaceae	*Muntingia*	*calabura*	Singapore Cherry	2	3	1	**6**				7		**7**	13
54	Euphorbiaceae	*Bridelia*	*retusa*	Asan	18	9	20	**47**	6		4	28	10	**48**	95
55		*Cicca*	*acida*	Rai awla	4	22	3	**29**						**0**	29
56		*Emblica*	*officinalis*	Awla	3	2		**5**						**0**	5
57		*Jatropha*	*curcus*	Mogli erand	1	1		**2**						**0**	2
58		*Macaranga*	*peltata*	Chanda	2		5	**7**				1	1	**2**	9
59		*Putranjiva*	*roxburghii*	Putranjeeva	2			**2**						**0**	2
60	Fabaceae	*Adenanthera*	*pavonina*	Ratangunj	1	3		**4**						**0**	4
61		*Butea*	*monosperma*	Palas	80	15	29	**124**			3	11	39	**53**	177
62		*Dalbergia*	*lanceolaria*		12		4	**16**					1	**1**	17
63		*Dalbergia*	*latifolia*		12		5	**17**					1	**1**	18
64	Fabaceae		*sisoo*	Sisum	4			**4**				1		**1**	5
65		*Derris*	*indica*	Karanj	4	27	33	**64**		15		12		**27**	91
66		*Erythrina*	*indica*	Pangara	1	37	13	**51**	1	1		2	2	**6**	57
67		*Gliricidia*	*sepium*	Giripushpa	91	30	49	**170**			3	53	3	**59**	229
68	Flacourtiaceae	*Casserea*	*tomentosa*				1	**1**					1	**1**	2
69		*Flacourtia*	*indica*	Bhakal		1	2	**3**						**0**	3
70	Lauraceae	*Cinnamomum*	*tamala*	Tamalpatra	+			+						**0**	+
71	Lecythidaceae	*Careya*	*arborea*	Kumbhi	4			**4**				2	1	**3**	7
72		*Couroupita*	*guianensis*	Kailashpati	2	6	7	**15**						**0**	15
73	Lytheraceae	*Lagerstroemoea*	*flos-reginae*	Taman	63		6	**69**						**0**	69
74		*Lagerstroemoea*	*indica*	Taman	1	9		**10**						**0**	10
75		*Lagerstroemoea*	*speciosa*	Taman			1	**1**						**0**	1
76	Magnoliaceae	*Michelia*	*champaca*	Sonchapha	2		8	**10**						**0**	10
77	Malvaceae	*Thespesia*	*populnea*	Bhend		1		**1**						**0**	1
78	Meliaceae	*Azadirachta*	*indica*	Neem	4	44	6	**54**				1		**1**	55
79		*Cedrella*	*toona*	Tooni				**0**			1			**1**	1
80		*Melia*	*azedarach*	Bukneem	2		2	**4**						**0**	4

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
81	Mimosaceae	*Acacia*	*auriculiformis*	Australian Acacia	26	6	22	**54**	1			22	2	**25**	79
82			*catechu*	Khair	25		5	**30**	2			1		**3**	33
83			*mangium*				1	**1**						**0**	1
84			*nilotica*	Babul		6	2	**8**						**0**	8
85		*Albizzia*	*lebbeck*	Shirish			2	**2**	4			2		**6**	8
86		*Leucaena*	*leucocephala*	Subabul	22	77	47	**146**	2			17	22	**41**	187
87		*Parkia*	*biglandulosa*	Chenduphal	3			**3**						**0**	3
88		*Pithecolobium*	*dulce*	Vilayati Chinch	15	15	11	**41**	1	15		5	1	**22**	63
89		*Samanea*	*saman*	Rain Tree	198	115	120	**433**	19			15	41	**75**	508
90	Moraceae	*Ficus*	*arnottiana*	Dev pimpal			2	**2**						**0**	2
91			*bengalensis*	Vad	11	4	7	**22**					1	**1**	23
92			*carica*	Anjeer	1			**1**						**0**	1
93			*elastica*	Indian Rubber Tree	3	11	2	**16**						**0**	16
94			*gibbosa*			1		**1**						**0**	1
95			*glomerata*	Umber	37	35	22	**94**	3		1	16	14	**34**	128
96			*hispida*	Kala umber	41	11	33	**85**	10	22	6	27	30	**95**	180
97	Moraceae	*Ficus*	*mysorensis*		1		2	**3**						**0**	3
98			*religiosa*	Pipal	17	19	10	**46**	1					**1**	47
99			*virens*				1	**1**						**0**	1
100		*Morus*	*alba*	Mulberry	1	2		**3**	1			1		**2**	5
101		*Streblus*	*asper*	Sandpaper Tree	24	98	50	**172**	14	43	6	8	9	**80**	252
102	Moringaceae	*Moringa*	*oliefera*	Shevga	84	88	22	**194**				7	1	**8**	202
103	Myrtaceae	*Eucalyptus*	*globulus*	Nilgiri	61	9	49	**119**						**0**	119
104		*Melaleuca*	*quinquenervia*	Bhojpatra	1			**1**						**0**	1
105		*Psidium*	*guyava*	Peru	16	40	19	**75**						**0**	75
106		*Syzygium*	*cumini*	Jambul	20	48	32	**100**	1	3		23	1	**28**	128
107			*jambosa*	Jamb		1	4	**5**						**0**	5
108	Nyctaginaceae	*Pisonia*	*alba*		2		4	**6**						**0**	6
109	Oleaceae	*Nyctanthus*	*arbor-tritis*	Parijatak	10	6	8	**24**						**0**	24
110	Oxalidaceae	*Averrhoa*	*bilimbi*	Bilimbi	3	2		**5**						**0**	5
111			*carambola*	Karmal				**0**				1		**1**	1
112	Proteaceae	*Grevillea*	*robusta*	Silver Oak		1	1	**2**						**0**	2
113	Punicaceae	*Punica*	*grenata*	Dalimb			1	**1**						**0**	1
114	Rhamnaceae	*Zizyphus*	*mauritiana*	Bor	8	30	22	**60**	5	1	2	9	7	**24**	84
115	Rubiaceae	*Gardenia*	*resinifera*	Anant	6			**6**						**0**	6
116		*Haldinia*	*cordifolia*	Haldu	6			**6**			4	2	2	**8**	14
117		*Hamelia*	*patens*		1			**1**						**0**	1
118		*Mitragyna*	*parvifolia*	Kalamb	1		1	**2**						**0**	2
119		*Morinda*	*pubescens*	Bartondi	131	14	33	**178**	7		26	36	73	**142**	320
120		*Neolamarckia*	*cadamba*	Kadamb	6	8	20	**34**					4	**4**	38
121		*Vangueria*	*spinosa*	Alu	1			**1**						**0**	1
122	Rutaceae	*Aegel*	*marmelos*	Bel	10	10	1	**21**			1		1	**2**	23
123		*Citrus*	*limon*	Lemon	4	13	2	**19**						**0**	19
124			*pseudolimon*	Idilimbu		2		**2**						**0**	2
125		*Murraya*	*koenigii*	Kadipatta		21	5	**26**						**0**	26
126	Sapindaceae	*Filicium*	*decipiens*	Fern Tree			2	**2**						**0**	2
127		*Sapindus*	*trifoliatus*	Ritha	3	1		**4**						**0**	4
128	Sapotaceae	*Madhuka*	*indica*	Moha			1	**1**						**0**	1
129	Sapotaceae	*Manilkara*	*hexandra*	Khirni			1	**1**	1					**1**	2
130			*zapota*	Chiku	9	18	3	**30**						**0**	30
131		*Mimusops*	*elangi*	Bakul	20	13		**33**						**0**	33
132	Sterculiaceae	*Pterospermum*	*acerifolium*	Kanak Champa	2			**2**						**0**	2
133		*Sterculia*	*alata*	Narikel	2		1	**3**						**0**	3
134			*foetida*	Jungli Badam	48	56	27	**131**				2		**2**	133
135			*urens*	Ghost Tree		1	2	**3**				6		**6**	9
136	Sterlitziaceae	*Ravenala*	*madagascariensis*	Traveller's Palm		1	28	**29**						**0**	29
137	Tiliaceae	*Grewia*	*tiliaefolia*	Dhaman	70	37		**107**		3	24	30	14	**71**	178
138	Ulmaceae	*Holoptelea*	*integrifolia*	Wavla	14	14	8	**36**	1	2	7	13	8	**31**	67
139	Urticaceae	*Artocarpus*	*incisa*	Neerphanas	1		1	**2**						**0**	2
140			*integrifolia*	Phanas	79	155	39	**273**		1		3	5	**9**	282
141		*Trema*	*orientalis*	Charcoal Tree	30	54	32	**116**	17	16		45	33	**111**	227
142	Verbenaceae	*Gmelina*	*arborea*	Shivan	5		1	**6**						**0**	6
143		*Tectona*	*grandis*	Teak	92	2	19	**113**		18	31	32	121	**202**	315
144				(un id 0445)				**0**				3		**3**	3
145				Un id	1			**1**						**0**	1
146				Unid	1			**1**						**0**	1
147				Unid	1			**1**						**0**	1
148				Unid	1			**1**						**0**	1
149				Unid 100-144 (108)	1			**1**						**0**	1

Table 5 : Table giving Maximum Girth and its respective Height and the Maximum Height and its respective Girth of the trees in the campus

Sr. No.	Family	Genus	Species	Name	Max. Girth (cm)	Height (m)	Max. Height (m)	Girth (cm)
1	Anacardiaceae	*Anacardium*	*occidentale*	Kaju	94	7	7	94
2		*Lannea*	*coromandelica*	Shemut	153	8	8	153
3		*Mangifera*	*indica*	Mango	720	9	12	174
4	Anonaceae	*Anona*	*reticulata*	Ramphal	83	6	7	68
5			*squamosa*	Sitaphal	60	4	4	60
6		*Artabotrys*	*hexapetalus*	Hirvachapha	47	6	6	47
7		*Polyalthia*	*longifolia*	Asopalav	411	8	12	132
8	Apocynaceae	*Alstonia*	*scholaris*	Saptaparni	110	10	10	110
9		*Holarrhena*	*antidysenterica*	Kutaj	49	6	6	49
10		*Nerium*	*oleander*	Kaner	18	3	3	18
11		*Plumeria*	*acutifolia*	Dev chapha	44	4	4	44
12			*alba*	Dev chapha	56	2	2	56
13			*obtusa*	Dev chapha	52	4	5	49
14			*rubra*	Dev chapha	42	2	4	29
15			*sp.*	Dev chapha	135	2	8	49
16		*Thevetia*	*peruviana*	Bitti	60	4	6	54
17		*Wrightia*	*tinctoria*	Kuda	54	5	7	49
18	Araucariaceae	*Araucaria*		Christmas Tree	78	8	8	78
19	Arecaceae	*Areca*	*catechu*	Supari	82	4	12	51
20		*Borassus*	*flabellifer*	Taad	356	6	16	193
21		*Caryota*	*urens*	Fish tail palm	183	7	10	162
22		*Cocos*	*nucifera*	Coconut	188	7	12	78
23		*Phoenix*	*sylvestris*	Khajur	191	8	10	82
24		*Roystonea*	*regia*	Bottle Palm	187	7	10	132
25				Fan palm	158	7	11	61
26	Bignoniaceae	*Kigelia*	*pinnata*	Sausage Tree	87	9	9	87
27		*Millingtonia*	*hortensis*	Indian Cork Tee	174	9	15	173
28		*Oroxylum*	*indicum*	Tetu	49	5	5	49
29		*Spathodea*	*campanulata*	African Tulip Tree	228	10	14	191
30		*Tabebuia*	*rosea*		212	12	12	212
31	Bombacaceae	*Bombax*	*ceiba*	Katesawar	272	8	13	138
32		*Chorisia*		Pandhara Sawar	110	8	9	104
33	Boraginaceae	*Cordia*	*dichotoma*	Bhokar	158	6	14	53
34			*sebestena*	Scarlet cordia	38	3	3	42
35	Burseraceae	*Garuga*	*pinnata*	Kakad	79	6	6	79
36	Caesalpinaceae	*Bauhinia*	*racemosa*	Apta	83	6	7	76
37			*variegata*	Kanchan	129	6	15	12
38		*Cassia*	*fistula*	Bahava	148	8	15	39
39			*renigera*	Pink Cassia	72	7	7	72
40			*siamea*	Siamese Cassia	148	7	10	99
41		*Delonix*	*regia*	Gulmohar	301	7	15	252
42		*Peltophorum*	*pterocarpum*	Copper pod Tree	240	7	12	210
43		*Saraca*	*asoca*	Sita Ashok	78	8	8	78
44		*Tamarindus*	*indicus*	Tamarind	404	7	10	280
45	Capparaceae	*Crataeva*	*tapia*	Sacred Barna	71	4	4	71
46	Casuarinaceae	*Casuarina*	*equisetifolia*	Suru	178	8	12	150
47	Clusiaceae	*Garcinia*	*indica*	Kokam	112	15	15	112
48	Combretaceae	*Terminalia*	*arjuna*	Arjun	93	8	8	93
49			*catappa*	Desi badam	202	12	12	202
50			*paniculata*		94	12	12	94
51	Cycadaceae	*Cycas*	*circinalis*	Cycas	72	2	2	72
52	Ebaneaceae	*Diospyros*	*melanoxylon*	Tendupatta	98	7	8	94
53	Eleocarpaceae	*Muntingia*	*calabura*	Singapore Cherry	63	3	6	42

Sr. No.	Family	Genus	Species	Name	Max. Girth (cm)	Height (m)	Max. Height (m)	Girth (cm)
54	Euphorbiaceae	*Bridelia*	*retusa*	Asan	183	8	8	183
55		*Cicca*	*acida*	Rai awla	59	4	8	39
56		*Emblica*	*officinalis*	Awla	89	7	9	82
57		*Jatropha*	*curcus*	Mogli erand	78	7	7	78
58		*Macaranga*	*peltata*	Chanda	128	8	8	128
59		*Putranjiva*	*roxburghii*	Putranjeeva	86	6	6	86
60	Fabaceae	*Adenanthera*	*pavonina*	Ratangunj	101	7	7	101
61		*Butea*	*monosperma*	Palas	289	11	11	289
62		*Dalbergia*	*lanceolaria*		138	8	12	130
63			*latifolia*		118	10	10	118
64			*sp.*		98	7	8	66
65		*Derris*	*indica*	Karanj	207	8	9	108
66		*Erythrina*	*indica*	Pangara	182	5	8	178
67		*Gliricidia*	*sepium*	Giripushpa	164	8	10	120
68	Flacourtiaceae	*Casserea*	tomentosa		72	8	8	72
69		*Flacourtia*	*indica*		107	4	6	66
70	Lecythidaceae	*Careya*	*arborea*	Kumbhi	225	8	9	208
72		*Couroupita*	*guianensis*	Kailashpati	182	10	10	182
73	Lytheraceae	*Lagerstroemoea*	*flos-reginae*	Taman	119	8	9	49
74			*indica*	Taman	123	7	8	71
75			*speciosa*	Taman	48	6	6	48
76	Magnoliaceae	*Michelia*	*champaca*	Sonchafa	224	10	12	124
77	Malvaceae	*Thespesia*	*populnea*	Bhend	238	10	10	238
78	Meliaceae	*Azadirachta*	*indica*	Neem	167	7	9	148
79		Cedrella	toona	Cedrella toona	115	9	9	115
80		*Melia*	*azedarach*	Bukneem	138	9	9	138
81	Mimosaceae	*Acacia*	*auriculiformis*	Australian acacia	201	10	13	115
82			*catechu*		96	6	8	94
83			*mangium*		73	6	6	73
84			*nilotica*	Babul	92	4	13	42
85		*Albizzia*	*lebbeck*	Shirish	143	9	11	82
86		*Leucaena*	*leucocephala*	Subabul	237	6	10	94
87		*Parkia*	*biglandulosa*	Chenduphal	228	10	10	228
88		*Pithecolobium*	*dulce*	Vilayati Chinch	228	8	10	198
89		*Samanea*	*saman*	Rain Tree	420	10	14	321
90	Moraceae	*Ficus*	*arnottiana*	Dev pimpal	189	8	10	91
91			*bengalensis*	Vad	576	8	12	420
92			*carica*	Anjeer	78	7	7	78
93			*elastica*	Indian Rubber Tree	248	8	7	200
94			*gibbosa*		36	3	3	36
95			*glomerata*	Umber	247	9	15	11
96			*hispida*	Kala umber	160	2	7	82
97			*mysorensis*		348	8	8	348
98			*religiosa*	Pipal	596	6	7	487
99			*virens*		387	9	9	387
100		*Morus*	*alba*	Mulberry	92	6	6	92
101		*Streblus*	*asper*	Sandpaper Tree	231	5	9	183
102	Moringaceae	*Moringa*	*oliefera*	Shevga	182	7	12	125
103	Myrtaceae	*Eucalyptus*	*globulus*	Nilgiri	272	12	12	272
104		*Melaleuca*	*quinquenervia*	Bhojpatra	93	7	7	93
105		*Psidium*	*guyava*	Peru	52	4	7	27
106		*Syzygium*	*cumini*	Jambul	332	10	12	314
107			*jambosa*	Jamb	53	7	7	53
108	Nyctaginaceae	*Pisonia*	*alba*		34	2	2	34
109	Oleaceae	*Nyctanthus*	*arbor-tritis*	Parijatak	69	4	9	60

Sr. No.	Family	Genus	Species	Name	Max. Girth (cm)	Height (m)	Max. Height (m)	Girth (cm)
110	Oxalidaceae	*Averrhoa*	*bilimbi*	Bilimbi	69	7	7	69
111			*carambola*	Karmal	52	4	4	52
112	Proteaceae	*Grevillea*	*robusta*	Silver Oak	72	8	9	68
113	Punicaceae	*Punica*	*grenata*	Dalimb	10	2	2	10
114	Rhamnaceae	*Zizyphus*	*mauritiana*	Bor	149	8	8	149
115	Rubiaceae	*Gardenia*	*resinifera*	Anant	29	3	3	29
116		*Haldinia*	*cordifolia*	Haldu	248	10	10	248
117		*Hamelia*	*patens*		33	4	4	33
118		*Mitragyna*	*parvifolia*	Kalamb	138	8	8	138
119		*Morinda*	*pubescens*	Bartondi	120	5	9	35
120		*Neolamarckia*	*cadamba*	Kadamb	245	10	10	245
121		*Vangueria*	*spinosa*	Alu	46	6	6	46
122	Rutaceae	*Aegel*	*marmelos*	Bel	91	7	8	57
123		*Citrus*	*limon*	Lemon	30	3	3	30
124			*pseudolimon*	Idilimbu	78	5	5	78
125		*Murraya*	*koenigii*	Kadipatta	30	3	4	25
126	Sapindaceae	*Filicium*	*decipiens*	Fern Tree	49	4	4	49
127		*Sapindus*	*trifoliatus*	Ritha	173	7	7	173
128	Sapotaceae	*Madhuka*	*indica*	Moha	218	8	8	218
129		*Manilkara*	*hexandra*	Khirni	138	6	8	135
130			*zapota*	Chiku	113	8	8	113
131		*Mimusops*	*elangi*	Bakul	112	6	8	89
132	Sterculiaceae	*Pterospermum*	*acerifolium*	Kanak champa	93	5	7	83
133		*Sterculia*	*alata*	Narikel	42	5	5	42
134			*foetida*	Jungli badam	225	12	16	134
135			*urens*	Ghost tree	139	8	8	139
136	Sterlitziaceae	*Ravenala*	*madagascariensis*	Traveller's Palm	68	4	4	68
137	Tiliaceae	*Grewia*	*tiliaefolia*	Dhaman	139	8	9	54
138	Ulmaceae	*Holoptelea*	*integrifolia*	Wavla	383	8	12	250
139	Urticaceae	*Artocarpus*	*incisa*	Neerphanas	102	7	7	102
140			*integrifolia*	Phanas	183	10	10	183
141		*Trema*	*orientalis*	Charcoal Tree	115	10	12	10
142	Verbenaceae	*Gmelina*	*arborea*	Shivan	88	5	7	69
143		*Tectona*	*grandis*	Teak	208	5	10	123
144				Un id	30	3	3	30
145				Unid	105	8	8	105
146				Unid	132	8	8	132
147				Unid	31	3	3	31
148				Unid 100-144 (108)	71	11	11	71
149				(un id(0445,47)	66	6	6	66

Tree saplings

Tree saplings are an important aspect in the study of biodiversity as they would determine the regeneration capacity of a forested area. In addition it plays an important role in carbon trapping and sequestration. It is a known fact that a growing forest traps more carbon than a full grown one, hence the germination and survival of the saplings is an indicator of the health of an ecosystem. Moreover it also provides information of the ability of different plant species to adapt, compete and grow in different climatic conditions. The total number of species of trees in Maharashtra (both indigenous and exotic) is 775. Mumbai has 318 species of trees 50% of which are exotics.

In the IIT-Bombay campus 49 species of saplings belonging to 43 genera and 21 families were observed, of which 34 species are indigenous to India (Table 6) were recorded. Two species one indigenous and one exotic was common to the entire campus. The indigenous *Ficus hispida* was highly dominant with 1231 saplings, 851 saplings were observed in the vegetated sector. The rain tree was more dominant in the urban sector while the vegetated sector had rain tree saplings in all the sub sectors in less numbers. The urban sector had seven species belonging to five genera and five families that were restricted to a single sub sector. Of the seven

species five were indigenous and only two species namely Gulmohar and Austrailan Acacia were exotic. The vegetated sub sector also had seven species belonging to seven genera and six families. Except for *Acacia mangium* which was planted all the other saplings were indigenous.

The Urban sector exclusively had nine species of tree saplings belonging to eight genera representing seven families, of which seven were indigenous. The Vegetated sector had 12 species belonging to 12 genera and seven families exclusive to the sector with 8 indigenous plant saplings.

The overall picture from the study of the saplings revealed that the indigenous trees were better suited to the climatic conditions and hence germinated in the entire campus. While only a few species of exotics could regenerate and adapt to the soil and climatic conditions.

Table 6: Distribution of Tree saplings in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Anacardiaceae	*Mangifera*	*indica*	Mango	31	5	5	**41**	16	1	0	11	9	**37**	78
2	Anonaceae	*Polyalthia*	*longifolia*	Asopalav	18	0	55	**73**	6	0	0	20	0	**26**	99
3	Apocynaceae	*Holarrhena*	*antidysenterica*	Kutaj	0	0	0	**0**	0	0	3	0	0	**3**	3
4		*Wrightia*	*tinctoria*	Kuda	0	0	0	**0**	0	0	35	4	11	**50**	50
5	Arecaceae	*Borassus*	*flabellifer*	Taad	3	0	0	**3**	0	0	0	12	0	**12**	15
6		*Caryota*	*urens*	Fish tail palm	12	0	0	**12**	1	0	0	0	0	**1**	13
7		*Cocos*	*nucifera*	Coconut	16	0	0	**16**	1	0	0	20	0	**21**	37
8		*Phoenix*	*sylvestris*	Khajur	6	0	2	**8**	1	0	0	0	0	**1**	9
9	Bignoniaceae	*Millingtonia*	*hortensis*	Indian Cork Tee	0	0	0	**0**	124	0	0	0	0	**124**	124
10		*Spathodea*	*campanulata*	African Tulip Tree	0	0	0	**0**	4	1	0	8	0	**13**	13
11	Bombacaceae	*Bombax*	*ceiba*	Katesawar	14	0	8	**22**	0	16	5	0	0	**21**	43
12	Boraginaceae	*Cordia*	*dichotoma*	Bhokar	4	0	0	**4**	0	0	0	0	0	**0**	4
13	Caesalpinaceae	*Bauhinia*	*racemosa*	Apta	1	0	0	**1**	0	1	6	0	7	**14**	15
14			*variegata*	Kanchan	80	0	0	**80**	0	12	15	0	0	**27**	107
15		*Cassia*	*siamea*	Siamese Cassia	320	0	0	**320**	0	0	0	0	1	**1**	321
16		*Delonix*	*regia*	Gulmohar	7	0	0	**7**	0	0	0	0	0	**0**	7
17		*Peltophorum*	*pterocarpum*	Copper pod Tree	11	0	0	**11**	8	0	0	0	0	**8**	19
18		*Tamarindus*	*indicus*	Tamarind	0	0	0	**0**	0	0	0	2	0	**2**	2
19	Euphorbiaceae	*Bridelia*	*retusa*	Asan	1	0	0	**1**	0	0	0	1	0	**1**	2
20	Fabaceae	*Adenanthera*	*pavonina*	Ratangunj	0	0	0	**0**	12	0	0	1	0	**13**	13
21		*Butea*	*monosperma*	Palas	16	0	5	**21**	0	2	1	4	2	**9**	30
22		*Dalbergia*	*lanceolaria*		0	0	4	**4**	0	0	0	0	0	**0**	4
23			*latifolia*		5	0	0	**5**	0	0	0	0	0	**0**	5
24		*Derris*	*indica*	Karanj	1	1	0	**2**	44	1477	4	247	0	**1772**	1774
25		*Erythrina*	*indica*	Pangara	0	0	0	**0**	0	46	0	0	0	**46**	46
26		*Gliricidia*	*sepium*	Giripushpa	34	0	1	**35**	0	1	25	144	0	**170**	205
27	Lecythidaceae	*Careya*	*arborea*	Kumbhi	2	0	0	**2**	0	0	0	0	0	**0**	2
28	Mimosaceae	*Acacia*	*auriculiformis*	Australian Acacia	31	0	1	**32**	0	0	0	0	0	**0**	32
29			*catechu*	Khair	21	0	0	**21**	24	2	0	7	1	**34**	55
30			*mangium*		0	0	0	**0**	0	0	2	0	0	**2**	2
31	Mimosaceae	*Albizzia*	*lebbeck*		0	0	0	**0**	0	2	0	0	0	**2**	2
32		*Leucaena*	*leucocephala*	Subabul	8	0	20	**28**	0	0	0	2	15	**17**	45
33		*Pithecolobium*	*dulce*	Vilayati Chinch	2	1	23	**26**	2	5	0	6	0	**13**	39
34		*Samanea*	*saman*	Rain Tree	103	8	32	**143**	45	2	1	23	11	**82**	225
35	Moraceae	*Ficus*	*glomerata*	Umber	39	0	12	**51**	0	0	0	0	2	**2**	53
36			*hispida*	Kala umber	125	14	241	**380**	582	96	4	164	5	**851**	1231
37		*Streblus*	*asper*	Sandpaper Tree	5	0	1	**6**	0	5	0	0	0	**5**	11
38	Myrtaceae	*Syzygium*	*cumini*	Jambul	7	0	8	**15**	0	0	0	0	0	**0**	15
39	Rhamnaceae	*Zizyphus*	*mauritiana*	Bor	22	0	19	**41**	0	1	28	6	5	**40**	81
40	Rubiaceae	*Mitragyna*	*parvifolia*	Kalamb	3	0	0	**3**	0	0	0	0	0	**0**	3
41		*Morinda*	*pubescens*	Bartondi	6	0	0	**6**	0	0	25	0	0	**25**	31
42		*Neolamarckia*	*cadamba*	Kadamb	3	0	0	**3**	0	0	0	0	0	**0**	3
43	Rutaceae	*Murraya*	*koenigii*	Kadipatta	2	0	0	**2**	0	0	0	0	1	**1**	3
44	Sterculiaceae	*Sterculia*	*foetida*	Jungli Badam	5	7	0	**12**	4	0	0	76	0	**80**	92
45			*urens*	Ghost Tree	0	0	0	**0**	0	0	40	0	0	**40**	40
46	Tiliaceae	*Grewia*	*tiliaefolia*	Dhaman	36	0	0	**36**	52	3	6	9	21	**91**	127
47	Urticaceae	*Trema*	*orientalis*	Charcoal Tree	22	0	5	**27**	16	0	0	11	0	**27**	54
48	Verbenaceae	*Gmelina*	*arborea*	Shivan	0	0	0	**0**	0	0	3	4	0	**7**	7
49		*Tectona*	*grandis*	Teak	0	0	0	**0**	0	0	30	0	2	**32**	32

Shrubs

Shrubs are an important and widespread life form, they are difficult to circumscribe. Individual species may be shrubs in some circumstances and trees in other circumstances. Other species may alternatively be shrubs or herbaceous plants depending on certain circumstances, for example, climate or soil fertility (Francis 2004).

Shrubs ordinarily have more than one main stem caused by branching below or above ground level, are perennial, and are lignified (Francis 2004). Often shrubs are thought of as midway between a tree and herb with adaptive advantages of both life forms that sustain the shrub habit in some unique situations. Shrubs have near relatives that are herbs and/or trees. Shrubs are dominant, but for the most part, only in habitats that place plants under considerable stress such as drought or aridity, nutrient-poor soils, fire, shade, poor soil aeration, winter cold, short growing seasons, and wind. Shrubs as subdominants are important to a greater or lesser degree in nearly all vegetative types. Several shrubs are also economically and medicinally important

The shrubs in the IIT Bombay campus were studied by plotting quadrants in the entire campus. And some plants that were important and not included in the quadrants were also noted, but the shrubs planted in the gardens were totally excluded. 41 species belonging to 36 genera representing 22 families were recorded in the campus (Table 7). Among the 41 species 29 are indigenous and nine exotic while three species lack information. Family Acanthaceae was the most dominant with six indigenous species. The shrub that was common to the entire campus was *Triumfetta rhomboidea* of family Tiliaceae was also the most dominant shrub numbering 4245; this shrub was highly dominant in the vegetated sector totaling 4108. This species was followed by *Abelmoschus manihot* which was more in number in the urban sector than the vegetated sector. The other two species common in the entire campus were *Eupatorium repandum* and *Capparis spinosa*.

14 species were exclusive to the entire urban sector with four exotic shrubs, whereas there were 11 species that were restricted to single sub sectors in the urban sector. Six of these species are indigenous four exotic and one species lacks information. The vegetated sector had 9 indigenous species exclusive to the sector, seven species are exclusive to the single sub sectors all of which are indigenous and one of the sub sectors also had the Karvi species. It was observed that most of the indigenous shrubs were food and nectar plants for a variety of faunal species. On the contrary the exotic species are invasive affecting the soil and the faunal habitats.

Scandent Shrub

Scandent shrubs are plants that are basically shrubs that adapt them selves to climb; this is aided by the presence of other tall trees and shrubs in the vicinity. The capacity of some shrubs to climb also depends on the soil characteristics and other climatic conditions.

Only three indigenous species of Scandent shrubs were observed in the campus with *Cocculus hirsutus* being the common and evenly distributed species in the entire campus (Table 8). *Scutia indica* was found in a few sub sectors in the campus while the *Acacia pennata* was restricted to a single sub sector in the vegetated sector and was found to spread and cover a large area in the sub sector.

Herbs

Herbaceous plants are succulent and soft vascular plants without significant woody tissue above or at the ground they die after one growing season. in contrast with woody plants, which keep adding growth and remain active during the season when herbaceous plants are dormant. As a general rule, annual plants are all classified as herbaceous, but herbaceous plants can also be biennials or perennials as well. Plants, which are either annuals or perennials, drive the animal production system as well as keep the landscape functional. Despite their short life span the herbs play a major role in carbon trapping. Most of the herbaceous plants found in India are used in ayurvedic and traditional medicines as well as spices. In India around 3000 plants are officially recognized for use in medicine.

In the IIT-Campus 100 species (one unidentified) belonging to 81 genera and 38 families were recorded (Table 9). Of the 100 species 79 species are indigenous, 15 are alien and five lack data. Among the 15

Table 7: Distribution of Shrubs in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Acanthaceae	*Adhatoda*	*vasica*	Adulsa	3	0	0	**3**	0	0	0	0	0	**0**	3
2		*Barleria*	*cristata*					**0**					+	+	+
3		*Barleria*	*prionitis*	Pivali Koranti	0	17	0	**17**	0	0	0	5	3409	**3414**	3431
4		*Carvia*	*callosa*	Karvi	0	0	0	**0**	0	0	0	83	0	**83**	83
5		*Crossandra*	*infundibuliformis*	Aboli	4	0	0	**4**	0	0	0	0	0	**0**	4
6		*Hygrophila*	*auriculata*	Talimkahan				**0**	+	+			+	+	+
7	Apocynaceae	*Carissa*	*carandas*	Karvanda	11	2	2	**15**	23	3	0	4	0	**30**	45
8		*Rauvolfia*	*tetraphylla*		0	0	2	**2**	0	0	0	0	0	**0**	2
9		*Tabernaemontana*	*divaricata*	Tagar	5	0	2	**7**	0	0	0	0	0	**0**	7
10	Asclepiadaceae	*Calotropis*	*gigantea*	Rui	13	0	4	**17**	8	0	59	8	3	**78**	95
11	Asteraceae	*Baccaroides*	*scabridium*					**0**	+					+	+
12		*Eupatorium*	*repandum*		88	3	37	**128**	178	38	89	9	77	**391**	519
13	Caesalpinaceae	*Bauhinia*	*tomentosa*			+		+						**0**	+
14		*Caesalpinaea*	*pulcherimma*	Sankasur	+	+		+						**0**	+
15	Capparaceae	*Capparis*	*spinosa*		82	1	28	**111**	4	51	20	5	17	**97**	208
16			*zeylanica*	Mastodi	9	0	0	**9**	0	0	0	0	0	**0**	9
17	Caricaceae	*Carica*	*papaya*	Papaya	8	0	13	**21**	1	0	0	12	2	**15**	36
18	Convolvulaceae	*Ipomoea*	*carnea*	Besharam	0	48	16	**64**	0	0	0	0	0	**0**	64
19	Euphorbiaceae	*Ricinus*	*communis*	Castor	4	30	0	**34**	4	0	44	0	6	**54**	88
20	Fabaceae	*Desmodium*	*umbellatum*					**0**	+					+	+
21	Leeaceae	*Leea*	*indica*		33	0	0	**33**	73	4	9	63	1	**150**	183
22			*macrophylla*		24	0	12	**36**	0	0	16	2	1	**19**	55
23	Malvaceae	*Abelmoschus*	*manihot*	Ran Bhendi	432	378	194	**1004**	159	14	326	239	122	**860**	1864
24		*Hibiscus*	*rosa-sinensis*	Shoe Flower	+	+	+	+						**0**	+
25		*Kosteletzkya*	*vitifolia*					**0**			+			+	+
26	Nyctaginaceae	*Mirabilis*	*jalapa*	Gulbakshi			+	+						**0**	+
27	Oleaceae	*Jasminum*	*indicum*		0	4	0	**4**	0	0	0	0	0	**0**	4
28	Onagraceae	*Jussiaea*	*suffruticosa*		3	0	20	**23**	68	28	0	0	3	**99**	122
29	Pandanaceae	*Pandanus*		Kevda	+			+						**0**	+
30	Rhamnaceae	*Zizyphus*	*rotundifolia*					**0**	+					+	+
31	Rubiaceae	*Ixora*	*coccinea*		0	0	0	**0**	764	129	0	169	0	**1062**	1062
32	Solanaceae	*Capsicum*	*annuum*	Mirchi	1	0	0	**1**	0	0	0	0	0	**0**	1
33		*Solanum*	*nigrum*	Hound's Berry	14	2	4	**20**	0	12	0	0	2	**14**	34
34			*torvum*		2	2	0	**4**	2	9	0	4	0	**15**	19
35	Sterculiaceae	*Helicteres*	*isora*	Murud Sheng	0	0	2	**2**	8	0	6	0	0	**14**	16
36	Tiliaceae	*Triumfetta*	*pentaphylla*			+		+						**0**	+
37			*rhomboidea*		93	25	19	**137**	793	76	237	81	2921	**4108**	4245
38	Verbenaceae	*Clerodendrum*	*paniculata*		0	0	0	**0**	20	0	0	0	0	**20**	20
39		*Duranta*	*erecta*		8	0	0	**8**	0	0	0	0	0	**0**	8
40		*Lantana*	*camara*	Ghaneri	48	30	26	**104**	67	31	0	20	40	**158**	262
41		*Vitex*	*nigundo*	Nirgudi	+	+	+	+		+	+	+		+	+

Table 8: Distribution of Scandent Shrub in the IIT-Bombay Campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Menispermiaceae	*Cocculus*	*hirsutus*	Parvel	225	28	107	**360**	158	22	19	101	52	**352**	712
2	Mimosaceae	*Acacia*	*pennata*					**0**					5	**5**	5
3	Rhamnaceae	*Scutia*	*indica*		1	0	7	**8**	0	4	0	28	0	**32**	40

species of alien herbs four species are invasive viz. *Alternanthera philoxeroides, Hyptis suaveolens, Mimosa pudica* and *Echorrnia crassipes;* threatening the other flora on the campus. During the study only nine species belonging to 7 genera representing six families were observed to be common throughout the campus. *Urena lobata* was the only alien of the nine species. *Alternanthera sessilis* was the most dominant herb followed by *Achyranthes asper* both representing the Amaranthaceae family. Interestingly none of the nine species are planted in the campus but were found to be growing wild.

The family Fabaceae was the most represented family with 15 species belonging to eight genera all of which were indigenous. The Asteraceae family followed the Fabaceae with 12 species belonging to 11 genera with one alien species.

15 species (one unidentified) belonging to 14 genera representing 13 families were observed restricted to the Urban sector only. Of the 15 four are alien with two invasive species. The urban sector had five species that were restricted to a single sub sector within the urban sector. 32 species belonging to 29 genera and 17 families were restricted in its occurrence to the vegetated sector. Of these only one species *Euphorbia heterophylla* is alien, three species the data is lacking while the remaining 28 species are indigenous. The vegetated sector had 25 species belonging to 24 genera and 16 families that were restricted in their distribution to a single sub sector only. Among the 25 species *Euphorbia heterophylla* was the only alien species restricted to V4 sub sector that was very close to the human habitation. This plant could have been planted to extract its exceptional medicinal property. Over all it can be inferred that the herbs grow wild and in an undisturbed situation the native species are more dominant and out number the exotic species introduced by man.

Table 9: Distribution of Herbs in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Acanthaceae	*Barleria*	*lawii*		0	22	0	**22**	2805	0	0	0	0	**2805**	2827
2		*Eranthemum*	*roseum*	Ran Aboli	251	0	0	**251**	0	0	0	7	0	**7**	258
3		*Haplanthode*	*neilgherryensis*		1105	1312	16429	**18846**	6912	63	11203	6416	403	**24997**	43843
4		*Justicia*	*glauca*	Kala Adulsa	0	0	0	**0**	0	0	0	34	0	**34**	34
5		*Peristrophe*	*paniculata*		38	14	10	**62**	0	3	0	0	9	**12**	74
6		*Ruellia*	*tuberosa*		258	41	3017	**3316**	0	0	0	0	0	**0**	3316
7		*Rungia*	*linifolia*		+			**+**						**0**	+
8			*repens*		7035	0	341	**7376**	52	43	8328	18270	264	**26957**	34333
9	Amaranthaceae	*Achyranthes*	*aspera*	Aghada	15110	511	24439	**40060**	149	8803	5119	10578	7357	**32006**	72066
10		*Aerva*	*lanata*	Kapurphuti				**0**		+				**+**	+
11		*Alternanthera*	*sessilis*		123090	37205	71599	**231894**	48265	97108	3060	21793	16844	**187070**	418964
12			*philoxeroides*				+	**+**						**0**	+
13		*Amaranthus*	*spinosus*	Kate math	0	0	0	**0**	0	0	6	0	0	**6**	6
14		*Celosia*	*argentea*	Cock's Comb	87	24	11	**122**	0	0	243	485	54	**782**	904
15	Apiaceae	*Centella*	*asiatica*	Brahmi				**0**				+		**+**	+
16	Araceae	*Amorphophallus*	*commutatus*	Jungli Suran	45	2	6	**53**	8	13	38	21	71	**151**	204
17		*Colocasia*	*esculenta*	Alu	76	168	33	**277**	252	0	1	192	0	**445**	722
18	Asteraceae	*Ageratum*	*conyzoides*		82	0	43	**125**	40	8	0	0	16	**64**	189
19		*Blumea*	*oxyodonta*		50	0	175	**225**	23	16	174	41	68	**322**	547
20			*paniculata*		0	0	0	**0**	3	0	0	0	0	**3**	3
21		*Cyathocline*	*purpurea*		0	0	0	**0**	0	30	0	0	0	**30**	30
22		*Eclipta*	*alba*	Maka	0	0	0	**0**	0	0	17	0	0	**17**	17
23		*Elephantopus*	*scaber*		113	0	158	**271**	14	13	263	20	2	**312**	583
24		*Laggera*	*aurita*		4	1	5	**10**	154	5	0	8	7	**174**	184
25		*Spilanthes*	*acmella*	Akkalkara	+		+	**+**						**0**	+
26		*Synedrella*	*nodiflora*		7279	179	14704	**22162**	291	19	21	14725	13943	**28999**	51161
27		*Tricholepis*	*amplexicaulis*		1	0	0	**1**	1	3	0	0	3	**7**	8
28		*Tridax*	*procumbens*	Ek Dandi	119	0	91	**210**	0	0	262	16	42	**320**	530
29		*Vernonia*	*cinerea*	Purple Flabane	26	8	137	**171**	28	0	0	8	16	**52**	223
30	Balsaminaceae	*Impatiens*	*balsamina*	Terda	2	105	8	**115**	0	1	2	17	0	**20**	135
31			*rosmarinifolia*		0	0	0	**0**	0	0	1	0	0	**1**	1
32	Boraginaceae	*Trichodesma*	*indicum*	Indian Borage	1	0	17	**18**	0	0	90	68	0	**158**	176
33	Caesalpinaceae	*Cassia*	*absus*					**0**			+			**+**	+
34			*tora*	Takla	44	0	0	**44**	0	9	36	76	9	**130**	174
35	Cannaceae	*Canna*	*indica*	Kardal	0	5	0	**5**	0	0	0	0	0	**0**	5
36	Cleomaceae	*Cleome*	*burmanii*		0	42	4	**46**	0	0	0	0	2	**2**	48
37			*viscosa*	Kanphodi	12	7	1	**20**	44	0	0	0	14	**58**	78
38	Commelinaceae	*Commelina*	*benghalensis*		2947	21	279	**3247**	84	0	42	63	0	**189**	3436
39			*hasskarllii*		2751	0	3	**2754**	0	0	52	37	3	**92**	2846
40		*Cyanotis*	*fasciculata*		151	0	2403	**2554**	0	0	0	80	11	**91**	2645
41	Cypereceae	*Cyperus*		Nagarmotha	7	0	400	**407**	175	0	8	21	0	**204**	611

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
42	Euphorbiaceae	*Acalypha*	*malabarica*	Khajoti	0	0	0	**0**	0	0	4	0	0	**4**	4
43		*Chrozophora*	*prostrata*					**0**	+					**+**	+
44		*Euphorbia*	*heterophylla*					**0**				+		**+**	+
45			*hirta*	Dudha nali	0	0	0	**0**	0	0	0	12	0	**12**	12
46		*Phyllanthus*	*amarus*	Bhui Awla	224	0	3613	**3837**	0	71	0	627	2	**700**	4537
47			*reticulata*		6	20	17	**43**	0	64	33	10	0	**107**	150
48	Fabaceae	*Alysicarpus*	*vaginalis*		13	0	30	**43**	0	1	595	14	1	**611**	654
49		*Crotolaria*	*filipes*		0	0	0	**0**	16	0	197	24	0	**237**	237
50			*madurensis*		0	0	0	**0**	0	0	3	4	0	**7**	7
51			*juncea*		0	3	3	**6**	0	0	73	8	1	**82**	88
52		*Desmodium*	*heterocarpum*		0	0	0	**0**	0	4	0	0	0	**4**	4
53			*triflorum*		0	0	0	**0**	0	0	100	4	1600	**1704**	1704
54			*triquetrum*		57	0	0	**57**	8	37	13	1	0	**59**	116
55		*Indigofera*	*cordifolia*		2	0	0	**2**	0	0	3	0	0	**3**	5
56			*dalzelli*					**0**			+			**+**	+
57			*glandulosa*		0	0	1	**1**	0	0	4	8	0	**12**	13
58			*linifolia*		+			**+**						**0**	+
59		*Pueraria*	*tuberosa*		0	0	0	**0**	24	0	0	0	3	**27**	27
60		*Smithia*	*sensitiva*	Press-me-not	0	0	0	**0**	4	0	41	37	0	**82**	82
61		*Tephrosia*	*purpurea*	Sharpunkha				**0**			+			**+**	+
62		*Teramnus*	*labialis*					**0**			+			**+**	+
63	Gentianaceae	*Exacum*	*pumilum*		0	0	0	**0**	0	0	37	0	0	**37**	37
64	Hypoxidaceae	*Curculigo*	*orchioides*	Kali Musli	0	0	0	**0**	0	0	1	0	0	**1**	1
65	Lamiaceae	*Anisomeles*	*heyneana*	Sundara	0	0	0	**0**	0	0	1	69	0	**70**	70
66		*Hyptis*	*suaveolens*		142	16	0	**158**	0	0	259	113	0	**372**	530
67		*Pogostemon*	*benghalensis*	Pangli				**0**			+			**+**	+
68	Lytheraceae	*Ammannia*	*baccifera*	Bharjambhul	0	0	0	**0**	21	0	0	0	0	**21**	21
69	Malvaceae	*Abutilon*	*indicum*	Akkai	0	0	2	**2**	0	0	0	0	0	**0**	2
70		*Hibiscus*	*hirsutus*					**0**			+			**+**	+
71		*Malachra*	*capitata*		71	0	6	**77**	23	0	1	4	0	**28**	105
72		*Sida*	*acuta*	Tupkadi	69	9	91	**169**	242	3	101	0	13	**359**	528
73			*cordifolia*	Chikna	7	2	10	**19**	52	18	19	22	14	**125**	144
74			*rhombifolia*	Maha bala	57	35	23	**115**	313	14	199	26	13	**565**	680
75		*Urena*	*lobata*		180	68	44	**292**	72	198	466	511	156	**1403**	1695
76	Martyniaceae	*Martynia*	*diandra*		0	0	0	**0**	6	0	0	20	0	**26**	26
77	Mimosaceae	*Mimosa*	*pudica*	Lajalu	0	143	7	**150**	94	0	0	0	0	**94**	244
78	Musaceae	*Musa*	*paradisiaca*	Banana	+	+	+	**+**						**0**	+
79	Nyctaginaceae	*Boerhavia*	*diffusa*	Punarnava	40	0	11	**51**	0	0	1	8	41	**50**	101
80	Orobanchaceae	*Aeginetia*	*indica*		0	0	0	**0**	0	3	0	0	0	**3**	3
81	Oxalidaceae	*Oxalis*	*corniculata*	Ambuti	+	+	+	**+**						**0**	+
82	Papaveraceae	*Argemone*	*mexicana*	Mexican Poppy	0	0	1	**1**	0	0	0	0	0	**0**	1
83	Pedaliaceae	*Sesamum*	*orientale*	Til	0	0	1	**1**	0	0	19	22	0	**41**	42
84	Piperaceae	*Peperomia*	*pellucida*		0	0	9	**9**	0	0	0	0	3	**3**	12
85	Plumbaginaceae	*Plumbago*	*zylenica*	Chitrak	+			**+**						**0**	+
86	Polygonaceae	*Persicaria*	*glabra*		9	0	0	**9**	0	0	0	124	0	**124**	133
87	Portulacaceae	*Portulaca*	*oleracea*		1	0	0	**1**	0	0	0	0	0	**0**	1
88	Potenderiaceae	*Echorrnia*	*crassipes*	Jal Kumbhi	+	+	+	**+**	+	+				**+**	+
89	Rubiaceae	*Oldenlandia*	*corymbosa*	Phapti	1	0	3700	**3701**	0	0	16	0	0	**16**	3717
90	Scrophulariaceae	*Bonnaya*	*oppositifolia*		63	19	56	**138**	85	0	0	4	3	**92**	230
91	Scrophulariaceae	*Lindernia*	*antipoda*					**0**		+				**+**	+
92	Scrophulariaceae	*Scoparia*	*dulcis*		30	2	33	**65**	39	0	0	1	1	**41**	106
93		*Sopubia*	*delphinifolia*		31	0	0	**31**	0	0	245	0	0	**245**	276
94	Solanaceae	*Physalis*	*minima*		4	0	0	**4**	0	0	0	1	0	**1**	5
95		*Solanum*	*indicum*	Ran ringani		+		**+**						**0**	+
96	Tiliaceae	*Corchorus*	*olitorius*		165	13	23	**201**	557	94	39	1	5	**696**	897
97	Urticaceae	*Boehmeria*	*caudata*		27	0	68	**95**	235	12	4	425	156	**832**	927
98	Zinziberaceae	*Costus*	*speciosus*	Pev	1	13	9	**23**	88	0	9	18	0	**115**	138
99		*Curcuma*	*pseudomontana*	Hill Turmeric	0	0	0	**0**	0	0	6	0	0	**6**	6

Grass

The grass family, known scientifically as the Poaceae or Gramineae, is one of the four largest families of flowering plants, with approximately 500 genera and 10,000 species. Grasses range from tiny inconspicuous herbs less than an inch high to the giant bamboos that grow to 130 feet tall. The family is undoubtedly the most important flowering plant family to humans, directly or indirectly providing more than 3/4 of our food. It also is a major producer of our oxygen and provides a large component of the earth's environmental illtering processes due to its enormous geographic range, spatial coverage and biomass.

Perennial grasses are our most valuable resource, as they stabilise the landscape, trap nutrients and moisture, and provide animals with a readily available long-term feed reservoir. Grasses survive throughout the year. In adverse periods they become dormant and later regenerate from energy reserves stored in the roots and basal buds. At opening rains, grasses respond very rapidly, and their shoots are readily eaten by stock. They are able to send up shoots quicker than the shoots from germinating seeds.

In contrast to the enormous economic benefit of grasses, it must also be noted that a large percentage of the world's worst weeds are in this group as well; and they cost millions of dollars every year to manage.

The IIT-Bombay campus has 18 species (two unidentified) of grasses belonging to 15 genera was observed with only one species i.e. *Aploch monas* spread through out the campus (Table 10). The number of grasses that were restricted to the urban sector were only two with one species being restricted to a single sub sector i.e. *Pennisetum typhoides.* The vegetated sector had four species with one unidentified species that was restricted in its occurrence to a single sub sector as well.

Table 10: Distributionand abundance (in percent) of Grasses In IIT-Bombay campus.

Sr. No.	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	*Aploch*	*monas*		12.43	2.68	4.5	**19.61**	0.79	1.23	0	1.95	0.21	**4.18**	23.79
2	*Apluda*	*mutica*		0	0.15	0.05	**0.2**	0	0	0.18	0.31	0.01	**0.5**	0.7
3	*Brachiaria*			0	0	0	**0**	0.5	0	0	0	0	**0.5**	0.5
4	*Chloris*			0.76	0	0.05	**0.81**	0	0	0	0	0.4	**0.4**	1.21
5	*Coix*	*lacryma-jobi*	Ran Jondhli	0	0.1	0	**0.1**	0	0.01	0	0	0	**0.01**	0.11
6	*Cynodon*	*dactylon*	Durva	0.27	0.02	0.61	**0.9**	0	0	0.3	0.4	0.06	**0.76**	1.66
7	*Dendrocalamus*	*strictus*	Bamboo	0	+	0	+	+	0	+	+	0	+	+
8	*Dichanthium*	*assimile*		0	0	0	**0**	0	0	0.03	0.13	0	**0.16**	0.16
9	*Eleusine*	*indica*		1.15	0	0.59	**1.74**	0.02	0.01	0.18	0.97	0.81	**1.99**	3.73
10	*Eragrostis*	*unioloides*		0.21	0	0.1	**0.31**	0.12	0	0.35	0	0	**0.47**	0.78
11	*Ischaemum*	*indicum*		0.1	0.1	0	**0.2**	1	0	0.15	0	0.05	**1.2**	1.4
12	*Paspalidium*			0	0	0.06	**0.06**	0	0	0	0	0	**0**	0.06
13	*Pennisetum*	*pedicilatum*					**0**	+					+	+
14		*typhoides*		+			+						**0**	+
15	*Pseudanthistiria*						**0**			+			+	+
16	*Themeda*	*cymbaria*		0.05	0	0.05	**0.1**	0	0	2.03	0.57	0	**2.6**	2.7
17		*Un id*		0	0	0	**0**	0	0	0.05	0.12	0.25	**0.42**	0.42
18				0	0	0.1	**0.1**	0	0	0	0.55	0	**0.55**	0.65

Climbers

These are the plants with soft stems that grow only with a support. They rely on something else for support; another plant, a wall or trellis. Different types of climbers have devised many crafty ways to hold on to whatever they grasp. Climbing plants are found in most climates and every type of vegetation where there are trees to support them. But they are more abundant and far more numerous in species in the tropics than in any other plant formation. Globally 90 % of the climbing plants occur in the tropics. Climbing plants play an important part in the forest ecosystem and make a considerable contribution to their structure and productivity. However the abundance of climbers varies very much between different forest types and seral stages.

The flowering period of the trees and the climbers is different during the lean period of the flowering of trees the fruits of climbers provide food for arboreal mammals and different species of birds. In addition the climbers are a continuously growing form and hence aid in trapping carbon from the air for a longer time.

In the IIT Bombay campus 54 species of climbers including six unidentified ones were observed that belonged to 40 genera representing 17 families (Table 11). Of the 54 only two species were common to the

entire campus i.e. the indigenous *Mucuna pruiens* and the other unidentified form of climber. Three species of climbers are alien species while two species lack information. The alien species i.e. *Quisqualis indica* and *Mukia maderaspatana* were sporadically sited in the campus while the exotic *Passiflora foetida* was restricted to the vegetated sub sector only and close to the human habitation.

The urban sector had nine species belonging to eight genera and six families that were restricted in its occurrence, eight of which were exclusive to a single sub sector. Of the nine species two species lack information while the others are all indigenous, except that *Ipomoea aquatica* which is also an invasive plant. The vegetated sector had indigenous 21 species (4 unidentified) belonging to 15 genera representing 8 families, none of these were common to the entire vegetated sector.

Table11: Distribution of Climbers in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Acanthaceae	*Thumbergia*	*fragrans*					**0**		+				+	+
2	Asclepiadaceae	*Holostemma*	*annularae*					**0**			+			+	+
3		*Wattakaka*	*volubilis*		0	0	0	**0**	1	0	0	0	0	**1**	1
4	Combretaceae	*Quisqualis*	*indica*	Madhumalti	0	5	0	**5**	0	14	0	0	0	**14**	19
5	Convolvulaceae	*Argyreia*	*sericea*	Elephant Creeper	2	0	0	**2**	0	4	19	10	7	**40**	42
6		*Cuscuta*	*reflexa*		0	0	0	**0**	12	0	1	0	0	**13**	13
7		*Evovulus*	*alisnoides*		+	+		+						**0**	+
8		*Ipomoea*	*aquatica*	Nalachi Bhaji		+		+						**0**	+
9			*batata*				+	+						**0**	+
10			*Almost Δ leaves*		0	0	0	**0**	0	0	42	0	0	**42**	42
11			*cairica*		0	87	3	**90**	0	1	0	0	0	**1**	91
12			*nil*	Indian Jalap				**0**			+			+	+
13			*palmata*		0	12	5	**17**	24	0	1	0	0	**25**	42
14			*pes-tigridis*		0	0	0	**0**	0	0	2	0	0	**2**	2
15			*un id*		69	7	46	**122**	54	11	39	52	27	**183**	305
16		*Merimea*	*vitifolia*					**0**			+			+	+
17		*Operculina*	*turpethum*	Indian Rhubarb	2	37	7	**46**	0	0	4	32	32	**68**	114
18		*Rivea*	*hypocrateriformis*		0	0	0	**0**	7	7	0	0	0	**14**	14
19			*2106*		0	10	4	**14**	0	0	13	2	4	**19**	33
20	Cucurbitaceae	*Coccinia*	*indica*	Tondli	0	0	0	**0**	1	0	0	1	1	**3**	3
21		*Cucumis*	*trigonus*	Kareta	21	0	0	**21**	15	10	0	1	8	**34**	55
22		*Cucurbita*	*maxima*	Pumpkin			+	+						**0**	+
23		*Luffa*		Turai	0	0	4	**4**	0	0	0	8	0	**8**	12
24		*Momordica*	*subangulata*		0	2	0	**2**	0	0	0	0	0	**0**	2
25		*Mukia*	*maderaspatana*		0	0	2	**2**	0	0	0	6	0	**6**	8
26		*Solena*	*amplexicaulis*					**0**			+			+	+
27		*Trichosanthes*	*cucumerina*	Kadu Padval	0	0	0	**0**	0	2	3	0	0	**5**	5
28			*tricuspidata*	Kaundal				**0**			+			+	+
29	Dioscoreaceae	*Dioscorea*	*bulbifera*		0	10	0	**10**	0	16	28	4	14	**62**	72
30	Dioscoreaceae	*Dioscorea*			12	3	2	**17**	49	8	0	47	15	**119**	136
31	Fabaceae	*Abrus*	*precatorius*	Gunj	2	0	0	**2**	9	0	0	8	0	**17**	19
32		*Atylosia*	*platycarpa*		0	0	3	**3**	0	0	194	0	0	**194**	197
33		*Canavalia*	*ensiformis*	Broad Sword Bean	0	0	3	**3**	12	2	8	3	0	**25**	28
34		*Clitoria*	*ternatea*	Gokarna	0	0	2	**2**	0	0	208	57	2	**267**	269
35		*Derris*	*scandens*		2	0	0	**2**	48	7	0	0	0	**55**	57
36	Fabaceae	*Mucuna*	*pruriens*	Khaj khujli	114	12	38	**164**	60	1	17	42	11	**131**	295
37		*Paracalyx*	*scariosus*		0	0	0	**0**	8	0	0	0	0	**8**	8
38		*Taverneria*	*cuneifolia*		0	0	0	**0**	0	0	8	0	0	**8**	8
39		*Vigna*	*radiata*	Wild Moong	32	0	16	**48**	0	13	194	149	15	**371**	419
40			*vexillata*		+			+						**0**	+
41			*2313urvi*		0	0	0	**0**	0	0	0	2	0	**2**	2
42			*Unid*		0	0	0	**0**	0	0	8	0	0	**8**	8
43	Liliaceae	*Asparagus*	*racemosus*	Shatavari			+	+						**0**	+
44		*Gloriosa*	*superba*	Glory Lily	0	0	0	**0**	0	1	4	0	0	**5**	5
45	Menispermiaceae	*Cocculus*	*villosus*		+			+						**0**	+
46		*Tinospora*	*cordifolia*	Gul vel	0	1	0	**1**	12	5	0	18	0	**35**	36
47	Moraceae	*Ficus*	*repens*	Wagh nakhi	+			+						**0**	+
48	Passifloraceae	*Passiflora*	*foetida*	Passion Flower				**0**					+	+	+
49	Periplocaceae	*Hemidesmus*	*indicus*	Anantmul	34	11	3	**48**	0	13	61	19	24	**117**	165
50	Piperaceae	*Piper*	*longum*	Pepper	0	0	0	**0**	2	0	0	0	0	**2**	2
51	Ranunculaceae	*Clematis*	*spp*	Morvel	20	0	14	**34**	0	0	24	0	14	**38**	72
52	Smilacaceae	*Smilax*	*zeylanica*		0	0	0	**0**	59	10	0	4	0	**73**	73
53	Verbenaceae	*Clerodendrum*	*inermae*		+			+						**0**	+
54	Vitaceae	*Ampelocissus*	*latifolia*	Wild Grapes	8	0	0	**8**	28	22	15	18	4	**87**	95

Woody Climbers

These are climbing plant found in tropical forests with long, woody rope-like stems. These are one of the indicators of dense forest and also imply a healthy ecosystem.

In the present study four species belonging to three families were observed. However, none of the species were distributed through out the campus and all the four were recorded in different sub sectors. Of the four species *Combretum ovalifolium* was the most dominant and occurs in large numbers in the sectors that it existed.

The woody climbers were totally absent in the U2 and the V3 sub sectors of the urban and vegetated sectors respectively. The absence of woody climbers can be attributed to the human presence and lack of proper forest in U2 and the hilly terrain in the V3 sub sectors (Table 12).

Table 12: Distribution and abundance of Woody Climbers in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Combretaceae	*Calycopteris*	*floribunda*	Ukshi	9	0	0	**9**	400	20	0	0	0	**420**	429
2		*Combretum*	*ovalifolium*		20	0	1340	**1360**	123	1727	0	0	0	**1850**	3210
3	Nyctaginaceae	*Bougainvillea*	*spectabilis*	Bougan Vel	20	0	0	**20**	12	0	0	9	0	**21**	41
4	Rhamnaceae	*Zizyphus*	*rugosa*	Toran	6	0	9	**15**	1	0	0	9	15	**25**	40

Epiphytes

Epiphytes are known to affect the forest ecosystem as a whole by their remarkable ability to absorb and retain atmospheric nutrients borne in rain, mist and dust. They are highly efficient at straining aerial mineral nutrients, incorporating them into their living tissues and eventually transferring them to other parts of the ecosystem via herbivory, litterfall and in some cases host tree root system. The presence of epiphytes may foster environmental conditions within the canopy that promote nitrogen fixation.

The epiphytic community also provides a source of food and habitat for a variety of birds, mammals, amphibians, reptiles and insects, some of which depend exclusively upon the epiphytic plant resources. The epiphytic habitats are utilized by over 200 genera of animals the world over.

In the present study two indigenous species of epiphytes belonging to two families were observed (Table 13). Of the two the unidentified ephiphyte belonging to Family Orchidaceae was observed through out the campus. While the *Dendrophthoe falcata* belonging to family Loranthaceae was restricted only to the V4 sub sector in the vegetated sector.

Table 13: Distribution and abundance of Epiphytes in the IIT-Bombay campus.

Sr. No.	Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
1	Loranthaceae	*Dendrophthoe*	*falcata*	Bandgul	0	0	0	**0**	0	0	0	2	0	**2**	2
2	Orchidaceae	*Unid*			+	+	+	**+**	+	+	+	+	+	**+**	+

Fauna

The fauna forms an important aspect in biodiversity studies and mainly comprises of invertebrates and vertebrates. Invertebrates may be found in all conceivable habitats - freshwater, marine, high and low latitudes, hot rift vents, deserts, mountaintops and the Antarctic. Invertebrates are the most successful and prolific animals on the planet. They have been around for over 400 million years and dominate the animal kingdom in terms of numbers of species and numbers of individuals. Invertebrates have also adapted to occupy practically every ecological niche. Even when we include plants, algae and micro-organisms, invertebrate animals are the dominant life on earth. The number of invertebrate species is staggering and new species are being discovered all the time. To date scientists have only documented 1.7 million invertebrate species but they estimate numbers could range from 5 - 30 million. At this rate it will take scientists over a thousand years to identify all invertebrate species. Unfortunately, species numbers are declining faster than we can record their existence. Estimates of invertebrate densities in localised areas have found invertebrates are so abundant that it is difficult to even approximate global numbers let alone count them. For example, an area the size of an Olympic swimming pool in a rainforest may contain three

million insects. Termites alone can reach abundances of up to 10,000 individuals per metre squared.

Because plants and animals are threatened by human activities all over the world there is great demand for better ecological management. Unfortunately, this is severely impeded by the large biological knowledge deficit. For example, faunas are often poorly described and catalogued with possibly 90% of species being undescribed. Difficulties in identification (particularly invertebrates) often make studies in ecology, conservation or environmental impact incomplete. Studies that include organisms identified at order or family level give little indication of species diversity. But these groups often provide the basic framework of whatever ecological system is under threat.

The importance of invertebrates is, in general, not appreciated, but the theme of ecological importance of "hidden species" runs throughout biology. Vertebrates depend on invertebrates in an obvious way for food and in less obvious ways as pollinators of food plants. Biological invasions of invertebrates can have great economic impact on health care and agriculture.

The vertebrates - mammals, birds, reptiles, frogs and fish are only one group of thirty that make up the animal kingdom. Therefore all the vertebrates put together are only a tiny proportion of the species of animals on earth. All the rest, well over 90%, are invertebrates. It is not known precisely how many invertebrate species exist on Earth or how many of them are at risk of extinction, though IUCN's 2008 Red List puts the global total at about 1.2 million species and the percentage at risk of extinction at about 41 percent of species evaluated.

Table 14 : Distribution of Fauna in the IIT-Bombay campus.

	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Turbellaria	0	0	0	**0**	1	0	0	0	0	**1**	**1**
Annelids	0	1	0	**1**	1	0	1	0	0	**1**	**1**
Crustaceans	1	2	0	**2**	1	0	0	0	0	**1**	**2**
Insects*	141(15)	115(9)	121(10)	**186(22)**	125(14)	98(6)	122(11)	123(13)	129(10)	**222(35)**	**245(53)**
Diplopods	1	1	0	**1**	1	1	1	1	0	**1**	**1**
Chilopods	1	1	1	**1**	1	1	1	1	1	**1**	**1**
Arachnids	14	13	9	**19**	16	9	11	16	15	**21**	**23**
Gastropods*	0	2	0	**2**	0	0	1	1	0	**2**	**3**
Pisces*	0	0	0	**0**	1	0	0	0	0	**1**	**1**
Reptiles*	3(3)	4(2)	5(1)	**7(4)**	3(1)	3(2)	3(1)	2(1)	2(1)	**9(2)**	**11(5)**
Amphibians*	0	1(1)	(1)	**1(2)**	3	0	0	1	0	**4**	**4(2)**
Birds*	43	58	32	**75**	60	17	37	28	38	**87**	**102**
Mammals*	10	5	5	**13**	5	4	5	5	3	**11(1)**	**16 (1)**
Total	**232**	**215**	**185**	**320**	**233**	**141**	**194**	**192**	**199**	**400**	**472**

The figures in the table are exclusive of the figures in the brackets ( ) indicating the unidentified fauna.
* Includes fauna that is identified up to the species level also.

During the study in the IIT Bombay campus the fauna consisted of both the vertebrates as well as the in vertebrates. The invertebrates were observed in large numbers with greater species diversity than the vertebrates (Table 14) The insects were the dominant form followed by the birds in both the diversity and abundance. The vegetated sector had more species diversity as compared to the urban sector, though there is very insignificant difference between the U1, U2 and the V1 sub sectors. This is because the area studied in the vegetated sector is smaller and the introduced flora is more diverse in the urban sector creating an imbalance to the natural distribution of fauna.

Invertebrate fauna

The invertebrates mainly comprised of Turbellarians, Oligochaetes, Crustaceans, Insects, Diplopods, Chilopods, Arachnids and Gastropods. The insects formed almost 90 % of the invertebrate population while the others were sporadic in their occurrence.

Turbellarians

Turbellarians are free living flat worms belonging to phylum Platyhelminthes. They are found in moist soil, fresh water and sea. The name Turbellaria given by scientist Ehrenberg in 1831, refers to the disturbances (turbellae) caused in water by beating of their cilia. The turbellarians are of little economic value. The genera observed *Bipalium sp*. was restricted to the V1 sub sector of the vegetated sector (Table 15). The *Bipalium* species is a land predator and is ecologically important as it keeps the population of a number of species in check.

Oligochaetes

Oligochaetes belong to phylum Annelida, the example being earthworm which was also observed in the campus (Table 15). Over 3100 species of earthworms are described the world over. The earth worms are known for their ecological significance. They have the ability to bring to surface 5 mm of new earth every year and even stabilise the soil of its acidity and alkalinity. In the campus the earthworms were rare in their sightings.

Table 15: Distribution and abundance of Invertebrate fauna other than Insects and Arachnids in IIT-Bombay campus

Class	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Turbellaria	Bipalium		Hammer headed flatworm	0	0	0	0	1	0	0	0	0	1	1
Oligochaeta			Earthworm	0	3	0	3	6	0	3	0	0	9	12
Crustecea			Land Crabs	1	2	0	3	13	0	0	0	0	13	16
			Crab Holes	22	39	15	76	61	50	0	33	4	148	224
			Wood Louse	0	3	0	3	0	0	0	0	0	0	3
Chilopoda			Centipedes	1	5	2	8	3	5	23	1	2	34	42
Diplopoda			Millipede	6	2	0	8	3	2	1	2	0	8	16
Gastropoda	Achaetina		Giant African Snail	0	1	0	1	0	0	0	0	0	0	1
			Slug	0	0	0	0	0	0	0	1	0	1	1
			Snail	0	7	2	9	0	0	1	0	0	1	10

Crustaceans

Crustaceans are particularly useful in aquatic environmental studies for several reasons. They are diverse and abundant in many habitats, play important roles in ecosystem processes, are often good indicators of stressed/polluted conditions, are relatively amenable to life history studies and frequently have commercial and cultural significance. Roughly around 35,000 species have been described the world over, in India 2900 species are described. In the campus land crabs and wood louse were observed (Table 15). These crustaceans are ecologically significant as they are very good scavengers and excellent at recycling.

Insects

Insects comprise the largest group of organisms and are involved in various vital 'ecosystem services'. These include pollination, decomposition, soil enrichment, herbivory and biological control as well as contributing directly to human-based economies through silk, lac and honey production (silkworm, lac insects and honey bee). The presence of insects enhances the beauty of nature and of our surroundings, despite the fact that some of them are harmful to man and his economy. India is one among the twelve mega bio-diversity countries of the world and 80% of the insects are endemic in India. The structure of insects has allowed them to exploit niches in almost all the habitats of the world. It is estimated that more than 800,000 forms have been described the world over. The Insects are divided into a number of Orders. These are grouped together into two sub-classes called the Apterygota (*wingless* insects) and the Pterygota (*winged* insects) there are a total of 32 insect orders.

During the study in the IIT Bombay campus 302 types of insect types belonging to 14 orders were recorded. Of these 159 were identified up to species level, 22 up to generic level and 73 were placed in the family level while 48 insects types could be identified only up to the insect order. These also included the insects that live in colonies. On the basis of number of families recorded among the insect orders in the campus, the Lepidoptera was the most dominant. Though 124 families are reported globally the campus had five families of butterflies and 12 moth families. Of these 111 butterflies and moths were identified up to the species level, 14 up to generic level and 13 placed in the family level.

Among the butterflies Nymphalidae was the largest family with 27 species followed by Lycaenidae (23 species), Peridae (16 species), Hesperidae (13 species) and Papilionidae (7 species). Of the 86 species of

Table 16: Distribution and abundance of Lepidoptera in the IIT-Bombay campus.

Butterflies: Family Hesperidae:

Genus	Species	Form	Common Name	Sex	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Badamia	*exclamationis*		Brown Awl		1	0	0	1	0	0	0	0	0	0	1
Hasora	*chromus*		Common Banded Awl		2	0	6	8	0	1	1	1	0	3	11
Arnetta	*vindhiana*		Vindhiyan Bob		0	0	8	8	0	1	2	2	0	5	13
Borbo	*cinnara*		Rice Swift		10	2	4	16	0	3	3	0	1	7	23
Iambrix	*salsala*		Chestnut Bob		5	1	0	6	1	1	0	1	2	5	11
Matapa	*aria*		Common Red eye		0	0	4	4	0	0	1	0	2	3	7
Pelopidas	*conjucta*		Conjoint Swift		0	0	1	1	0	0	0	0	0	0	1
Suastus	*gremius*		Indian Palm Bob		1	0	2	3	1	0	1	0	0	2	5
Telicota	*ancilla*		Dark Palm Dart		0	0	4	4	0	1	3	0	1	5	9
Udasoes	*folus*		Grass Demon		0	8	0	8	1	1	1	0	1	4	12
Coladenia	*indrani*		Tricoloured Pied Flat		0	0	0	0	0	2	0	0	0	2	2
	dasahara		Common Small Flat		1	0	0	1	1	2	0	0	0	3	4
Sarangesa	*purendra*		Spotted Small Flat		1	0	0	1	0	0	1	0	0	1	2

Butterflies: Family Lycaenidae:

Genus	Species	Form	Common Name	Sex	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Curetis	*sp*		Sunbeam		0	2	0	2	2	2	0	1	1	6	8
Spalgis	*epius*		Apefly		0	0	1	1	0	0	0	0	1	1	2
Actolepis	*puspa*		Common Hedge Blue		3	0	2	5	2	0	2	0	0	4	9
Caleta	*caleta*		Angled Pierrot		3	0	8	11	6	0	2	1	2	11	22
Castalius	*rosimon*		Common Pierrot		3	1	6	10	1	2	2	1	1	7	17
Catochrysops	*strabo*		Forget-me-not		0	0	0	0	0	0	2	0	0	2	2
Chilades	*lajus*		Lime Blue		1	1	0	2	0	0	0	0	1	1	3
Euchrysops	*cnejus*		Gram Blue		30	15	38	83	11	2	31	13	49	106	189
Freyeria	*trochylus*		Grass Jewel		2	1	1	4	6	0	1	0	0	7	11
	bochus		Dark Cerulean		6	1	0	7	1	0	0	1	3	5	12
Jamides	*celeno*		Common Cerulean		5	2	2	9	17	1	0	8	5	31	40
Lampides	*boeticus*		Pea Blue		1	0	4	5	0	0	0	0	2	2	7
Leptotes	*plinius*		Zebra Blue		0	0	4	4	0	0	2	0	0	2	6
Prosotas	*nora*		Common Line Blue		0	0	0	0	0	1	0	1	0	2	2
Pseudizizeeria	*maha*		Pale Grass Blue		5	0	1	6	0	1	0	1	0	2	8
Talicada	*nyseus*		Red Pierrot		1	0	0	1	0	0	1	0	0	1	2
Tarucus	*nara*		Rounded Pierrot		0	0	0	0	1	0	0	0	0	1	1
Zizeeria	*karsandra*		Dark Grass Blue		1	1	5	7	0	0	0	1	1	2	9
Zizula	*hylax*		Tiny Grass Blue		4	0	1	5	1	2	0	1	0	4	9
Abisara	*echerius*		Plum Judy		0	0	0	0	1	0	0	1	1	3	3
Rapala	*manea*		Slate flash		0	0	0	0	1	0	0	0	1	2	2
Spindasis	*vulcanus*		Common Silverline		0	0	1	1	0	0	0	1	0	1	2
Tajuria	*cippus*		Peacock Royal		0	0	0	0	0	0	1	0	0	1	1

Butterflies: Family Nymphalidae:

Genus	Species	Form	Common Name	Sex	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
	ariadne		Angled Castor		0	0	0	0	0	0	1	0	0	1	1
Ariadne	*merione*		Common Castor		19	21	8	48	13	3	9	8	12	45	93
Charaxes	*solon*		Black rajah		0	1	0	1	0	0	0	0	0	0	1
Polyura	*athamas*		Common Nawab		0	0	1	1	2	0	0	0	0	2	3
	chrysippus		Plain Tiger		8	4	12	24	1	2	23	8	5	39	63
Danaus	*genutia*		Striped Tiger		10	7	2	19	8	21	32	3	3	67	86
Euploea	*core*		Common Indian Crow		18	20	16	54	20	25	10	5	36	96	150
Parantica	*aglea*		Glassy Tiger		2	2	2	6	12	2	0	2	2	18	24
Tirumala	*limniace*		Blue tiger		7	1	6	14	10	4	18	0	2	34	48
Acraea	*violae*		Tawny Coster		5	4	8	17	7	1	3	2	11	24	41
Phalanta	*phalantha*		Common Leopard		0	0	5	5	0	1	2	1	2	6	11
	aconthea		Common Baron	M, F	4	1	6	11	2	0	1	2	1	6	17
Euthalia	*lubentina*		Gaudy Baron		1	0	0	1	0	0	0	0	0	0	1
Moduza	*procris*		Commander		1	2	0	3	0	0	0	0	1	1	4
Neptis	*hylas*		Common Sailer		1	0	0	1	0	0	0	0	0	0	1
	bolina		Great Eggfly	M, F	3	3	2	8	3	0	13	3	3	22	30
Hypolimnas	*misippus*		Danaid Eggfly	M, F	6	5	7	18	3	2	2	3	0	10	28
	almana		Peacock Pansy		2	1	4	7	0	1	1	0	1	3	10
	atlites		Grey Pansy	M, F	16	14	15	45	13	9	2	6	8	38	83
	iphita		Chocolate Pansy		9	16	9	34	13	5	1	11	10	40	74
Junonia	*lemonias*		Lemon Pansy		13	10	6	29	2	1	2	2	6	13	42

Butterflies- Family Nymphalidae cont.

Genus	Species	Form	Common Name	Sex	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Kallima	*horsfieldi*		Blue Oakleaf		2	1	0	3	1	0	0	1	0	2	5
Elymnias	*hypermnestra*		Common Palmfly	M, F	21	3	6	30	2	0	0	7	5	14	44
					7	2	2	11	1	0	1	1	3	6	17
Melanitis	*leda*	*DSF*	Common Evening Brown		0	1	2	3	0	0	0	0	3	3	6
	perseus		Common Bushbrown		1	0	8	9	0	3	0	10	0	13	22
Mycalesis	*visala*		Long branded Bushbrown		0	0	0	0	1	1	0	0	1	3	3
Ypthima	*huebneri*		Common Four Ring		8	0	16	24	3	1	5	15	2	26	50

Butterfly- Family Papilionidae:

Genus	Species	Form	Common Name	Sex	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Atrophaneura	*aristolochiae*		Common Rose		1	1	0	2	3	0	0	1	1	5	7
	agamemnon		Tailed Jay		10	9	1	20	6	2	4	2	3	17	37
	doson		Common Jay		0	2	2	4	0	0	0	1	0	1	5
Graphium	*sarpedon*		Common Bluebottle		0	0	0	0	0	1	0	0	0	1	1
	demoleus		Lime Butterfly		0	1	0	1	0	0	0	0	0	0	1
	polymnester		Blue Mormon		2	3	3	8	3	0	0	2	1	6	14
				M	9	14	2	25	5	1	2	4	3	15	40
		stichus		F	2	1	2	5	0	0	0	1	1	2	7
		rommulus		F	1	3	2	6	1	0	0	1	0	2	8
Papilio	*polytes*	*cyrus*	Common Mormon	F	0	0	1	1	0	1	0	0	0	1	2

Butterfly- Family Peridae:

Genus	Species	Form	Common Name	Sex	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
	pomona		Common Emigrant		10	13	0	23	5	0	0	1	5	11	34
Catopsilia	*pyranthe*		Mottled Emigrant		1	1	0	2	0	0	0	0	0	0	2
	hecabe		Common Grass Yellow		7	0	0	7	0	0	0	0	1	1	8
	laeta		Spotless Grass yellow		0	0	0	0	0	0	1	0	1	2	2
	brigitta		Small Grass Yellow		0	0	0	0	0	0	0	0	2	2	2
Eurema	*blanda*		Three spot Grass Yellow		1	0	0	1	0	0	0	0	0	0	1
Appias	*libythea*		Striped Albatross		0	1	0	1	0	0	0	0	0	0	1
Belenois	*aurota*		Pioneer		0	0	2	2	1	0	0	0	0	1	3
Cepora	*nerissa*		Common Gull		4	0	5	9	16	9	2	3	5	35	44
Colotis	*etrida*		Small Orange Tip	M, F	1	0	1	2	0	1	0	3	0	4	6
Delias	*eucharis*		Common Jezebel	M, F	3	0	3	6	2	0	2	3	2	9	15
Hebomoia	*glaucippe*		Great Orange Tip	M, F	7	2	2	11	5	4	4	1	7	21	32
	marianne		White Orange Tip	M, F	0	0	2	2	0	2	3	2	1	8	10
Ixias	*pyrene*		Yellow Orange Tip	M, F	7	2	4	13	10	16	3	7	21	57	70
Leptosia	*nina*		Psyche		41	37	20	98	62	50	22	60	39	233	331
				M, F	17	16	13	46	24	13	13	14	14	78	124
Pareronia	*valeria*	*spilomela*	Common Wanderer	F	0	0	0	0	0	2	0	0	0	2	2

Moths - Family Arctiidae													
Genus	**Species**	**Common Name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Argina	*astrea*		0	0	0	0	1	0	0	0	0	1	1
Euchromia	*sp.*	Hand Maiden Moth	0	1	0	1	0	0	0	0	1	1	2
Brunia	*antica*		0	0	0	0	0	0	0	0	1	1	1
Moths - Family Crambidae													
Antigastra	*catalaunalis*	Sesame Leaf roller	0	0	5	5	1	1	0	0	1	3	8
Spoladea	*recurvalis*	Beetroot webworm Moth	12	2	8	22	1	1	0	0	1	3	25
Talanga			0	0	0	0	0	0	1	0	0	1	1
Diaphania	*indica*	Cucumber Moth	1	0	0	1	0	0	0	0	1	1	2
Pygospila	*tyres*		0	0	0	0	0	0	1	0	0	1	1
Sameodes	*cancellalis*		0	0	0	0	0	0	1	0	0	1	0
Moths - Family Drepanidae													
		Hooktip Moth	0	0	0	0	0	0	1	0	0	1	1
Moths - Family Geomatridae													
Chiasmia	*eleonora*	Geometrid moth	1	0	0	1	0	0	0	0	1	1	2
Hyposidra	*talaca*	Inchworms	0	0	0	0	0	1	0	0	0	1	1
		Geometrid moth	0	0	0	0	0	0	1	0	0	1	1
Moths - Family Hyblaeidae:													
Hyblaea	*puera*	Teak defoliator	0	0	3	3	0	0	0	0	2	2	5
Moths - Family Limacodidae:													
		Neetle Caterpillar	0	1	0	1	2	0	0	0	0	2	3

Moths -Family Noctuidae													
Genus	**Species**	**Common Name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Asota	*caricae*		3	0	1	4	0	0	0	0	0	0	4
		Tiger Moth	0	0	0	0	0	1	0	0	0	1	1
Episteme	*adulatrix*	Day flying moth	0	0	0	0	0	0	1	0	0	1	1
		Unid Brown Moth	0	1	0	1	0	0	0	0	7	7	8
Anomis	*flava*		0	0	0	0	1	0	0	0	0	1	0
Artena			1	0	0	1	0	0	0	0	0	0	1
	macrops	Owl Moth	0	0	0	0	0	1	0	0	4	5	5
Erebus	*hieroglyphica*	Owl Moth	0	0	0	0	1	2	0	0	1	4	4
Ischyja	*hemiphaea*		0	0	1	1	0	0	0	0	0	0	1
Mocis	*undata*		1	0	0	1	0	0	0	0	0	0	1
Plusiodonta	*coelonota*		0	3	0	3	0	0	0	0	0	0	2
Rhesala			4	7	10	21	0	0	0	0	60	60	81
Spirama	*retorta*	Owlet Moth	1	0	0	1	2	0	0	1	1	4	5
Autoba	*abrupta*		0	1	0	1	0	0	0	0	0	0	1
Hypena			0	4	0	4	0	0	0	0	0	0	4
Lymantria	*sp.*	Tussock Moth	1	0	0	1	0	0	0	0	0	0	1
		Tussock Moth	0	0	1	1	0	0	0	0	0	0	1
Gabala	*sp.*		0	1	0	1	0	0	1	0	0	1	2
Chrysodeixis	*eriosoma*		0	0	0	0	1	0	0	0	0	1	1
Moths - Family Nolidae													
Earias	*vitella*		0	0	0	0	0	0	0	0	3	3	3
Carea			0	1	0	1	0	0	0	0	0	0	1
Moths - Family Pterophoridae													
		Plume Moth	2	2	0	4	0	0	0	0	1	1	5
Moths - Family Sphingidae													
Neogurelica	*hyas*	Hawk Moth	0	0	0	0	0	0	0	2	0	2	2
Theretra	*silhetensis*	Hawk Moth	0	0	0	0	0	0	0	0	1	1	1
		Clearwing Hawk Moth	1	0	0	1	0	0	0	0	0	0	1
		Coffee Bee Hawk Moth	0	0	0	0	0	0	1	0	0	1	1
		Hawk Moth	1	0	1	2	0	0	1	0	0	1	3
Moths - Family Thyrididae													
Striglina			0	0	0	0	0	0	1	0	0	1	1
Moths - Family Uraniidae													
Micronia	*aculeata*	Uraniid Moth	0	0	1	1	2	0	1	0	0	3	4

Table 17: Distribution and abundance of Hemiptera in IIT-Bombay campus.

Family	**Genus**	**Species**	**Common name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Cercopidae			Spit Bug	1	0	0	1	0	0	3	0	2	5	6
Cicadellidae			Leaf Hopper	8	7	4	19	7	9	12	8	12	48	67
Cicadidae			Cicada	0	0	0	0	1	0	0	4	0	5	5
Coreidae	*Acanthocephala*		Leaf footed Bug	1	0	1	2	8	0	0	0	1	9	11
Derbidae			Derbid Planthopper	1	0	1	2	0	0	0	0	0	0	2
Flatidae			Flatid	3	0	0	3	0	0	0	2	0	2	5
Gerridae			Water Skater	0	0	0	0	0	0	0	15	0	15	15
			Tree Hopper	0	0	0	0	1	0	0	0	0	1	1
Membracidae	*Alosextius*	sp.	Horned tree hopper	6	4	1	11	0	0	4	2	0	6	17
Miridae			Leaf Bug	7	7	3	17	9	0	10	12	5	36	53
			Shield Bug	13	79	5	97	9	5	3	14	18	49	146
Pentatomidae			Stink Bug	0	2	1	3	2	3	4	2	1	12	15
		cingulatus	Red Silk Cotton Bug	8	74	12	94	25	0	3	3	3	34	128
Pyrrhocoridae	*Dysdercus*		Cotton Strainer Bug	0	0	2	2	0	0	0	0	0	0	2
Reduviidae			Assasin Bug	4	23	2	29	1	0	2	4	2	9	38
			Jewel bug	0	0	0	0	0	1	1	0	0	2	2
			Un id red bug	0	0	0	0	1	0	0	0	0	1	1
			Unid Bug	1	0	0	1	0	0	0	0	0	0	1

butterflies only 14 were common through out the campus, with dominance of Psyche and Gram Blue. However, the *Eurema* species (Grass Yellow) that was identified up to the generic level was sighted the maximum in the entire campus. Only nine butterflies were restricted to the urban sector and except for the mottled emigrant the remaining eight were observed in only a single sub sector. The vegetated sector had 12 butterflies that were exclusive to the region with six exclusive to single sub sectors. Some of the interesting butterflies observed in the campus were the migratory Blue Mormon which was observed during the first two phases; the Apefly whose caterpillars are carnivorous was sighted which is other wise not common in the city and all the three forms of the Common Mormon female were sighted.

It is known that in the order Lepidoptera moths comprise 80 percent of the global species composition. In the campus twelve families of moths were observed however the moths could not be studied during the night when their activity is at peak hence no moth was found common in the entire campus. However from the families noted Noctuidae was the most dominant with 19 species followed by Crambidae (6 species) and Sphingidae (5 species). Of the 44 types of moths observed 19 were exclusive to the vegetated sectors while only eight were exclusive to the urban sector.

A comparison between the orrurance of butterflies and moths in the campus indicates that the urban sector has 99 lepiodepterans with 17 species exclusive to it, while the vegetated sector has 100 species and 31 species exclusive in occurrence (Table16). The number of lepiodepterans sighted exclusive to the vegetated sector during the study are indicators of the feeding plants and the better habitats in the vegetated sectors.

The order Lepiodeptera was followed by order Hemiptera with 12 families in the campus of the 133 families known globally recorded. The Hemiptera is the largest and by far the most successful of the Hemimetabolic insects (where the young look like wingless adults). There are at least 80,000 named species globally, however, the species level identification was not possible in the present study. From the 19 types recorded 14 were observed in the urban sector while 16 in the vegetated sector with only the shield bug common to the entire campus (Table 17). Hemipterans are important as they are important natural pest controllers, of the 19 types recorded in the campus six were exclusive to the urban sector while three were restricted to the vegetated sector.

Diptera was the third largest order as far as the number of families observed in the campus are concerned(Table 18). Dipterans' are one of the major success's of the insect world, and the 145,000 species (about 160 families) are reported. Dipterans (flies) have been of incredible importance to mankind all over the world, this is because many of the primary diseases of humanity are transmitted by flies. In the present study 10 families and 20 types were recorded of which mosquitoes, house fly, flesh fly and hover fly were common to the entire campus. The urban sector had 16 different dipterans with three exclusive to the sub sectors. The vegetated sector had 18 dipterans four exclusive to the sub sectors.

Table 18 : Distribution and abundance of Diptera in the IIT-Bombay campus.

Family	Genus	Species	Common name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Asilidae			Robberfly	2	0	0	2	0	0	32	19	4	55	57
Bombyliidae			Bee fly	3	1	2	6	0	1	2	8	3	14	20
			Blue bottle Fly	11	11	6	28	9	4	0	3	9	25	53
Calliphoridae			Green Bottle Fly	3	0	1	4	3	0	3	3	1	10	14
Dolichopodidae			Long legged fly	10	20	0	30	2	4	2	5	9	22	52
Lauxaniidae			Lauxaniid fly	1	0	0	1	1	0	12	1	4	18	19
Muscidae	*Musca*	*domestica*	Housefly	22	3	9	34	12	3	18	17	9	59	93
Sarcophagidae			Flesh Fly	13	9	5	27	3	3	6	5	4	21	48
Syrphidae	*Symosyrphus*	sp.	Hover fly	7	19	5	31	2	1	1	7	12	23	53
Tipulidae			Crane Fly	2	11	0	13	6	4	9	6	3	28	41
			Black banded Fly	0	0	0	0	0	0	0	1	0	1	1
			Fly yellow orange stripes on abdomen	0	1	0	1	0	0	0	0	0	0	1
			Black coloured Fly	0	0	1	1	0	0	0	0	0	0	1
			Green coloured Fly	0	1	0	1	0	0	0	0	0	0	1
			Long Sized Fly	0	0	0	0	0	0	1	0	0	1	1
			Orange robber fly like	0	0	0	0	0	1	0	0	0	1	1
			Fly	2	1	15	18	1	0	1	3	1	6	24
			Fly 1	0	1	0	1	0	0	1	0	0	1	2
Unidentified			Fly 2	0	0	0	0	0	0	1	0	0	1	1

The Coleoptera (beetles) are the largest single order of insects, they total a staggering 360 000 named species with 125 different families. Many beetles are regarded as major pests of agricultural plants and

stored products. They attack all parts of living plants as well as processed fibers, grains, and wood products. Scavengers and wood boring beetles are useful as decomposers and recyclers of organic nutrients. Predatory species, such as lady beetles, are important biological control agents of aphids and scale insects. In the campus 20 types of beetles belonging to nine families were recorded of which six remained unidentified (Table 19). The urban sector had 12 types with three exclusive to individual sub sectors. The vegetated sector had 15 types with 5 exclusive to the region, there was no beetle that was common to the entire campus.

Table 19: Distribution and abundance of Order Coleoptera in the IIT-Bombay campus.

Family	Genus	Species	Common name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Buprestidae			Jewel Beetle	0	0	0	0	0	1	0	1	0	2	2
Cerambycidae			Long horned Beetle	1	1	0	2	0	0	2	0	2	4	6
			Pumpkin Beetle	0	12	0	12	3	0	0	0	0	3	15
Chrysomelidae			Tortoise Beetle	0	7	0	7	6	2	10	42	3	63	70
Coccinellidae			Lady bird beetle	9	2	2	13	1	0	0	8	0	9	22
Curculionoidea			Weevil	1	1	0	2	4	1	5	2	1	13	15
Dytiscidae			Diving Beetle	0	0	0	0	1	0	0	2	0	3	3
Melastomataceae			Giraffe Weevil	0	0	0	0	0	0	1	0	0	1	1
			Blister beetle	0	0	2	2	0	4	4	9	0	17	19
Meloidae			Unidentified Long necked beetle	0	0	0	0	0	0	1	0	1	2	2
			Dung Beetle	0	1	0	1	0	5	0	0	0	5	6
Scarabaeidae			Scarab Beetle	0	1	0	1	0	0	0	1	0	1	2
			Small beetle	1	0	0	1	0	0	0	0	0	0	1
			Yellow & black bands beetle	0	0	0	0	0	0	2	0	0	2	2
			Beetle1	2	4	0	6	0	0	0	1	1	2	8
			Bronze colour beetle	1	0	0	1	0	0	0	0	0	0	1
			Orange Beetle	0	0	0	0	1	0	0	0	0	1	1
Unidentified			Red beetle black stripes	1	0	0	1	0	0	0	0	0	0	1

The Odonata with six families was the next dominant order in the campus with four families of Damselflies and two families of dragon flies. About 6,000 extant species belonging to 26 families are distributed all over the world. India is highly diverse with more than 500 known species. Odonates are primarily aquatic insects and their life history is closely linked to specific aquatic habitats. This habitat specificity makes them a good indicator of wetland health. India with its unique geography and diverse bioclimatic regions, support a rich odonate fauna Adult odonates feed on mosquitoes, blackflies and other blood-sucking flies and act as an important biocontrol agent of these harmful insects In addition to the direct role of predators in ecosystem, their value as indicators of quality of the biotope is now being increasingly recognized. In the campus 37 species of odonates (Table 20) including eight unidentified were observed of these only the Ruddy Marsh skimmer was common in the entire campus. The campus had a number of pollution indicator species in the urban sector from the 28 species recorded with three exclusive to the sector. The vegetated sector had 37 species most of which indicated a healthy habitat and 12 were exclusive to the sector. Moreover the odonates were dominant in their number during the monsoon and gradually decreased in the subsequent phases.

Hymenoptera is one of the most diverse orders of insects, including over 115,000 described species representing 84 families. Only the Coleoptera (beetles) out number the Hymenoptera in species described, and the Diptera (flies) and Lepidoptera (moths and butterflies) rival them in species diversity. Common names highlight the diversity of Hymenoptera. While most insect orders can be associated with a single common name (i.e. Coleoptera are beetles, Diptera are flies), Hymenoptera includes such varied insects as ants, bees, wasps, sawflies, and many others without any common names at all. However, only by comparing the Hymenoptera with a well known group such as the vertebrates is their diversity truly demonstrated: there are only half as many species of vertebrates (which includes all mammals, birds, fish, reptiles, and amphibians) as there are Hymenoptera. Hymenoptera are not only diverse in terms of structure, size, and numbers of species, but also in their habits and life histories. Some are phytophagous (plant-feeding), while others are herbivorous, predatory, or even parasitic. Many Hymenoptera lead a solitary lifestyle, while some of the bees, ants, and wasps show some of the highest degrees of social organization of any animals. In the IIT-Bombay campus four families were recorded with 52 types (Table 21). Of these 16 were identified up to the species level, while three were identified till the generic level, 23 could be placed in the families while the remaining ten remained unidentified till the order level. Of the 52 types seven were common through out the campus four of which were ants. The ants are an important fauna

Table 20: Distribution and abundance of Order Odonata in the IIT-Bombay campus

Family	*Genus*	*Species*	Common name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
	Aeschna		Brown Darner	0	0	0	0	0	0	1	0	0	1	1
	Anax	*immaculifrons*	Blue Darner	0	0	1	1	0	1	2	0	1	4	5
Aeshnidae	*Gynacantha*	*bayadera*	Parakeet Darner	0	0	1	1	0	0	0	0	0	0	1
Calopterygidae	*Vestalis*	*gracilis*	Clearwing Forest Glory	0	0	0	0	2	0	0	0	0	2	2
			Pigmy Dartlet	2	4	4	10	3	2	0	1	0	6	16
	Agriocenemis	*pygmaea*	Pygmy dartlet (red)	0	1	1	2	1	0	0	0	0	1	3
	Ceriagrion	*coromendelianum*	Coromondel Marsh Dart	17	33	6	56	43	33	0	4	0	80	136
	Ischnura	*aurora*	Golden Darlet	1	0	0	1	0	0	1	0	0	1	2
			Senegal Golden Dartlet	2	11	0	13	0	0	0	0	0	0	13
	Ischnura	*senegalensis*	Senegal Golden Dartlet (morph)	0	7	0	7	2	0	0	0	0	2	9
Coenagrionidae	*Pseudagrion*	*microcephalum*	Blue Grass Dartlet	2	9	5	16	5	0	0	0	0	5	21
	Acisoma	*panorpoidea*	Trumpet tail	0	0	1	1	1	3	0	0	0	4	5
	Brachythemis	*contaminata*	Ditch Jewel	1	10	1	12	5	1	5	1	0	12	24
	Bradinopyga	*geminata*	Granite Ghost	0	0	1	1	0	0	0	1	0	1	2
	Crocothemis	*servillia*	Ruddy Marsh Skimmer	40	29	29	98	55	8	16	31	22	132	230
	Diplacodes	*trivialis*	Ground Skimmer	35	9	11	55	14	0	13	6	4	37	92
	Lathrecista	*asiatica*	Asiatic Bloodtail	0	0	0	0	3	1	1	1	0	6	6
	Neurothemis	*intermedia*		1	0	0	1	0	0	0	0	0	0	1
		glaucaum	Blue Forest Marsh hawk	0	0	0	0	0	0	0	1	0	1	1
		pruniosum	Crimsontailed Marsh Hawk	2	2	1	5	5	0	0	5	1	11	16
	Orthetrum	*sabina*	Green Marsh Hawk	1	0	1	2	4	1	2	4	4	15	17
	Palpopleura	*sexmaculata*	Blue tailed Yellow Marsh Hawk	0	1	1	2	0	0	5	5	1	11	13
	Pantala	*flavescens*	Wandering Glider	2	3	2	7	14	0	2	2	12	30	37
	Potamatcha	*congrener*	Yellow tailed Ashy Skimmer	0	0	0	0	0	0	0	1	0	1	1
	Rhodothemis	*rufa*	Rufous Hawk Marsh	0	0	2	2	3	0	0	1	0	4	6
	Rhyothemis	*variegata*	Picture Wing	5	1	0	6	2	4	0	1	6	13	19
	Tholymis	*tillagra*	Coral tailed Cloud wing	1	1	0	2	6	5	2	0	1	14	16
	Tramea	*basilaris*	Red Marsh Trotter	0	0	0	0	0	0	0	1	0	1	1
Libellulidae	*Trithemis*	*pallidinervis*	Long legged Marsh Glider	0	0	0	0	5	0	0	0	1	6	6
	Copera	*marginipes*	Yellow Bush Dart	7	0	3	10	14	0	0	20	5	39	49
Platycnemididae	*Copera*	*vittata*	Blue Bush Dart	1	2	1	4	1	1	0	2	0	4	8
Protoneuridae	*Disparoneura*	*quadrimaculata*	Black winged Bambootail	2	0	0	2	0	1	0	1	0	2	4
			Damselfly Larva	0	0	0	0	0	0	0	14	0	14	14
			Dragonfly larvae	0	0	0	0	0	0	0	20	0	20	20
			Damsel blue tiped tail	0	2	0	2	1	0	0	0	0	1	3
			Damselfly white tipped	0	0	0	0	1	0	0	0	0	1	1
			Orange and blue dart	0	0	0	0	1	0	0	0	0	1	1
			Damselfly	0	0	1	1	2	0	0	1	0	3	4
			Damselfly 2	0	0	0	0	15	0	0	0	0	15	15
Unidentified			Dragonfly	0	0	1	1	1	0	0	0	0	1	2

Table 21: Distribution and abundance of Order Hymenoptera in the IIT-Bombay campus.

Family	Genus	Species	Common name	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
			Honey bee	3	1	0	4	0	11	1	1	0	13	17
	Amegilla	sp.	Blue banded bee	1	5	1	7	8	2	2	2	2	16	23
Apidae	Xylocopa	sp.	Carpenter Bee	2	1	1	4	8	3	25	6	1	43	47
Chrysididae			Cuckoo Wasp	1	2	1	4	1	0	0	1	3	5	9
			Ground digger Wasp	0	0	0	0	0	0	1	0	0	1	1
			Hornet	1	0	0	1	3	0	0	0	0	3	4
			Mud dauber Wasp	0	0	0	0	0	0	0	0	1	1	1
			Paper Wasp	13	8	2	23	6	3	3	2	2	16	39
			Potter Wasp	12	0	1	13	4	3	3	2	4	16	29
			Sawfly	1	3	3	7	0	2	0	3	1	6	13
			Small black wasp with prom. Yellow markings	0	0	1	1	0	0	0	0	0	0	1
			Small Wasp Unid	2	0	0	2	0	0	0	0	0	0	2
			Spider Wasp	0	0	0	0	0	0	0	2	0	2	2
			Un id Black Wasp	0	0	0	0	2	1	0	0	0	3	3
			Wasp (brown banded)	0	0	0	0	0	0	0	1	0	1	1
			Wasp red abdomen black body	0	0	0	0	0	0	1	0	0	1	1
			Wasp Un id	8	0	5	13	6	1	3	6	15	31	44
Vespidae			Wasp Unid Large	0	0	0	0	0	0	0	0	1	1	1
			Banded Bee	0	3	0	3	0	1	0	0	0	1	4
			Bee (Orange abdomen)	3	0	0	3	0	1	1	0	0	2	5
			Bee black with single band	0	0	2	2	0	0	0	0	0	0	2
			Bee 1	2	0	0	2	0	0	0	0	0	0	2
			Small Bee	5	0	0	5	0	0	0	0	1	1	6
			Stingless Bee	4	0	0	4	0	0	0	0	0	0	4
			Orange and black bee	4	0	0	4	0	0	0	0	0	0	4
			Bee 2	7	0	1	8	7	1	0	1	0	9	17
			Blue Bee	0	0	0	0	0	0	0	1	0	1	1
			Bee 3	0	0	0	0	1	0	0	0	0	1	1
Unidentified			Yellow banded bee	0	0	0	0	0	0	1	0	0	1	1

as they are indicators of the physical condition of a habitat. The urban sector had 35 hymneopterans and eight were exclusive to the individual sub sectors, while the vegetated sector had 43 types with 17 exclusive to the sector and 14 types were restricted to the individual sub sectors.

Table 22: Distribution and abundance of insects living in colonies observed in the IIT-Bombay campus.

Order Hemiptera														
Family	**Genus**	**Species**	**Common name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
			Scale Insects	10	6	2	18	3	0	4	2	4	13	31
Order Diptera														
Culicidae			Mosquito	20	12	8	40	19	14	8	18	22	81	121
Order Hymenoptera														
Apidae			Stingless bee nest	5	0	0	5	2	0	0	0	0	2	7
	Xylocopa	*sp.*	Carpenter bee colony	0	0	0	0	3	0	0	0	1	4	4
Formicidae	*Anoplolepis*	*gracilipes*	Yellow Crazy Ant	6	2	1	9	1	3	0	1	1	6	15
	Camponotus	*angusticollis*	Long necked sugar Ant	2	2	0	4	0	1	1	0	0	2	6
		compressus	Common Godzilla Ant	7	2	3	12	10	0	8	5	1	24	36
		irritans	Giant Honey Ant	0	0	0	0	0	0	1	0	0	1	1
	Crematogaster	*ransonneti*	Glossy Slender Acrobat Ant	0	1	0	1	0	0	0	0	0	0	1
		subnuda	Common Broad Acrobat Ant	6	4	1	11	5	5	14	4	12	40	51
		sp	Pagoda Ant Nest	1	1	0	2	2	0	3	0	48	53	55
	Leptogenys	*chinensis*	Slender Jawed Sail Ant	0	0	0	0	4	0	0	0	0	4	4
	Monomorium	*pharaonis*	Pharaoh Ant	3	2	1	6	1	3	0	1	0	5	11
	Oecophylla	*smaragdina*	Weaver Ant	0	0	0	0	1	0	1	1	2	5	5
	Paratrachina	*longicornis*	Black Crazy Ant	27	10	9	46	14	5	15	12	5	51	97
	Pheidole	*sp.*	Harvester ant colony	0	0	0	0	0	0	5	0	0	5	5
	Salenopsis	*geminata*	Common Red Fire Ant	5	4	6	15	4	0	0	4	1	9	24
	Tapinoma	*melanocephalum*	Odour Ant	22	5	7	34	3	3	10	7	4	27	61
	Technomyrmex	*albiceps*	White footed Ghost Ants	0	3	0	3	0	0	0	0	4	4	7
	Tetramorium	*smithi*	Miniscule House Ant	3	4	4	11	0	0	1	2	1	4	15
	Tetraponera	*allaborans*	Polished Leaf-border Ant	2	0	0	2	0	0	0	0	2	2	4
		rufonigra	Arboreal bicolored Ant	6	1	4	11	7	6	1	5	8	27	38
	Unidentified		Ant 1	1	1	0	2	0	0	0	0	1	1	3
			Ants with red head	0	0	0	0	0	0	0	0	1	1	1
			Black ants procession	0	0	0	0	0	0	0	2	0	2	2
			Black ants woolly/ striated nature	0	0	0	0	3	0	0	2	1	6	6
			Winged Ant	0	0	1	1	0	0	0	0	0	0	1
Vespidae			Paper wasp nest	1	0	1	2	0	1	7	0	1	9	11
			Pot of Potter wasp	0	0	0	0	0	1	0	0	0	1	1
				97	42	38	177	60	28	67	46	94	295	472
Order : Isopetera														
			Termites	1	0	0	1	0	0	6	1	5	12	13
Other Colonial Insects														
			Leaf miner	1	1	3	5	0	0	2	1	2	5	10
			Gall Insects	2	0	0	2	0	0	3	0	0	3	5
			Aphids	2	0	0	2	0	0	1	0	0	1	3

Numbers indicate the number of colonies.

Several groups of insects are known to exhibit and live in social groups. This arrangement is beneficial to the faunal forms as they can create a better impact on the environment. The most well known social insect is the Honey bee that has a high economic importance. The honey bee can also indicate the productivity of the ecosystem. During the study insects living in colonies representing three orders were observed (Table 22). Of the three orders Hymenoptera was the dominant one with more species diversity in the vegetated sector than the urban sector. The family formicidae was represented by 23 different ant species, some of which also indicated the disturbances taking place in the vegetated sector e.g. Odour ant. The ants were well distributed in the campus with four species common through out the campus. However it was observed that harvestor ant was present only in the V3 sub sector on the Hill side, indicating its preference for grasses. The mosquitoes belonging to order diptera were the most wide spread, while the scale insects (order Hemiptera) were more prominent in the urban sector.

Table 23: Distribution and abundance of several less represented insect orders in the IIT-Bombay campus.

Order Neuroptera													
Family	**Genus**	**Species**	**Common name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Ascalaphidae			Owlfly	0	0	0	0	0	0	2	0	0	2	2
Chrysopidae			Lacewing	5	4	1	10	5	2	0	1	4	12	22
Myrmeleontidae			Antlion	2	0	1	3	1	6	2	2	2	13	16
Order Orthoptera														
Pyrgomorphidae	*Poekilocerus*	*pictus*	Painted Grasshopper	0	0	0	0	0	0	3	0	1	4	4
Gryllidae			Cricket	5	14	6	25	0	1	4	0	7	12	37
Tettigoniidae			Katydid	1	2	5	8	5	4	5	2	3	19	27
			Grasshopper	9	9	12	30	4	7	32	10	11	64	94
			Ground Hopper	4	0	2	6	1	0	0	0	0	1	7
Order Megaloptera														
Corydalidae			Dobson's fly	0	0	0	0	0	0	3	0	0	3	3
Order Thysanura														
Lepismatidae	*Lepisma*		Silver fish	1	0	0	1	1	0	0	0	1	2	3
Order Phasmatodea														
			Stick Insect	0	0	0	0	1	1	2	3	0	7	7
Order Mantodae														
			Ant mimicking praying mantis	0	0	0	0	0	0	2	0	0	2	2
			Bark mantis	1	1	0	2	1	1	4	0	1	7	9
			Praying mantis	2	3	2	7	0	4	6	3	2	15	22
Order Blattaria														
			Forest Cockroach	17	12	6	35	0	1	2	10	16	29	64
			Unid Cockroach	3	0	12	15	0	0	1	2	1	4	19
Order Isoptera														
			Termites	1	0	0	1	0	0	6	1	5	12	13
Order Dermaptera														
			Earwig	2	0	0	2	0	0	0	0	1	1	3

Table 24: Distribution and abundance of fauna belonging to class Arachinida in the IIT-Bombay Campus.

Order Araneae (Spiders)												
Family Araneidae												
Genus	**Species**	**Common Name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Argiope	*anasuja*	Signature spider	0	0	0	0	0	0	0	1	0	1	1
Cyclosa	*sp.*	Debri spider	4	7	4	15	7	9	4	5	8	33	48
Gastracantha		Spiny orb Weaver	0	0	0	0	0	0	0	1	1	2	2
		Dome Spider	19	25	16	60	7	0	26	21	5	59	119
		Garden orb weaver	4	1	1	6	1	0	0	1	2	4	10
		Orb Weaver	0	1	0	1	1	1	0	4	3	9	10
		Signature Spider	3	2	7	12	3	5	5	4	3	20	32
Family Clubionidae													
		Sac spider	0	1	0	1	0	0	0	0	0	0	1
Family Gnaphosidae													
		Ground spider	2	1	0	3	2	0	3	1	0	6	9
Family Hersilidae													
		Two tailed Spider	0	1	0	1	0	0	0	0	0	0	1
Family Lycosidae													
		Tunnel sheet spider	11	0	3	14	5	11	0	252	32	300	314
		Wolf spider	1	0	0	1	2	0	1	0	1	4	5
Family Oxyopidae													
Peucetia	*viridans*	Green lynx spider	0	0	0	0	0	0	1	0	0	1	1
		Lynx spider	8	12	9	29	14	5	6	7	6	38	67
Family Pisauaridae													
		Nursery Web Spider	0	0	0	0	0	0	1	0	0	1	1
Family Salticidae													
Myrmyche		Ant mimicking Spider	1	0	0	1	1	0	0	0	0	1	2
Telamonia	*dimidata*	Mopsus Spider	0	0	1	1	0	0	0	1	0	1	2
		Jumping Spider	20	13	9	42	9	3	3	11	14	40	82
Family Scytodidae													
		Spitting Spider	0	1	0	1	3	2	0	2	0	7	8
Family Sparassidae													
		Huntsman Spider	0	0	0	0	1	0	0	3	0	4	4
Family Tetragnathidae													
		Long jawed Orb Weaver	1	1	0	2	2	0	1	2	2	7	9
Leucauge	*venusta*	Venusta Orchard Spider	1	1	0	2	1	1	5	1	1	9	11
Family Thomisidae													
		Crab spider	6	0	2	8	2	0	5	3	2	12	20
Family Uloboridae													
		Hackled orb weaver	2	0	0	2	0	0	0	0	1	1	3
Order Opiliones													
		Harvesterman	0	0	0	0	0	1	0	0	1	2	2

The other orders that were sighted in the campus included the Neuroptera, Orthoptera, Megaloptera, Thysanaura, Phasmoidea, Mantodae, Blattaria, Isoptera and Dermoptera (Table 23). These orders were not very significant but are ecologically important as indicator species.

Diplopods

Diplopods (Millipedes) always look pretty clean and when healthy they are in fact very clean animals, spending a great deal of time cleaning and polishing all the various parts of their bodies. They live in the leaf litter zone or burrow into the top soil but some specialise in living under the bark on dead trees or else in rotten wood and some can even be found climbing living trees. Millipedes are important agents of nutrient fluxes in many habitats, in fact in some tropical areas they are of more importance than earthworms. Their main role is one of comminution of plant material, meaning they breakup dead plant material into small pieces thus increasing the surface area. This is important because the surface is the only part the bacteria and microfungi can reach and they are the main agents of recycling in the soil. Millipedes when they eat rotting vegetation are really only digesting the fungi and bacteria and the plant material they have already broken down. More than 10000 species are named the world over, in the present study the millipede was observed in the entire campus except in the U3 and V5 sub sectors of the Urban and Vegetated sectors respectively (Table 15).

Chilopods

The class Chilopoda includes five orders, 21 families, and 3,200 known species globally. Centipedes are common in wet forest and woodland, but many species inhabit dry forest, and some live in grassland or deserts. They occur worldwide, except Antarctica. Some species have become more widespread as a result of commerce and plant introductions, carried in soil or with plants. Some species have disappeared from islands with the introduction of exotic mammals and snakes. In the IIT-Bombay Campus the centipedes were observed in the entire campus (Table 15) and were found in larger numbers in the vegetated sectors.

Arachnida

Most arachnids are terrestrial. However, some inhabit freshwater environments and, with the exception of the pelagic zone, marine environments as well. They comprise over 100,000 named species, including spiders, scorpions, harvestmen, ticks, and mites. Arachnids are mostly carnivorous, feeding on the pre-digested bodies of insects and other small animals. Only in the harvestmen and among mites, such as the house dust mite, is there ingestion of solid food particles, and thus exposure to internal parasites, although it is not unusual for spiders to eat their own silk. Several groups secrete venom from specialized glands to kill prey or enemies. Several mites are parasites, some of which are carriers of disease.

Spiders are voracious predators of insects. Because they are able to tide over periods of low food availability and take advantage of periods of abundance, they have adapted to many habitats. They are important in controlling pests which are injurious to man and animals.

In the present study two orders of class Arachnida were recorded viz. Araneae and Opiliones (Table 24). The order Opiliones was represented by Harvestman that was restricted to the V2 and the V5 sub sectors only. The harvestman is ecologically important as it is a carnivore feeding on aphids, spiders and springtails.

Araneae is the largest order of Arachnids comprising of more than 30,000 species distributed over 60 families. The spiders are widely distributed in different habitats including one at 23,000 feet on Mount Everest. In the campus 13 families were recorded with 24 types of spiders, four of which were identified up to species level while three up to generic level and the remaining were placed into families. Family Araneidae was the most dominant with seven types of spiders, followed by family Salticidae (three spiders), Oxyopidae and Tetragnathidae (two types each) and the remaining had one type of spider each. Of the 24 types of spiders five were exclusive to the vegetated sector while only one was exclusive to the urban sector. However an important observation was the absence of the Giant wood spider that is commonly found in the Mumbai region in the forested areas.

Gastropods

Gastropods inhabit diverse biotopes. They are found in the sea, in fresh as well as brackish water and many also live permanently on dry land. The diet of gastropods shows marked diversity, some are omnivorous, others herbivorous and still others feed on bodies of dead animals. Many species are predaceous and some

are even parasitic. The gastropods contain the greatest number of species, i.e. more than 100,000 which are divided in to 409 recent families plus 202 families of fossil gastropods. In the present study three types of gastropods were recorded (Table 15). The Giant African snail, which damages the barks of trees and is a serious pest to the trees, was exclusive to the U2 urban sub sector. The slug was exclusive to the V4 vegetated sub sector while the unidentified snail was more common though not found in the entire campus. The presence of gastropods in an ecosystem is important as they trap the carbon in their shells and remove some carbon from the atmosphere.

Vertebrate Fauna

The **vertebrates** form an important component in terms of conservation of habitats and ecosystems. Their existence and abundance could indicate the health of the ecosystem. In addition it also plays a significant role in planning conservation measures and the economy of a country.
There are about 2546 species of fish (about 11% of the world species) found in Indian waters.197 species of amphibians (4.4% of the world total) and more than 408 reptile species (6% of the world total) are found in India. Among these groups the highest levels of endemism are found in the amphibians. There are about 1250 species of birds from India with some variations depending on taxonomic treatments accounting for about 12% of the world species There are about 410 species of mammals known from India which is about 8.86% of the world species.

Pisces

Cold-blooded, scaled aquatic vertebrates, fish were the first animals known to develop bones. Ray-finned fishes comprise about 30,000 species throughout freshwater and ocean habitats all over the world. Globally, 1,275 species of fish — including lampreys and hag fish, sharks, skates, rays and chimaeras, bony fishes, coelacanths, sea urchins, and starfish — or 4 percent of described fish species were deemed at risk of extinction by IUCN's 2008 Red List.
In the present study fish was not collected or studied specifically unless it was found in the waters within the study area. However only one species of fish i.e. *Oreochromis mossambicus* (Tilapia fish) was recorded in the V1 vegetated sub sector. This species is an alien invasive species that was observed in the waters close to the vegetated area of the campus.

Amphibians

Amphibians play a pivotal role in ecosystem as secondary consumers in many food chains. Tadpoles have significant impact in nutritional cycling. They are herbivorous to omnivorous and are the prey items for both invertebrates and vertebrates. Adult amphibians are the best biological pest controllers. Invertebrates and vertebrates also predate them. Because of their importance in ecosystem, decline or extinction of their population has significant impact on other organisms along with them.
From the ecological perspective, amphibians are regarded as good ecological indicators. Due to high degree of sensitivity, either during tadpole stage or as adults, they respond to very slight change in the environment. Such responses have been used to indicate habitat fragmentation, ecosystem stress, impact of pesticides, and various anthropogenic activities.
Globally, 1,866 species of amphibians, or 30 percent of the total number of 6,221 described existing amphibian species, were deemed at risk of extinction by IUCN's 2008 Red List.
In the IIT-Bombay campus six species of amphibians belonging to order Salientia were observed (Table 25). Of these four were identified up to the species level. And one frog and a toad remained unidentified and were observed in the urban sector only. Of the four identified one was a toad and was found restricted to the V4 sub sector. The other three only *Polypedates maculates* was observed in the urban sector while the eggs were recorded in the vegetated sector indicating the importance of the vegetated habitat.

Table 25: Distribution and abundance of Amphibians in IIT-Bombay campus.

Family	Genus	Species	Common Name	Stage	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Bufonidae	*Bufo*	*melanostictus*	Common Indian Toad					0				1		1	**1**
Ranidae	*Euphyctics*	*hexadactylus*	Indian Pond Frog					0	1					1	**1**
	Hoplobatrachus	*tigerinus*	Indian Bull Frog					0	2					2	**2**
Rhacophoridae		*maculatus*		A, YA		2		2						0	**2**
	Polypedates		Tree frog	Egg				0	1					1	**1**
Unidentified			Toad (?)				1	1						0	**2**
			Unid Frog	YA		3		3						0	**6**

Reptiles

Reptiles are air-breathing, cold-blooded vertebrates that have scaly bodies rather than hair or feathers; most reptile species are egg-laying, though certain "squamates" — lizards, snakes and worm-lizards — give birth to live young. "Reptile" is an ambiguous category: it usually refers to lizards, snakes, turtles, alligators, and crocodiles, but to be genetically consistent should also include birds, since crocodilians are more closely related to birds than to lizards, snakes, or turtles.

Most of the species inhabit tropical as well as sub tropical regions and live on ground, trees, bushes as well as in water. They are mostly carnivorous and benefit man by eating up abnoxius insects and destructive rodents.

Globally, 423 species of reptiles, or 5 percent of the total described species, were deemed endangered or vulnerable to extinction by IUCN's 2008 Red List. In the campus two orders of reptiles were recorded i.e. Squamata and the Crocodilia (Table 26). In the order Squamata seven families of reptiles were observed. Four families of which included the ten lizard types. The *Calotes* species was found to be common in the entire campus. The monitor lizard was restricted to the urban sub sector U3, while Brook's gecko was restricted to the vegetated sub sector V3. Three different geckos were observed in the urban sector remain unidentified, while one lizard observed in the vegetated sub sector was not identified.

Three families of snakes were represented by four species and one unidentified snake which was classified to the order level only. None of the snakes were common in the campus except for the rat snake which had a fairly good representation.

The marsh crocodile was the lone representative of the family Crocodylidae from order Crocodilia and was restricted to the lake waters close to V1 in the vegetated sub sector. This was observed only during the third phase of the study.

Considering the area of the campus and its green patches the overall reptile diversity is poor.

Table 26 : Distribution and abundance of Reptiles in IIT-Bombay campus.

Order Squamata														
Family	**Genus**	**Species**	**Common Name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
		rouxii	Forest Calotes	0	2	0	2	0	4	0	0	2	6	8
		versicolor	Garden Calotes	0	1	3	4	2	0	0	0	0	2	6
Agamidae	*Calotes*		Calotes	2	2	4	8	2	2	3	2	3	12	20
Scincidae	*Mabuya*	*carinata*	Brahminy Skink	7	1	3	11	2	3	4	3	0	12	23
Varanidae	*Varanus*	*benghalensis*	Common Monitor Lizard	0	0	1	1	0	0	0	0	0	0	1
	Hemidactylus	*brokii*	Brook's Gecko	0	0	0	0	0	0	1	0	0	1	1
			Gecko 1	1	0	0	1	0	0	0	0	0	0	1
			Gecko 2	0	1	0	1	0	0	0	0	0	0	1
Gekkonidae			Gecko 3	1	0	0	1	0	0	0	0	0	0	1
			Unid Lizard	0	0	0	0	0	1	0	0	0	1	1
Colubridae	*Ahaetulla*	*nasuta*	Vine Snake	0	0	1	1	0	0	0	0	0	0	1
Viperidae	*Daboia*	*russelii*	Russell's Viper	0	0	0	0	0	0	0	0	1	1	1
	Ptyas	*mucosus*	Rat Snake	4	1	1	6	0	0	1	0	0	1	7
Colubridae	*Xenochrophis*	*piscator*	Checkered Keelback	1	0	0	1	0	0	0	1	0	1	2
			Unid Snake	0	0	0	0	0	1	0	0	0	1	1
Order Crocodilia														
Crocodylidae	*Crocodylus*	*palustris*	Marsh Crocodile	0	0	0	0	2	0	0	0	0	2	2

Birds

Birds are bipedal, warm-blooded, egg-laying vertebrates with about 9,856 living species. Birds play several important roles in ecosystems. As consumers, they help regulate populations of smaller animals they prey upon, disperse plant seeds, and pollinate flowering plants. As prey items, birds and bird eggs are consumed by a variety of larger predators.

Birds provide important ecological services that contribute to maintaining ecosystem processes and some of the necessary conditions on which humans and other organisms depend. These services range from food provisioning to modification of habitats and resource flows in biological communities. Bird declines can have negative impacts on ecosystems, and their sensitivity to environmental change often lends them as useful indicators of environmental quality.

Globally, 1,226 species of birds, or 12.4 percent of the total of 9,856 extant described bird species, were deemed endangered or threatened with extinction by IUCN's 2008 Red List.

Table 27: Distribution and abundance of Birds in IIT-Bombay campus.

Family	*Genus*	*Species*	Common Name	Feeding Habit	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Order Anseriformes															
Anatidae	*Anas*	*poecilorhyncha*	Spot billed Duck	Herbivore	0	2	0	**2**	0	0	0	0	0	**0**	**2**
	Dendrocygna	*javanica*	Lesser Whistling Teal	Omnivore	0	9	0	**9**	10	0	0	0	0	**10**	**19**
	Nettapus	*coromandelianus*	Cotton Pygmy Goose	Omnivore	0	0	0	**0**	8	0	0	0	0	**8**	**8**
	Tadorna	*ferruginea*	Ruddy Shelduck	Omnivore	0	16	0	**16**	0	0	0	0	0	**0**	**16**
			Goose	Herbivore	37	0	0	**37**	0	0	0	0	0	**0**	**37**
Order Apodiformes															
Apodidae	*Apus*	*affinis*	House Swift	Insectivores	0	0	0	**0**	0	0	3	0	0	**3**	**3**
	Cypsiurus	*balasiensis*	Asian Palm Swift	Insectivores	20	1	4	**25**	78	0	12	0	2	**92**	**117**
Order Charadriformes															
Charadriidae	*Vanellus*	*indicus*	Red wattled Lapwing	Mixed diet	0	4	0	**4**	2	0	0	0	0	**2**	**6**
Jacanidae	*Hydrophasianus*	*chirurgus*	Pheasant tailed Jacana	Omnivore	0	7	0	**7**	9	2	0	0	0	**11**	**18**
	Metapidius	*indicus*	Bronze winged Jacana	Omnivore	0	10	0	**10**	2	0	0	0	0	**2**	**12**
Laridae	*Chlidonias*	*hybridus*	Whiskered Tern	Mixed diet	0	0	0	**0**	2	0	0	0	0	**2**	**2**
Recurvirostidae	*Himantopus*	*himantopus*	Black winged Stilt	Mixed diet	0	6	0	**6**	0	0	0	0	0	**0**	**6**
Scolopacidae	*Actitis*	*hypoleucos*	Common Sandpiper	Mixed diet	0	1	0	**1**	0	0	0	0	0	**0**	**1**
Order Ciconiiformes															
Ardaeidae	*Ardea*	*cinerea*	Grey Heron	Mixed diet	1	5	0	**6**	0	0	0	0	0	**0**	**6**
		purpurea	Purple Heron	Mixed diet	0	2	0	**2**	1	0	0	0	0	**1**	**3**
	Ardeola	*grayii*	Indian Pond Heron	Mixed diet	2	17	1	**20**	5	1	0	2	2	**10**	**30**
	Bubulcus	*ibis*	Cattle Egret	Mixed diet	14	49	5	**68**	37	3	5	5	3	**53**	**121**
	Casmerodius	*albus*	Greater Egret	Mixed diet	0	6	0	**6**	2	0	0	0	0	**2**	**8**
	Mesophoyx	*intermedia*	Median Egret	Mixed diet	0	1	0	**1**	1	0	0	0	0	**1**	**2**
	Nycticorax	*nycticorax*	Black Crowned Night Heron	Mixed diet	0	0	1	**1**	1	0	0	0	0	**1**	**2**
Threskiornithidae	*Plegadis*	*falcinellus*	Glossy Ibis	Mixed diet	1	2	0	**3**	0	0	0	0	0	**0**	**3**
Order Columbiformes															
Columbidae	*Columbia*	*livia*	Blue Rock Pigeon	Granivores	27	24	39	**90**	8	0	39	25	13	**85**	**175**
	Streptopelia	*chinensis*	Spotted Dove	Granivores	0	6	1	**7**	13	0	0	0	4	**17**	**24**
		decaocto	Eurasian Collared Dove	Granivores	0	0	0	**0**	1	0	0	0	0	**1**	**1**
Order Coraciiformes															
Alcedinide	*Alcedo*	*atthis*	Small Blue Kingfisher	Piscivore	5	5	0	**10**	3	0	0	3	2	**8**	**18**
	Halcyon	*smyrnensis*	White throated Kingfisher	Mixed diet	2	9	8	**19**	8	0	0	6	3	**17**	**36**
Bucerotidae	*Ocyceros*	*birostris*	Indian Grey Hornbill	Omnivore	0	2	0	**2**	0	0	3	0	4	**7**	**9**
Coraciidae	*Coracias*	*benghalensis*	Indian Roller	Mixed diet	0	0	0	**0**	0	1	0	0	0	**1**	**1**
Meropidae	*Merops*	*orientalis*	Small Green Bee-eater	Insectivores	11	4	3	**18**	15	0	22	2	3	**42**	**60**
		philippinus	Blue tailed Bee eater	Insectivores	0	0	0	**0**	5	0	0	0	0	**5**	**5**
Upupidae	*Upupa*	*epops*	Hoopoe	Insectivores	0	0	1	**1**	0	0	0	0	0	**0**	**1**
Order Cuculiformes															
Cuculidae	*Centropus*	*sinensis*	Greater Coucal	Mixed diet	12	16	2	**30**	12	2	15	22	5	**56**	**86**
	Clamator	*jacobinus*	Pied Crested Cuckoo	Omnivore	0	0	0	**0**	0	0	4	0	0	**4**	**4**
	Eudynamys	*scolopacea*	Asian Koel	Mixed diet	8	23	4	**35**	11	0	4	7	7	**29**	**64**
Order Falconiformes															
Accipitridae	*Accipiter*	*badius*	Shikra	Mixed diet	1	0	0	**1**	0	0	1	0	0	**1**	**2**
	Circus	*aeruginosus*	Eurasian Marsh Harrier	Mixed diet	0	2	0	**2**	0	0	0	0	0	**0**	**2**
	Hiliastur	*indus*	Brahminy Kite	Mixed diet	0	0	0	**0**	0	1	0	0	0	**1**	**1**
	Milvis	*migrans*	Black Kite	Scavenger	63	28	74	**165**	105	16	67	28	34	**250**	**415**
Falconidae	*Falco*	*tinnunculus*	Common Kestrel	Mixed diet	0	0	0	**0**	0	0	0	0	2	**2**	**2**
Pandonidae	*Pandion*	*haliaetus*	Osprey	Piscivore	0	2	0	**2**	0	0	0	0	0	**0**	**2**
Order Galliformes															
Phasianidae	*Pavo*	*cristatus*	Indian Peafowl	Omnivore	1	1	0	**2**	0	0	2	0	0	**2**	**4**
Order Gruiformes															
Rallidae	*Amaurornis*	*phoenicurus*	White breasted Waterhen	Omnivore	0	8	0	**8**	3	0	0	0	0	**3**	**11**
	Fulica	*atra*	Common Coot	Omnivore	0	0	0	**0**	3	0	0	0	0	**3**	**3**
	Gallinula	*chloropus*	Common Moorhen	Omnivore	0	0	0	**0**	1	0	0	0	0	**1**	**1**
	Porphyrio	*porphyrio*	Purple Swamphen	Omnivore	0	34	0	**34**	4	0	0	0	0	**4**	**38**
Order Passeriformes															
Campephagidae	*Coracina*	*macei*	Large Cuckooshrike	Omnivore	0	0	0	**0**	0	0	0	0	1	**1**	**1**
		melanoptera	Barheaded Cuckooshrike	Omnivore	0	0	0	**0**	0	0	0	0	1	**1**	**1**
Corvidae	*Corvus*	*macrorhynchos*	Jungle Crow	Scavenger	19	26	60	**105**	128	20	27	18	32	**225**	**330**
		splendens	House Crow	Scavenger	135	275	81	**491**	320	13	112	99	63	**607**	**1098**
Dicaeidae	*Dicaeum*	*agile*	Thick billed Flowerpecker	Frugivores	0	0	0	**0**	3	0	0	0	4	**7**	**7**
Dicruridae	*Dicrurus*	*leucophaeus*	Ashy Drongo	Insectivores	5	0	0	**5**	1	0	1	0	0	**2**	**7**
		macrocerus	Black Drongo	Insectivores	2	3	1	**6**	5	1	1	0	2	**9**	**15**
Estrildidae	*Amandava*	*amandava*	Red Avadavat	Granivores	0	0	0	**0**	1	0	0	0	0	**1**	**1**
	Lonchura	*punctulata*	Scaly breasted Munia	Granivores	5	7	24	**36**	23	0	9	0	0	**32**	**68**

Birds continued..

Family	Genus	Species	Common Name	Feeding Habit	U1	U2	U3	U	V1	V2	V3	V4	V5	V	Total
Hirundinidae	*Hirundo*	*concolor*	Dusky Crag Martin	Insectivores	0	0	0	**0**	0	0	33	1	0	**34**	**34**
	Hirundo	*daurica*	Red rumped Swallow	Insectivores	0	0	30	**30**	0	0	24	0	0	**24**	**54**
Irenidae	*Aegithina*	*tiphia*	Common Iora	Insectivores	3	0	1	**4**	1	0	0	1	0	**2**	**6**
Laniidae	*Lanius*	*schach*	Long tailed Shrike	Mixed diet	2	2	2	**6**	3	0	4	1	0	**8**	**14**
Motacillidae	*Motacilla*	*alba*	White Wagtail	Insectivores	0	1	0	**1**	0	0	0	0	0	**0**	**1**
		cinerea	Grey Wagtail	Insectivores	0	0	0	**0**	0	0	0	0	1	**1**	**1**
		citreola	Citrine Wagtail	Insectivores	7	1	0	**8**	1	0	0	0	0	**1**	**9**
Muscicapidae	*Acrocephalus*	*concinens*	Blythe's Reed Warbler	Insectivores	0	8	0	**8**	7	0	0	0	0	**7**	**15**
	Chrysomma	*sinense*	Yellow-eyed Babbler	Omnivore	0	1	0	**1**	0	0	0	0	0	**0**	**1**
	Copsychus	*saularis*	Oriental Magpie Robin	Omnivore	35	7	5	**47**	23	2	9	3	23	**60**	**107**
	Cyornis	*tickelliae*	Tickell's Blue Flycatcher	Insectivores	0	0	0	**0**	1	0	0	0	0	**1**	**1**
	Ficedula	*parva*	Red throated Flycatcher	Insectivores	0	1	1	**2**	0	0	0	2	0	**2**	**4**
	Hippolais	*caligata*	Booted Warbler	Insectivores	9	11	0	**20**	12	0	0	0	0	**12**	**32**
	Hypothymis	*azurea*	Black Naped Monarch	Insectivores	1	0	0	**1**	0	0	0	0	0	**0**	**1**
	Orthotomus	*atrogularis*	Common Tailorbird	Omnivore	1	10	1	**12**	9	2	7	4	10	**32**	**44**
	Pellorneum	*ruficeps*	Spotted Babbler	Insectivores	0	0	0	**0**	0	0	0	1	0	**1**	**1**
	Phylloscopus	*trochiloides*	Greenish Warbler	Insectivores	0	0	0	**0**	0	0	0	1	0	**1**	**1**
	Prinia	*inornata*	Plain Prinia	Insectivores	0	0	0	**0**	1	0	0	0	0	**1**	**1**
		socialis	Ashy Prinia	Insectivores	6	14	0	**20**	9	3	7	1	1	**21**	**41**
	Rhipidura	*aureola*	White browed Fantail Flycatcher	Insectivores	3	2	1	**6**	0	0	2	0	0	**2**	**8**
	Saxicola	*leucora*	Common Stonechat	Insectivores	0	0	0	**0**	3	0	0	0	0	**3**	**3**
	Saxicoloides	*fulicata*	Indian Robin	Insectivores	0	0	0	**0**	0	0	6	0	0	**6**	**6**
	Terpsiphone	*paradisi*	Asian Paradise Flycatcher	Insectivores	11	0	0	**11**	2	0	0	0	5	**7**	**18**
	Turdoides	*striatus*	Jungle Babbler	Omnivore	3	0	4	**7**	19	0	13	2	32	**66**	**73**
	Zoothera	*citrina*	Orange headed Thrush	Omnivore	0	0	0	**0**	0	0	0	0	1	**1**	**1**
			Unid Warbler		0	3	1	**4**	0	0	0	1	0	**1**	**5**
			Warbler		2	0	0	**2**	1	1	1	0	1	**4**	**6**
Nectariniidae	*Aethopyga*	*siparaja*	Crimson Sunbird	Nectarivores	1	0	0	**1**	1	0	0	0	0	**1**	**2**
	Nectarinia	*asiatica*	Purple Sunbird	Nectarivores	7	0	0	**7**	0	0	7	0	0	**7**	**14**
		zeylonica	Purple rumped Sunbird	Nectarivores	0	8	5	**13**	0	1	9	2	0	**12**	**25**
Oriolidae	*Oriolus*	*oriolus*	Eurasian Golden Oriole	Omnivore	4	7	2	**13**	8	0	4	0	8	**20**	**33**
Passeridae	*Passer*	*domesticus*	House Sparrow	Omnivore	22	16	14	**52**	23	0	11	0	7	**41**	**93**
Pittidae	*Pitta*	*brachyura*	Indian Pitta	Insectivores	0	0	0	**0**	0	0	0	0	1	**1**	**1**
Pycnonotidae	*Pycnonotus*	*cafer*	Red-vented Bulbul	Omnivore	0	5	1	**6**	5	5	14	6	1	**31**	**37**
		jocosus	Red-whiskered Bulbul	Omnivore	12	15	0	**27**	7	0	7	1	9	**24**	**51**
		leucotis	White cheeked bulbul	Omnivore	0	0	0	**0**	0	0	0	0	2	**2**	**2**
		luteolus	White browed Bulbul	Omnivore	0	0	0	**0**	0	1	0	2	0	**3**	**3**
Sturnidae	*Acridotheres*	*tristis*	Common Myna	Omnivore	75	65	54	**194**	49	6	19	11	40	**125**	**319**
	Sturnus	*contra*	Asian Pied Starling	Omnivore	0	7	0	**7**	0	0	1	0	0	**1**	**8**
		erythropygius	Chestnut Tailed Starling	Omnivore	0	4	0	**4**	0	0	0	0	0	**0**	**4**
		pagodarum	Brahminy Starling	Omnivore	1	0	0	**1**	0	0	0	0	0	**0**	**1**
Order Pelecaniformes															
Anhingidae	*Anhinga*	*melanogaster*	Oriental Darter	Piscivore	0	1	0	**1**	1	0	0	0	0	**1**	**2**
Phalacrocoracidae	*Phalacrocorax*	*niger*	Small Cormorant	Piscivore	0	5	0	**5**	2	0	0	0	0	**2**	**7**
Order Piciformes															
Capitonidae	*Megalaima*	*haemacephala*	Coppersmith Barbet	Frugivores	11	6	7	**24**	5	0	6	11	6	**28**	**52**
Picidae	*Dendrocopos*	*hyperythrus*	Rufous Woodpecker	Insectivores	1	0	0	**1**	2	0	0	0	4	**6**	**7**
Order Podicipediformes															
Podicipedidae	*Tachybaptus*	*ruficollis*	Little Grebe	Mixed diet	0	0	0	**0**	2	0	0	0	0	**2**	**2**
Order Psittaculiformes															
Psittacidae	*Psittacula*	*cyanocephala*	Plum headed Parakeet	Frugivores	0	0	0	**0**	0	0	0	0	1	**1**	**1**
		eupatria	Alexandrine Parakeet	Frugivores	7	2	5	**14**	0	0	14	0	0	**14**	**28**
		krameri	Rose Ring Parakeet	Frugivores	29	49	49	**127**	21	0	31	14	14	**80**	**207**
Order Strigiformes															
Strigidae	*Athene*	*brama*	Spotted Owlet	Mixed diet	2	0	0	**2**	0	0	0	0	0	**0**	**2**

Table 28: Distribution and abundance of Mammals in the IIT-Bombay campus.

Order Artiodactyla														
Family	**Genus**	**Species**	**Common name**	**U1**	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Bovidae			Domestic Cattle	2	32	14	48	31	2	9	0	1	43	91
Order Carnivora														
Canidae	*Canis*	*familaris*	Domestic Dog	37	30	19	86	42	0	24	10	0	76	162
Felidae	*Felis*	*catus*	Domestic Cat	1	14	2	17	0	0	3	0	0	3	20
Herpestidae	*Herpestes*	*edwardsii*	Indian Grey Mongoose	0	5	0	5	1	0	1	0	0	2	7
		smithii	Ruddy Mongoose	0	0	0	0	0	1	0	0	0	1	1
Order Primates														
	Macaca	*mulatta*	Rhesus Macaque	15	0	0	15	0	0	0	0	0	0	15
Cercopithecidae	*Semnopithecus*	*entellus*	Hanuman Langoor	8	0	0	8	0	0	0	0	0	0	8
Order Logomorpha														
Leporidae	*Lepus*	*nigricollis*	Indian Hare	0	0	0	0	0	1	0	0	0	1	1
Order Rodentia														
Muridae	*Bandicota*		Bandicoot Rat	1	0	0	1	0	0	0	0	0	0	1
Muridae			House Rat	2	0	0	2	0	0	0	0	0	0	2
Muridae			Rat	0	0	0	0	0	0	0	0	1	1	1
Muridae			Rat (Burrows)	0	5	1	6	0	0	0	2	0	2	8
Sciuridae	*Funambulus*	*palmarum*	Three-striped Palm Squirrel	19	26	2	47	26	12	20	18	9	85	132
Order Chiroptera														
Pteropodidae	*Pteropus*	*giganteus*	Indian Flying Fox	190	0	0	190	2	0	0	1	0	3	193
			Unid Bat	0	0	0	0	0	0	0	3	0	3	3
Order Insectivora														
Soicidae			Shrew	0	0	1	1	0	0	0	0	0	0	1
Viverridae			Civet	1	0	0	1	0	0	0	0	1	1	2

During the present study in the campus 104 species (two unidentified warblers) belonging to 84 genera representing 44 families distributed over 16 orders were recorded. 58 species were common to the entire campus with the House crow being the most dominant followed by Black kite, Jungle crow, Common Myna and Rose ringed Parakeet in terms of numbers. The urban sector had 72 different species belonging to 64 genera from 38 families distributed over 15 orders. 14 species of the 72 were exclusive and except for Grey heron the remaining 13 were restricted to single urban sub sector. The vegetated sector had 86 species belonging to 74 genera representing 39 families spread over 15 orders. The 29 species were exclusive to single vegetated sub sector, except for Dusky craig Martin and thick billed flower pecker.

Species wise the Family Muscicpidae of order Passeriformes was the most represented by 18 species and 17 genera. Seven of these were exclusive to the vegetated sector while only Black napped monarch was observed in the urban sector. With more than 5,700 species approximately 59% of the total number of bird species passerines makes up the single largest order of birds in the world. This corroborated with the observations in the campus where in the order Passeriformes had the maximum number of families and was the single most dominant order. The order had 16 families with 50 species (two unidentified waders) of birds representing 35 genera i.e. almost 50 % of the birds observed in the campus. Four species were exclusive to the urban sectors while 16 species were restricted to the vegetated sector. Passerines, being generally small to medium-sized, have a high basal metabolic rate. Their diet, as a whole, is as diverse as the order.

The 102 species exhibited nine different feeding types viz Herbivory, Omnivory, Granivory, Insectivory, Nectarivory, Frugivory, Piscivory, Mixed diet and Scavengers (Table 27). The omnivores comprised of 29 species belonging to 23 genera and 12 families representing 7 orders, of these 16 species were common to the entire campus while 10 species were exclusive to the vegetated sector while only three were restricted to the urban sector. The Insectivores were the second dominant type with 28 species belonging to 23 genera covering eight families and four orders. The common birds were only 15 while 10 species were restricted in their distribution to the vegetated sector and three species to the urban sector. The birds that showed mixed diet were spread over eight orders covering 14 families with 23 species belonging to 22 genera. 12 of the birds exhibiting mixed diet were common to the campus while only 6 and 5 birds were restricted to the urban and vegetated sectors respectively. Except for the spot billed duck and the Domestic Goose that were restricted to the urban sector and exhibited herbivory. The number of bird species showing exclusiveness to the vegetated sector was high. This indicated habitat preference.

Mammals

Mammals are warm-blooded vertebrates with sweat glands, hair and can be identified by the presence of mammary glands in females. Mammals now encompass approximately 5,400 species, including humans.
Globally, 1,094 species of mammals, or about 20 percent of the total 5,416 described mammal species, were deemed endangered or vulnerable to extinction by IUCN's 2007 Red List.
In the IIT campus seven orders covering seven families were recorded (Table 28). The domestic animals were found to out number the wild mammals. The Rodentia along with the Domestic dog belonging to order Carnivora were the most dominant mammals on the campus followed by the cattle. Although there were some interesting observations like the Rhesus Macaque, Hanuman Langur, Indian Grey Mongoose, Ruddy Mongoose, the Indian flying fox and the droppings of civet cat; the mammal diversity was not as expected in the campus. This can be attributed to the increased human interference in the vegetated areas along with the increase in the domestic species. The presence of wild mammals in a vegetated patch would usually indicate the healthy status. There were reports of leopard presence in the campus during the study however this could not be confirmed during the site visit, hence has not been documented in this report. The campus does have a suitable amount of vegetation; however the increasing interference is disturbing the occurrence of wild mega fauna.

Phase wise comparison of the flora and fauna between the different sectors.

Flora is known to change with the changing seasons and this also reflects on the fauna. The seasonal changes in flora and fauna follow a set pattern. However if there is any anthropogenic influence on the habitat it would also depict on the biodiversity of the region. In some cases extreme changes to an ecosystem can also lead to an imbalance, the loss of biodiversity and ecosystems is a threat to the functioning of our planet at large, our economy and human society.

Flora

During the present study except for the trees the other flora was studied in three phases. Table 29 clearly indicates the pattern of variations that have occurred in the campus. The tree saplings were seen in large numbers in the entire campus, however the survival rate was much lower than expected. It was only the vegetated sub sector V1 that showed healthy survival rates while the remaining parts of the campus the saplings were destroyed. The saplings in the urban sector that showed stability were mostly of the exotic species. The other flora also showed a declining trend from Phase one to Phase three, the reasons for which are varied. The herbs and shrubs are mostly the monsoon flora and were in abundance during the monsoon and would gradually decline with the change in season. However the decline observed was far too alarming than the natural trend and showed human interference. The interference was not restricted only to the Urban sectors but also in the vegetated sectors highly impacting the V2, V4 and V5 sub sectors. This observation was supported by the fact that 19 numbers of quadrats from the urban sector and 11 quadrats from the vegetated sector were cleared starting from the end of the first Phase till the end of the second phase. i.e. 30 quadrats out of the 149 plotted to study flora in the entire campus. Moreover the number of trees in the vegetated sector is less compared to the urban sector as seen in Table 31, which also points out to the fact that the introduced tree species were given protection and they increased in numbers while the vegetated sector is exploited despite its natural species diversity.

Table 29 : Phase wise variations in the flora in the different sectors in IIT-Bombay campus

	U1			U2			U3			V1			V2			V3			V4			V5		
Habit	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**	**PI**	**P II**	**PIII**
TS	698	150	174	0	22	14	296	18	128	0	534	429	1574	31	68	167	41	25	403	282	97	60	15	18
SH	625	150	110	356	163	23	263	62	56	982	692	498	210	117	68	560	192	54	463	179	62	6337	189	78
SS	13	55	158	0	0	28	54	0	60	4	24	130	4	0	22	0	0	19	28	2	99	3	0	49
HR	117910	41073	2901	4129	20123	15758	95109	23647	23315	4999	19261	36898	49763	32826	24067	10791	13754	6910	40376	21315	13403	32711	1102	7337
GR	14.94	0.03	0	1.37	1.68	0	5.14	0.95	0.02	0.61	1.82	0	1.25	0	0	2.26	1.01	0	4.1	0.9	0	1.78	0.01	0
CL	177	121	20	102	55	40	77	43	32	128	183	94	96	25	25	695	131	67	303	121	59	81	75	22
WC	13	16	26	0	0	0	1209	84	56	0	516	20	1744	3	0	0	0	0	3	7	8	15	0	0
EP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
	119436	**41565**	**3389**	**4588**	**20363**	**15863**	**97008**	**23854**	**23647**	**6113**	**21210**	**38069**	**53391**	**33002**	**24250**	**12213**	**14118**	**7075**	**41576**	**21906**	**13730**	**39207**	**1381**	**7504**

TS- Tree Saplings, SH- Shrubs, SS- Scandent Shrubs, HR- Herbs, GR- Grass, CL- Climbers, WC- Woody Climbers, EP- Epiphytes

Table 30: Comparision of the number of Quadrats plotted in Phase 1 and the final existing quadrants in Phase III.

Sub sector	**Flora**				**Fauna**			
	Herbs, Shrubs, Creepers 10m x 10m				**Insects, Arachnids 2m x 2m**			
	P I	**P II**	**P III**	**Cleared**	**P I**	**P II**	**P III**	**Cleared**
U1	40	31	25	**15**	40	37	21	**19**
U2	10	10	8	**2**	18	18	14	**4**
U3	21	21	19	**2**	18	18	16	**2**
V1	17	16	16	**1**	18	18	18	**0**
V2	12	8	8	**4**	20	15	15	**5**
V3	16	14	13	**3**	18	18	18	**0**
V4	17	17	15	**2**	20	20	20	**0**
V5	16	16	15	**1**	26	22	22	**4**
	149	133	119	**30**	178	166	144	**34**

Table 31: Structure of trees in the IIT-Bombay campus.

	U1	**U2**	**U3**	**U**	**V1**	**V2**	**V3**	**V4**	**V5**	**V**	**Total**
Total Trees	3181	2535	1866	**7582**	164	161	234	509	505	**1573**	**9155**
No. of Species	114	89	98	**141**	29	19	21	48	44	**65**	**143**
Unid Species	5	0	1	**5**	0	0	0	1	0	**1**	**6**
No. of Genera	94	74	75	**106**	26	19	20	45	41	**56**	**108**
No. of Families	40	37	38	**45**	17	15	15	24	24	**30**	**46**
Avg. Girth (cm)	80.58	84.74	74.56	**80.49**	60.84	52.54	30.74	56.13	51.24	**50.91**	**75.41**
S.D. (cm)	54.01	69.75	46.98	**58.37**	66.64	54.25	17.07	51.16	44.12	**48.51**	**57.88**
Min. Girth (cm)	10	10	10	**10**	10	10	10	10	10	**10**	**10**
Max. Girth (cm)	576	596	720	**720**	404	208	138	332	321	**404**	**720**
Avg. Height (m)	6.47	5.61	6.43	**6.17**	5.53	4.09	3.54	4.96	4.76	**4.65**	**5.91**
S.D. (m)	2.17	2.73	2.31	**2.44**	2.98	2.32	1.40	2.50	2.54	**2.49**	**2.51**
Min. Height (m)	1	1	1	**1**	2	1	2	1	1	**1**	**1**
Max. Height (m)	15	16	14	**16**	16	10	9	14	14	**16**	**16**
>200 cm	114	176	29	**319**	11	4	0	18	9	**42**	**361**

Table 32 shows the comparison of the flora that is exclusive to either the urban or vegetated sector. The table however gives a wrong picture with greater species diversity in the urban sector. This higher diversity is mainly due to the introduced exotic tree species. Where as the actual diversity can be gauged from the shrub and herb diversity which is more natural in occurrence and is higher in the vegetated sector than the urban sector. Another aspect that should not be ignored is the area that could be studied in the vegetated sector was roughly 4 acres only compared to the entire urban sector.

Table 32: Flora Exclusive to Urban / Vegetated Sector in the IIT-Bombay campus.

	Urban Sector			Vegetated Sector		
Habits	**Species**	**Genera**	**Families**	**Species**	**Genera**	**Families**
Trees	78(5)	64	39	3(1)	3	3
Saplings	9*	8	7	12*	12	7
Shrubs	14	14	12	9	9	7
Scandent Shrubs	0	0	0	1	1	1
Herbs	15(1)	15	14	31	29	17
Grass	2	2	1	4(1)	4	1
Climbers	9	8	6	17(4)	15	8
Woody Climbers	0	0	0	0	0	0
Epiphytes	0	0	0	1	1	1
Total	**126(6)**	**105**	**55**	**79(6)**	**72**	**34**

*Species counted in trees hence not counted in total
The figures in the table are exclusive of the figures in the brackets ( ) indicating the unidentified flora.

Fauna

The Insects were the most dominant invertebrate fauna in the campus (Table 33). The invertebrates in the urban sector followed the trend of the flora i.e. the declining one. While in the vegetated sector, except for the V2 and V5 sub sector the invertebrate fauna was much stable in the first two phases and followed the normal seasonal pattern. Among the insects the Lepidoptera were the most dominant (Table 34), however there was no set pattern. It was observed that the U1, U3, V2, V3 and V5 sub sectors showed a decreasing trend with the phases coupled with decreasing diversity. Where as in the U2, V1 and V4 the number and species diversity increased in the second phase and then decreased. This was due to abundance of feeding plants in that phase. Among the Lepidoptera the butterflies were the most significant and dominant fauna. Nymphalidae family was most represented in the campus and was the dominant one in the entire campus during all the three phases (Table 35).

Table 33: Phase wise variation in the Invertebrate fauna in IIT-Bombay campus.

	U1			U2			U3			V1			V2			V3			V4			V5		
	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III
Turbellaria	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelids	0	0	0	3	0	0	0	0	0	6	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Crusteceans	0	1	0	5	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insects*	630	295	87	345	390	142	439	137	101	334	461	65	257	117	115	452	137	62	344	330	109	454	156	91
Diplopods	6	0	0	2	0	0	0	0	0	3	0	0	2	0	0	1	0	0	2	0	0	0	0	0
Chilopods	1	0	0	5	0	0	2	0	0	3	0	0	5	0	0	23	0	0	1	0	0	2	0	0
Arachnids	16	56	11	36	12	26	4	22	20	25	19	28	7	9	68	21	12	3	31	225	0	29	47	0
Gastropods	0	0	0	8	0	0	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0

The vertebrate fauna was dominated by birds (Table 36). The vertebrates mostly followed the seasonal pattern in its distribution and abundance. However the vegetated sector was more stable in terms of diversity in each of the phases compared to the urban sector. Among the vegetated sector the most damaged sub sector is the V2 followed by V4.
As already discussed the bird species diversity was greater in the vegetated sector. Phase wise there was no set pattern to the species diversity but the sectors close to the lake had a slightly higher diversity in the second phase. From the nine different feeding patterns recorded for birds, Omnivore were the most dominant, followed by Insectivore and Mixed diet birds (Table 37).

The number of quadrants that were erased during the period of study was 34 out of the total 178 plotted to study the fauna (Table 30). Of the 34 quadrats 25were erased in the urban sector while 9 from the vegetated sector. This impacted the entire faunal diversity and showed the human pressure on the biodiversity of the campus.

Table 34: Variation of insects in the IIT-Bombay campus during the three phases

	U1			U2			U3			V1			V2			V3			V4			V5		
	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III
Thysanura	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Odonata	86	35	1	40	74	11	43	23	8	122	84	3	36	14	11	31	17	2	92	29	3	50	7	1
Phasmida	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	1	2	0	0	0	0
Orthoptera	8	9	2	17	5	3	10	13	2	5	5	0	5	3	4	23	10	11	8	3	1	15	3	4
Mantodea	1	2	0	2	2	0	0	1	1	1	0	0	2	2	1	9	2	1	1	2	0	2	1	0
Blattaria	8	6	6	10	1	1	0	4	14	0	0	0	1	0	0	1	1	1	5	5	2	11	3	3
Dermaptera	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hemiptera	31	20	2	123	38	35	11	18	3	24	39	1	13	5	0	26	8	8	27	12	27	30	6	8
Diptera	39	23	14	25	21	32	4	5	35	14	17	10	14	5	2	67	16	6	46	12	20	29	8	22
Lepidoptera	416	159	49	106	232	43	365	69	28	136	295	35	162	79	79	237	72	27	93	249	46	302	108	41
Hymenoptera	26	33	10	9	5	9	2	3	9	16	17	13	6	7	16	27	10	4	11	7	10	9	16	6
Megaloptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Neuroptera	1	4	2	0	3	1	1	1	0	1	3	2	4	2	2	2	0	2	2	1	0	1	2	3
Coleoptera	11	4	1	13	9	7	3	0	1	14	1	0	13	0	0	24	1	0	58	8	0	4	2	2
Total*	**630**	**295**	**87**	**345**	**390**	**142**	**439**	**137**	**101**	**334**	**461**	**65**	**257**	**117**	**115**	**452**	**137**	**62**	**344**	**330**	**109**	**454**	**156**	**91**

Table 35: Distribution and variation of Butterfly species during the three phases in the IIT-Bombay campus

	U1			U2			U3			V1			V2			V3			V4			V5			
	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	
Hesperidae	6	2	0	2	1	0	7	0	0	2	2	0	7	2	0	8	0	0	2	1	0	4	1	0	**13**
Lycaenidae	7	10	5	4	6	2	8	6	4	6	7	1	2	5	1	5	3	4	5	6	3	7	5	6	**23**
Nymphalidae	18	15	8	9	14	10	19	8	7	15	14	7	12	8	3	17	5	7	12	14	7	17	8	7	**27**
Papilionidae	3	2	3	3	6	1	4	1	0	3	3	2	2	2	1	2	0	1	4	1	2	4	0	0	**7**
Pieridae	8	9	4	5	7	2	9	3	3	7	7	6	7	5	4	7	2	4	5	7	6	7	5	5	**16**
Total	**42**	**38**	**20**	**23**	**34**	**15**	**47**	**18**	**14**	**33**	**33**	**16**	**30**	**22**	**9**	**39**	**10**	**16**	**28**	**29**	**18**	**39**	**19**	**18**	**86**

Table 36: Phase wise Variation and distribution of vertebrate fauna in the IIT-Bombay campus.

	U1	U1	U1	U2	U2	U2	U3	U3	U3	V1	V1	V1	V2	V2	V2	V3	V3	V3	V4	V4	V4	V5	V5	V5
	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III	P I	P II	P III
Pisces	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0
Reptiles	8	3	5	4	4	0	10	3	0	2	5	1	7	1	3	8	0	1	3	0	3	5	0	1
Amphibians	0	0	0	5	0	0	1	0	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Birds	415	118	105	278	428	173	256	182	55	446	325	309	48	16	17	365	143	59	142	110	36	234	40	88
Mammals	118	65	93	43	58	11	12	2	25	20	50	32	3	1	12	21	13	23	9	20	6	2	0	9

Table 37: Phasewise distribution of bird species in the IIT-Bombay campus.

	U1			U2			U3			V1			V2			V3			V4			V5		
Feeding Habit	P I	P II	PIII	P I	P II	PIII	P I	P II	PIII	P I	P II	PIII	P I	P II	PIII	P I	P II	PIII	P I	P II	PIII	P I	P II	PIII
Frugivores	2	2	2	2	3	2	3	2	1	3	3	2	0	0	0	3	0	1	2	2	2	3	0	3
Granivores	2	1	1	3	2	3	1	1	3	3	3	3	0	0	0	1	2	1	1	0	0	2	1	1
Herbivore	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Insectivores	8	5	9	4	7	6	5	3	1	3	13	10	2	1	0	6	7	3	1	2	3	4	3	6
Mixed diet	6	5	5	5	11	8	5	4	0	9	8	5	4	2	0	4	3	1	5	2	3	6	2	2
Nectarivores	1	1	1	1	0	1	0	1	1	0	0	1	0	1	0	1	2	2	0	0	1	0	0	0
Omnivore	5	5	5	9	12	11	4	3	4	11	8	12	5	1	2	11	5	5	4	6	5	9	5	7
Piscivore	1	0	0	0	4	3	0	0	0	1	1	2	0	0	0	0	0	0	1	0	0	1	0	0
Scavenger	3	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	2	3	2	3
Total	**29**	**23**	**27**	**26**	**42**	**38**	**21**	**17**	**12**	**33**	**39**	**38**	**14**	**8**	**5**	**29**	**22**	**16**	**17**	**15**	**16**	**28**	**13**	**22**

Alien Species

Alien species are those moved by humans to areas outside of their native ranges. Once transported in this manner, they become removed from the predators, parasites, and diseases that kept them in balance in their native environments. As a result of losing these controls, they often become pests in the areas into which they are introduced. Alien species have created a tremendous amount of damage to our environment and economy and pose an ever-increasing threat to natural resources, native species, and ecosystems. Alien species introduce ecological challenges that native species have never faced before.

Alien species threaten our environment and livelihoods in many ways. They can reduce water quality and quantity by increasing runoff and erosion and this, in turn, degrades near-shore marine ecosystems like coral reefs. They present a continued threat to agricultural industry and home gardening, with every passing year seeing the arrival of new agricultural plant pests. They pose a potential threat to human health. Economy is directly tied to the quality of its environment, and alien species introductions have the potential to compromise the foundation upon which the State's economic well being rests. Because of increased trade volume with other parts of the world, the threat that alien species pose to the country's environment, native species, economy, and quality of life will not diminish with time.

During the study in the campus a total of 75 alien floral species were recorded (Table 38). These include one woody climber, five species of climbers, ten shrubs, 16 herbs and 43 trees. The urban sector had 72 species of alien flora, The U1 and U3 had the maximum of 51 species while the U2 had 46 species, indicating the introduction of exotic species into the campus. The vegetated sector also had some of the introduced flora totalling 35 in number. The maximum species were recorded in V4 followed by V5 and V1. This clearly indicated disturbances to the natural setting in the vegetated sector.

Among the fauna not much is known about the alien status, however from whatever information is available it was observed that six invertebrate species and three vertebrate species were observed during the study (Table 39). The urban sector had all the six species of invertebrates, while the vegetated sector had five species with minimum alien species in the V3 sub sector. The alien vertebrates comprised of a fish species observe din the V1 sub sector and the Birds i.e House sparrow and the Blue Rock Pigeon, both were observed in the entire campus except V2 sub sector.. The invertebrate fauna that comprised of ants clearly indicated the human interference that was disturbing the natural balance in the IIT-Bombay campus.

Table 38: Occurance and distribution of alien flora species in the IIT-Bombay campus.

Family	Genus	Species	Habit	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Acanthaceae	*Ruellia*	*tuberosa*	HR	1	1	1	**1**	0	0	0	0	0	**0**
Amaranthaceae	*Alternanthera*	*philoxeroides*	HR	1	1	1	**1**	1	1	1	1	1	**1**
Anacardiaceae	*Anacardium*	*occidentale*	TR	1	1	1	**1**	0	0	1	0	0	**1**
Anonaceae	*Anona*	*reticulata*	TR	1	1	1	**1**	0	0	0	0	0	**0**
		squamosa	TR	1	1	1	**1**	0	0	0	0	1	**1**
Apocynaceae	*Plumeria*	*acutifolia*	TR	0	1	0	**1**	0	0	0	0	0	**0**
		alba	TR	0	1	0	**1**	0	0	0	0	0	**0**
		obtusa	TR	1	0	0	**1**	0	0	0	0	0	**0**
		rubra	TR	1	1	0	**1**	0	0	0	0	0	**0**
		sp.	TR	1	1	1	**1**	0	0	0	0	0	**0**
	Rauvolfia	*tetraphylla*	SH	0	0	1	**1**	0	0	0	0	0	**0**
	Thevetia	*peruviana*	TR	1	1	0	**1**	0	0	0	0	0	**0**
Arecaceae	*Borassus*	*flabellifer*	TR	1	1	1	**1**	1	1	0	1	1	**1**
	Cocos	*nucifera*	TR	1	1	1	**1**	1	0	0	1	0	**1**
	Roystonea	*regia*	TR	1	1	1	**1**	0	0	0	0	0	**0**
	Vernonia	*cinerea*	HR	1	1	1	**1**	1	0	0	1	1	**1**
Bignoniaceae	*Kigelia*	*pinnata*	TR	1	0	0	**1**	0	0	0	0	0	**0**
	Spathodea	*campanulata*	TR	1	1	1	**1**	0	0	0	0	1	**1**
	Tabebuia	*rosea*	TR	1	0	0	**1**	0	0	0	0	0	**0**
Bombacaceae	*Chorisia*	*ventricosa*	TR	1	0	0	**1**	0	0	0	0	0	**0**
Boraginaceae	*Cordia*	*sebestena*	TR	0	0	1	**1**	0	0	0	0	0	**0**
Caesalpinaceae	*Bauhinia*	*tomentosa*	SH	0	1	0	**1**	0	0	0	0	0	**0**
	Cassia	*renigera*	TR	0	0	1	**1**	0	0	0	0	0	**0**
		siamea	TR	1	1	1	**1**	0	0	0	1	1	**1**
	Delonix	*regia*	TR	1	1	1	**1**	0	0	0	1	1	**1**
	Peltophorum	*pterocarpum*	TR	1	0	0	**1**	1	0	0	0	0	**1**
	Tamarindus	*indicus*	TR	1	1	1	**1**	1	1	0	1	1	**1**
Cannaceae	*Canna*	*indica*	HR	0	1	0	**1**	0	0	0	0	0	**0**
Capparaceae	*Capparis*	*spinosa*	SH	1	1	1	**1**	1	1	1	1	1	**1**
Caricaceae	*Carica*	*papaya*	SH	1	0	1	**1**	1	0	0	1	1	**1**
Casuarinaceae	*Casuarina*	*equisetifolia*	TR	1	1	1	**1**	0	0	0	0	0	**0**
Combretaceae	*Quisqualis*	*indica*	CL	0	1	0	**1**	0	1	0	0	0	**1**
	Terminalia	*catappa*	TR	1	1	1	**1**	0	0	0	1	1	**1**
Convolvulaceae	*Ipomoea*	*batata*	CL	0	0	1	**1**	0	0	0	0	0	**0**
		carnea	SH	0	1	1	**1**	0	0	0	0	0	**0**
Cucurbitaceae	*Cucurbita*	*maxima*	CL	0	0	1	**1**	0	0	0	0	0	**0**
	Mukia	*maderaspatana*	CL	0	0	1	**1**	0	0	0	1	0	**1**

Family	Genus	Species	Habit	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Eleocarpaceae	*Muntingia*	*calabura*	TR	1	1	1	**1**	0	0	0	1	0	**1**
Euphorbiaceae	*Euphorbia*	*heterophylla*	HR	0	0	0	**0**	0	0	0	1	0	**1**
	Jatropha	*curcus*	TR	1	1	0	**1**	0	0	0	0	0	**0**
	Phyllanthus	*amarus*	HR	1	0	1	**1**	0	1	0	1	1	**1**
	Ricinus	*communis*	SH	1	1	0	**1**	1	0	1	0	1	**1**
Fabaceae	*Gliricidia*	*sepium*	TR	1	1	1	**1**	0	1	1	1	1	**1**
Lamiaceae	*Hyptis*	*suaveolens*	HR	1	1	0	**1**	0	0	1	1	0	**1**
Lecythidaceae	*Couroupita*	*guianensis*	TR	1	1	1	**1**	0	0	0	0	0	**0**
Lytheraceae	*Lagerstroemoea*	*indica*	TR	1	1	0	**1**	0	0	0	0	0	**0**
Malvaceae	*Hibiscus*	*rosa-sinensis*	HR	1	1	1	**1**	0	0	0	0	0	**0**
	Malachra	*capitata*	HR	1	0	1	**1**	1	0	1	1	0	**1**
	Urena	*lobata*	HR	1	1	1	**1**	1	1	1	1	1	**1**
Mimosaceae	*Acacia*	*auriculiformis*	TR	1	1	1	**1**	1	0	0	1	1	**1**
		mangium	TR	0	0	1	**1**	0	0	1	0	0	**1**
		nilotica	TR	0	1	1	**1**	0	0	0	0	0	**0**
	Leucaena	*leucocephala*	TR	1	1	1	**1**	1	0	0	1	1	**1**
	Mimosa	*pudica*	HR	0	1	1	**1**	1	0	0	0	0	**1**
Myrtaceae	*Eucalyptus*	*globulus*	TR	1	1	1	**1**	0	0	0	0	0	**0**
	Melaleuca	*quinquenervia*	TR	1	0	0	**1**	0	0	0	0	0	**0**
	Psidium	*guyava*	TR	1	1	1	**1**	0	0	0	0	0	**0**
	Syzygium	*jambosa*	TR	1	0	1	**1**	0	0	0	0	0	**0**
Nyctaginaceae	*Bougainvillea*	*spectabilis*	WC	1	0	0	**1**	1	0	0	1	0	**1**
	Mirabilis	*jalapa*	SH	0	0	1	**1**	0	0	0	0	0	**0**
Oxalidaceae	*Averrhoa*	*carambola*	TR	0	0	0	**0**	0	0	0	1	0	**1**
	Oxalis	*corniculata*	HR	1	1	1	**1**	0	0	0	0	0	**0**
Papaveraceae	*Argemone*	*mexicana*	HR	0	0	1	**1**	0	0	0	0	0	**0**
Passifloraceae	*Passiflora*	*foetida*	CL	0	0	0	**0**	0	0	0	0	1	**1**
Piperaceae	*Peperomia*	*pellucida*	HR	0	0	1	**1**	0	0	0	0	1	**1**
Potenderiaceae	*Echorrnia*	*crassipes*	HR	1	1	1	**1**	1	1	0	0	0	**1**
Proteaceae	*Grevillea*	*robusta*	TR	0	1	1	**1**	0	0	0	0	0	**0**
Punicaceae	*Punica*	*grenata*	TR	0	0	1	**1**	0	0	0	0	0	**0**
Rubiaceae	*Hamelia*	*patens*	TR	1	0	0	**1**	0	0	0	0	0	**0**
Solanaceae	*Capsicum*	*annuum*	SH	1	0	0	**1**	0	0	0	0	0	**0**
Sterlitziaceae	*Ravenala*	*madagascariensis*	TR	0	1	1	**1**	0	0	0	0	0	**0**
Urticaceae	*Artocarpus*	*incisa*	TR	1	0	1	**1**	0	0	0	0	0	**0**
Verbenaceae	*Duranta*	*erecta*	SH	1	0	0	**1**	0	0	0	0	0	**0**
	Lantana	*camara*	SH	1	1	1	**1**	1	1	0	1	1	**1**
Zinziberaceae	*Costus*	*speciosus*	HR	1	1	1	**1**	1	0	1	1	0	**1**
				51	**46**	**51**	**72**	**18**	**10**	**10**	**24**	**20**	**35**

TS-Tree saplings; SH- Shrubs; HR- Herbs; CL-Climbers; WC- Woody Climbers
1- indicates presence and 0 - indicates absence

Table 39: Occurrance and distribution of alien and invasive fauna in the IIT-Bombay campus.

Family	Genus	Species	Common Name	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Invertebrates													
Formicidae	*Anoplolepis*	*gracilipes*	Yellow Crazy Ant	1	1	1	**1**	1	1	0	1	1	**1**
	Monomorium	*pharaonis*	Pharaoh Ant	1	1	1	**1**	1	1	1	1		**1**
	Salenopsis	*geminata*	Common Red Fire Ant	1	1	1	**1**	1	0	0	1	1	**1**
	Tapinoma	*melanocephalum*	Odour Ant	1	1	1	**1**	1	1	1	1	1	**1**
	Technomyrmex	*albiceps*	White footed Ghost Ants	0	1	0	**1**	0	0	0	0	1	**1**
Gastropod	*Achaetina*	*fulcata*	Giant African Snail	0	1	0	**1**	0	0	0	0	0	**0**
Vertebrates													
Osteichthyes	*Oreochromis*	*mossambicus*	Tilapia fish	0	0	0	**0**	1	0	0	0	0	**1**
Columbidae	*Columbia*	*livia*	Blue Rock Pigeon	1	1	1	**1**	1	0	1	1	1	**1**
Passeridae	*Passer*	*domesticus*	House sparrow	1	1	1	**1**	1	0	1	0	1	**1**
				6	**8**	**6**	**8**	**7**	**3**	**4**	**5**	**6**	**8**

1- indicates presence and 0 - indicates absence

Invasive Alien Species

Invasive alien species are plants, animals, pathogens and other organisms that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health. In particular, they impact adversely upon biodiversity, including decline or elimination of native species - through competition, predation, or transmission of pathogens - and the disruption of local ecosystems and ecosystem functions.

Invasive alien species, introduced and/or spread outside their natural habitats, have affected native biodiversity in almost every ecosystem type on earth and are one of the greatest threats to biodiversity. Since the 17th century, invasive alien species have contributed to nearly 40% of all animal extinctions for which the cause is known (CBD, 2006).

The problem continues to grow at great socio-economic, health and ecological cost around the world. Invasive alien species exacerbate poverty and threaten development through their impact on agriculture, forestry, fisheries and natural systems, which are an important basis of peoples' livelihoods in developing countries. This damage is aggravated by climate change, pollution, habitat loss and human-induced disturbance.

The campus has eight Invasive Alien Species comprising of two shrubs, 4 Herbs and 2 trees (Table 40). The two shrubs were found in the entire campus, while the urban sector had dominance of the other Invasive Alien flora. The invasive species were not restricted only to the urban sector but are spread out in the campus. The most disturbing observation was the invasion of six species in the V1 sub sector that has a very rich diversity. Although only eight species were recorded as Invasive alien they are detrimental as they have started invading the campus flora. Moreover there are 17 species whose information is lacking and could add to the list.

The fauna had six species that are alien and invasive to the country, observed in the campus. Of these only one was a vertebrate i.e *Tilapia mosambica* observed in the waters of the vegetated sector. The remaining six were invertebrates dominated by the Formicidae family comprising of five species of ants that indicated stress and various levels of pollution. The African snail being the most harmful pest on the plants was recorded in the urban sector.

Table 40: Distribution of Alien and Invasive species of flora in the IIT-Bombay campus.

Family	Genus	Species	Habit	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Amaranthaceae	*Alternanthera*	*philoxeroides*	HR	1	1	1	**1**	1	1	1	1	1	**1**
Casuarinaceae	*Casuarina*	*equisetifolia*	TR	1	1	1	**1**	0	0	0	0	0	**0**
Euphorbiaceae	*Ricinus*	*communis*	SH	1	1	0	**1**	1	0	1	0	1	**1**
Lamiaceae	*Hyptis*	*suaveolens*	HR	1	1	0	**1**	0	0	1	1	0	**1**
Mimosaceae	*Leucaena*	*leucocephala*	TR	1	1	1	**1**	1	0	0	1	1	**1**
Mimosaceae	*Mimosa*	*pudica*	HR	0	1	1	**1**	1	0	0	0	0	**1**
Potenderiaceae	*Echorrnia*	*crassipes*	HR	1	1	1	**1**	1	1	0	0	0	**1**
Verbenaceae	*Lantana*	*camara*	SH	1	1	1	**1**	1	1	0	1	1	**1**
				7	**8**	**6**	**8**	**6**	**3**	**3**	**4**	**4**	**7**

TS-Tree saplings; SH- Shrubs; HR- Herbs; CL-Climbers; WC- Woody Climbers
1- indicates presence and 0 - indicates absence

Flora and fauna that are accorded various protection statuses as per the wildlife laws of the country and observed in the campus.

Approximately 90,000 species of animals are known from India of which Fish account for 2,546 species; Amphibia, 210 species; Reptilia, 428 species; Birds, 2,000 species and subspecies; Mammals, 397 species and subspecies; the rest being represented by other faunal elements. Of these, 75 'species of Mammals, 59 species of Birds, 19 species of Reptiles, 3 species of Amphibians and a large number of Lepidoptera and Coleoptera are listed as endangered.

The IIT –Bombay campus has a mix biodiversity comprising of native, alien and invasive species. Amidst all the variety it has 100 species that have been included in either the wild life protection act of 1972, IUCN redlist or CITES(Table 41) . The list of species as per the statuses is given in table . Of the 100 species 10 are floral species and the remaining 90 are the fauna. Given that 645 species of flora and fauna were

identified in the campus and 100 of these have protection status at several levels, it makes the campus a biodiversity hot spot. Taking into consideration the existing diversity it is necessary that certain conservation measures are employed in the campus and whatever development is undertaken should be in a sustainable manner. Some of the probable conservation measures are given in the following paragraph.

Table 41: List giving the flora and fauna that are recorded in the campus and accorded the protection status

Sr. No.	Genus	Species	Common Name	WPA, 1972	CITES	IUCN	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Flora																
1	*Costus*	*speciousas*		XLIII-H^			1	1	1	**1**	1	0	1	1	0	**1**
2	*Cycas*	*circinalis*			II	DD	1	0	0	**1**	0	0	0	0	0	**0**
3	*Dalbergia*	*lanceolaria*				VU	1	0	1	**1**	0	0	0	0	1	**1**
4	*Delonix*	*regia*	Gulmohar			VU*	1	1	1	**1**	0	0	0	1	1	**1**
5	*Euphorbia*	*heterophylla*		XLIII-H^	II		0	0	0	**0**	0	0	0	1	0	**1**
6	*Euphorbia*	*hirta*		XLIII-H^	II		0	0	0	**0**	0	0	0	1	0	**1**
7	*Gloriosa*	*superba*		XLIII-H^			0	0	0	**0**	0	1	1	0	0	**1**
8	*Mangifera*	*indica*	Mango			DD	1	1	1	**1**	1	0	0	1	1	**1**
9	*Saraca*	*asoca*	Sita Ashoka			VU	1	0	0	**1**	0	0	0	0	0	**0**
10			Orchids	XLIII-H^	II		1	1	1	**1**	1	1	1	1	1	**1**
				5	**4**	**4**	**7**	**4**	**5**	**7**	**3**	**2**	**3**	**6**	**4**	**8**

Fauna

Sr. No.	Genus	Species	Common Name	WPA, 1972	CITES	IUCN	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Butterflies																
1	*Acytolepis*	*puspa*	Common Hedge Blue	I (IV)			1	0	1	**1**	1	0	1	0	0	**1**
2	*Appias*	*libythea*	Striped Albatross	IV			0	1	0	**1**	0	0	0	0	0	**0**
3	*Castalius*	*rosimon*	Common Pierrot	I (IV)			1	1	1	**1**	1	1	1	1	1	**1**
4	*Cepora*	*nerissa*	Common Gull	II (II)			1	0	1	**1**	1	1	1	1	1	**1**
5	*Euchrysops*	*cnejus*	Gram Blue	II (II)			1	1	1	**1**	1	1	1	1	1	**1**
6	*Euploea*	*core*	Common Indian Crow	IV			1	1	1	**1**	1	1	1	1	1	**1**
7	*Euthalia*	*lubentina*	Gaudy Baron	IV			1	0	0	**1**	0	0	0	0	0	**0**
8	*Hypolimnas*	*misippus*	Danaid Eggfly	II (II)			1	1	1	**1**	1	1	1	1	0	**1**
9	*Lampides*	*boeticus*	Pea Blue	II (II)			1	0	1	**1**	0	0	0	0	1	**1**
				9	**0**	**0**	**8**	**5**	**7**	**9**	**6**	**5**	**6**	**5**	**5**	**7**
Amphibians																
1	*Euphyctics*	*hexadactylus*	Indian Pond Frog		II	LC	0	0	0	**0**	1	0	0	0	0	**1**
2	*Haplobatrachus*	*tigerinus*	Indian Bull Frog	IV	II	LC	0	0	0	**0**	1	0	0	0	0	**1**
				1	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**
Reptiles																
1	*Ahaetulla*	*nasuta*	Vine Snake	IV			0	0	1	**1**	0	0	0	0	0	**0**
2	*Crocodylus*	*palustris*	Marsh Crocodile	I (II)	I	VU	0	0	0	**0**	1	0	0	0	0	**1**
3	*Daboia*	*russelii*	Russell's Viper	II (II)	III		0	0	0	**0**	0	0	0	0	1	**1**
4	*Ptyas*	*mucosus*	Rat Snake	II (II)	II		1	1	1	**1**	0	0	1	0	0	**1**
5	*Varanus*	*benghalensis*	Common Monitor Lizard	II (II)	I		0	0	1	**1**	0	0	0	0	0	**0**
6	*Xenochrophis*	*piscator*	Checkered Keelback	II (II)	III		1	0	0	**1**	0	0	0	1	0	**1**
				6	**5**	**1**	**2**	**1**	**3**	**4**	**1**	**0**	**1**	**1**	**1**	**4**
Mammals																
1	*Herpestes*	*edwardsii*	Indian Grey Mongoose	IV	III	LC Uk	0	1	0	**1**	1	0	1	0	0	**1**
2	*Herpestes*	*smithii*	Ruddy Mongoose	IV	III	LC Uk	0	0	0	**0**	0	1	0	0	0	**1**
3	*Lepus*	*nigricollis*	Indian Hare	IV		LC Uk	0	0	0	**0**	0	1	0	0	0	**1**
4	*Macaca*	*mulatta*	Rhesus Macaque	II(II)	II	LC Uk	1	0	0	**1**	0	0	0	0	0	**0**
5	*Pteropus*	*giganteus*	Indian Flying Fox	V	II	LC ?	1	0	0	**1**	0	0	0	0	0	**0**
6	*Semnopithecus*	*entellus*	Hanuman Langoor		I	LC ?	1	0	0	**1**	0	0	0	0	0	**0**
7			Civet	II(II)	III		1	0	1	**0**	0	0	0	0	1	**1**
				6	**6**	**6**	**4**	**1**	**1**	**4**	**1**	**2**	**1**	**0**	**1**	**4**

NT: Near Threatened; LC: Least Concerned; DD: Data Deficient; VU: Vulnerable; ↓ : Decreasing population trend; Uk: Population Trend Unknown;

WPA, 1972: Wildlife (Protection) Act 1942; CITES: Convention for Intrenational Trade in Endangered Species; IUCN: International Union for Conservation of Nature

*Vulnerable in its Native Range of Madagascar

^Appendix XLIII-H of WPA 197

1 indicates Present, 0 indicates absent; Numbers in Bold indicates total number of Species

Sr. No.	Genus	Species	Common Name	WPA, 1972	CITES	IUCN	U1	U2	U3	U	V1	V2	V3	V4	V5	V
Birds																
1	*Accipiter*	*badius*	Shikra	I		LC	1	0	0	**1**	0	0	1	0	0	**1**
2	*Acridotheres*	*tristis*	Common Myna	IV		LC	1	1	1	**1**	1	1	1	1	1	**1**
3	*Actitis*	*hypoleucos*	Common Sandpiper	IV		LC	0	1	0	**1**	0	0	0	0	0	**0**
4	*Aegithina*	*tiphia*	Common Iora	IV		LC	1	0	1	**1**	1	0	0	1	0	**1**
5	*Aethopyga*	*siparaja*	Crimson Sunbird	IV		LC	1	0	0	**1**	1	0	0	0	0	**1**
6	*Alcedo*	*atthis*	Small Blue Kingfisher	IV		LC	1	1	0	**1**	1	0	0	1	1	**1**
7	*Amandava*	*amandava*	Red Avadavat	IV		LC	0	0	0	**0**	1	0	0	0	0	**1**
8	*Anas*	*poecilorhyncha*	Spot billed Duck	IV		LC	0	1	0	**1**	0	0	0	0	0	**0**
9	*Anhinga*	*melanogaster*	Oriental Darter	IV		NT?	0	1	0	**1**	1	0	0	0	0	**1**
10	*Ardea*	*cinerea*	Grey Heron	IV		LC	1	1	0	**1**	0	0	0	0	0	**0**
11	*Ardea*	*purpurea*	Purple Heron	IV		LC	0	1	0	**1**	1	0	0	0	0	**1**
12	*Ardeola*	*grayii*	Indian Pond Heron	IV		LC	1	1	1	**1**	1	1	0	1	1	**1**
13	*Athene*	*brama*	Spotted Owlet	IV	II	LC	1	0	0	**1**	0	0	0	0	0	**0**
14	*Bubulcus*	*ibis*	Cattle Egret	IV		LC	1	1	1	**1**	1	1	1	1	1	**1**
15	*Casmerodius*	*albus*	Greater Egret	IV		LC	0	1	0	**1**	1	0	0	0	0	**1**
16	*Chrysomma*	*sinense*	Yellow-eyed Babbler	IV		LC	0	1	0	**1**	0	0	0	0	0	**0**
17	*Circus*	*aeruginosus*	Eurasian Marsh Harrier	I	II	LC	0	1	0	**1**	0	0	0	0	0	**1**
18	*Clamator*	*jacobinus*	Pied Crested Cuckoo	IV		LC	0	0	0	**0**	0	0	1	0	0	**1**
19	*Coracias*	*benghalensis*	Indian Roller	IV		LC	0	0	0	**0**	0	1	0	0	0	**1**
20	*Cyornis*	*tickelliae*	Tickell's Blue Flycatcher	IV		LC	0	0	0	**0**	1	0	0	0	0	**1**
21	*Dendrocopos*	*hyperythrus*	Rufous Woodpecker	IV		LC	1	0	0	**1**	1	0	0	0	1	**1**
22	*Dendrocygna*	*javanica*	Lesser Whistling Teal	IV		LC	0	1	0	**1**	1	0	0	0	0	**1**
23	*Dicaeum*	*agile*	Thick billed Flowerpecker	IV		LC	0	0	0	**0**	1	0	0	0	1	**1**
24	*Dicrurus*	*leucophaeus*	Ashy Drongo	IV		LC	1	0	0	**1**	1	0	1	0	0	**1**
25	*Dicrurus*	*macrocerus*	Black Drongo	IV		LC	1	1	1	**1**	1	1	1	0	1	**1**
26	*Eudynamys*	*scolopacea*	Asian Koel	IV		LC	1	1	1	**1**	1	0	1	1	1	**1**
27	*Falco*	*tinnunculus*	Common Kestrel		II	LC	0	0	0	**0**	0	0	0	0	1	**1**
28	*Ficedula*	*parva*	Red throated Flycatcher	IV		LC	0	1	1	**1**	0	0	0	1	0	**1**
29	*Fulica*	*atra*	Common Coot	IV		LC	0	0	0	**0**	1	0	0	0	0	**1**
30	*Halcyon*	*smyrnensis*	White throated Kingfisher	IV		LC	1	1	1	**1**	1	0	0	1	1	**1**
31	*Himantopus*	*himantopus*	Black winged Stilt	IV		LC	0	1	0	**1**	0	0	0	0	0	**0**
32	*Hydrophasianus*	*chirurgus*	Pheasant tailed Jacana	IV		LC	0	1	0	**1**	1	1	0	0	0	**1**
33	*Hypothymis*	*azurea*	Black Naped Monarch	IV		LC	1	0	0	**1**	0	0	0	0	0	**0**
34	*Lonchura*	*punctulata*	Scaly breasted Munia	IV		LC	1	1	1	**1**	1	0	1	0	0	**1**
35	*Megalaima*	*haemacephala*	Coppersmith Barbet	IV		LC	1	1	1	**1**	1	0	1	1	1	**1**
36	*Mesophoyx*	*intermedia*	Median Egret	IV		LC	0	1	0	**1**	1	0	0	0	0	**1**
37	*Metopidius*	*indicus*	Bronze winged Jacana	IV		LC	0	1	0	**1**	1	0	0	0	0	**1**
38	*Milvis*	*migrans*	Black Kite		II	LC	1	1	1	**1**	1	1	1	1	1	**1**
39	*Nectarinia*	*asiatica*	Purple Sunbird	IV		LC	1	0	0	**0**	0	0	1	0	0	**1**
40	*Nectarinia*	*zeylonica*	Purple rumped Sunbird	IV		LC	0	1	1	**1**	0	1	1	1	0	**1**
41	*Nettapus*	*coromandelianus*	Cotton Pygmy Goose	IV		LC	0	0	0	**0**	1	0	0	0	0	**1**
42	*Nycticorax*	*nycticorax*	Black Crowned Night Heron	IV		LC	0	1	0	**1**	1	0	0	0	0	**1**
43	*Oriolus*	*oriolus*	Eurasian Golden Oriole	IV		LC	1	1	1	**1**	1	0	1	0	1	**1**
44	*Pandion*	*haliaetus*	Osprey	I		LC	0	1	0	**1**	0	0	0	0	0	**0**
45	*Pavo*	*cristatus*	Indian Peafowl	I		LC	1	1	0	**1**	0	0	1	0	0	**1**
46	*Pellorneum*	*ruficeps*	Spotted Babbler	IV		LC	0	0	0	**0**	0	0	0	1	0	**1**
47	*Pitta*	*brachyura*	Indian Pitta	IV		LC	0	0	0	**0**	0	0	0	0	1	**1**
48	*Plegadis*	*falcinellus*	Glossy Ibis	IV		LC	1	1	0	**1**	0	0	0	0	0	**0**
49	*Psittacula*	*cyanocephala*	Plum headed Parakeet	IV	II	LC	0	0	0	**0**	0	0	0	0	1	**1**
50	*Psittacula*	*eupatria*	Alexandrine Parakeet	IV	II	LC	1	1	1	**1**	0	0	1	0	0	**1**
51	*Psittacula*	*krameri*	Rose Ring Parakeet	IV		LC	1	1	1	**1**	1	0	1	1	1	**1**
52	*Pycnonotus*	*cafer*	Red-vented Bulbul	IV		LC	0	1	1	**1**	1	1	1	1	1	**1**
53	*Pycnonotus*	*jocosus*	Red-whiskered Bulbul	IV		LC	1	1	0	**1**	1	0	1	1	1	**1**
54	*Pycnonotus*	*leucotis*	White cheeked bulbul	IV		LC	0	0	0	**0**	0	0	0	0	1	**1**
55	*Pycnonotus*	*luteolus*	White browed Bulbul	IV		LC	0	0	0	**0**	0	1	0	1	0	**1**
56	*Rhipidura*	*aureola*	White browed Fantail Flycatcher	IV		LC	1	1	1	**1**	0	0	1	0	0	**1**
57	*Streptopelia*	*chinensis*	Spotted Dove	IV		LC	0	1	1	**1**	1	0	0	0	1	**1**
58	*Streptopelia*	*decaocto*	Eurasian Collared Dove	IV		LC	0	0	0	**0**	1	0	0	0	0	**1**
59	*Sturnus*	*contra*	Asian Pied Starling	IV		LC	0	1	0	**1**	0	0	1	0	0	**1**
60	*Sturnus*	*erythropygius*	Chestnut Tailed Starling	IV		LC	0	1	0	**1**	0	0	0	0	0	**1**
61	*Sturnus*	*pagodarum*	Brahminy Starling	IV		LC	1	0	0	**1**	0	0	0	0	0	**0**
62	*Tachybaptus*	*ruficollis*	Little Grebe	IV		LC	0	0	0	**0**	1	0	0	0	0	**1**
63	*Tadorna*	*ferruginea*	Ruddy Shelduck	IV		LC	0	1	0	**1**	0	0	0	0	0	**0**
64	*Terpsiphone*	*paradisi*	Asian Paradise Flycatcher	IV		LC	1	0	0	**1**	1	0	0	0	1	**1**
65	*Turdoides*	*striatus*	Jungle Babbler	IV		LC	1	0	1	**1**	1	0	1	1	1	**1**
66	*Zoothera*	*citrina*	Orange headed Thrush	IV		LC	0	0	0	**0**	0	0	0	0	1	**1**
				64	**6**	**1**	**29**	**39**	**19**	**49**	**36**	**10**	**21**	**17**	**23**	**55**

Conservation Measures

When it comes to conserving biodiversity, the definition that we use for it becomes extremely important. Simply defining it as "nature" is too nebulous, and makes deciding what actions to take difficult. There is a great concern over the loss of biological diversity, but at the same time few people know in any detail what is happening. There is a natural tendency to think of conservation in terms of species. The loss of a species is something that is easier to grasp and more tangible than the loss of genetic diversity or an ecosystem, and many endangered species are photogenic enough to evoke an immediate emotional response.
Trying to save species individually is not very effective and separate efforts to save each of them would be wasteful. Protecting the habitat of the species makes much more sense, as there is little chance of them going extinct in their natural environment once it is safe. In addition to saving those already endangered species, this approach helps prevent other species who share the same habitat from becoming endangered and preserves the ecological integrity of the protected area. Protecting areas saves all levels of diversity.

During the study the field team observed several anthropogenic activities that are not very conducive to conservation. Some of the activities included destroying vegetation, cutting of wood for fuel, clearing up of dead wood and logs, feral cattle movement, plastic bags and bottle dumping, alcohol bottles thrown around in the vegetated sectors of the campus, disposal of chemical waste and trapping of water birds.

In order to maintain or increase the campus biodiversity the following measures should be employed in the campus.

1. The cutting of vegetation post monsoon season should be avoided as far as possible; this will help in increasing the bird population and some of the insect diversity as well. The campus has a rich diversity of Mycoflora which are the best recyclers of nutrients, however these recyclers are denied their role in the ecosystem due to the clearing up of dead logs in the campus.
2. The control burning of grass along the Hill side should be replaced by fire lines if possible.
3. The campus has a large variety of exotic species. Though the existing exotic species should be allowed to grow, introducing and adding new species should be avoided in the campus as they are affecting the survival of the native plants. The exotic plants provide food and shelter to a number of insects that are harmful to the native plants as well as human well being.
4. The nursery in the campus has a good number of exotic species of saplings these should be replaced by the native fruit and flower bearing species to increase the insect (butterfly) and bird life. Moreover there are some areas in the campus like the hill side where plantation of native species can be undertaken. Even if plantation is not undertaken the existing flora can be conserved by avoiding construction in places that have a healthy plant life, eg. Koldongri and several patches in the academic section.
5. In several areas in the campus especially behind some of the laboratories, it was observed that the used as well as unused chemical bottles were disposed off, which can be hazardous to health and environment. Measures should be employed to check such misuse of the resources and if the surroundings of the labs are found littered the occupants of that particular building should be fined and involved in a clean up drive.
6. The area behind SAMEER is filled with plastic garbage this region has a good diversity flora and fauna and the increasing plastics is destroying the diversity. The plastic should be given off to the rag pickers or some alternative should be devised.
7. The campus has several vegetated areas like Soneri baugh, Hill Side, Koldongri, Opp. SAIF, Opp. SAMEER that have rich biodiversity. These patches should be conserved, these can be enclosed by proper biological fences that will help the faunal movement at the same time restrict anthropogenic activities. The campus can have several interpretation zones e.g. Butterfly zone, herb and shrub zone, bird watching zone, etc.
8. Of the several vegetated patched the Soneribaugh is the most diverse in terms of both the flora and fauna. However easy access to this region is ruining the area of its richness. The road along the Soneribaugh should be closed for vehicular traffic and the visitors should be prevented from carrying plastics, soft drinks or alcoholic beverages and littering the place.
9. It has been noticed that there are people who misuse the vegetated patches (Soneribaugh, Hill side) for alcohol parties, this should be stopped as the people leave the place in a very bad shape affecting

the environment. Both the regions mentioned above have check post at one end while the other end is freely accessible and open to all, this can be improved to prevent destruction of the existing flora and fauna.

10. During the study it was also observed that along the Devi temple, Soneribaug and Koldongri people are involved in trapping water birds, these individuals were some campus residents as well as outsiders. Though our team did speak to them and discouraged the activity, this should be continuously monitored and awareness should be created to conserve the bird life.

Suggestions

The beautiful green campus has a lot of construction activity which was disheartening during the study. This was because at a number of places after recording the flora and fauna on subsequent visits the place would be cleared for construction activity. The construction of facilities is a necessary evil but if this is done by considering the environmental status it will prove beneficial. With increasing human pressure and demand for increased educational facilities, it would be more appropriate if the infrastructure grows vertically than horizontally. This will not only help in maintaining the biodiversity but also continue to be an example of carbon sink and green lung.

The campus is known for its excellence in education, in addition the entire campus has a fairly diverse ecological setting. It would be ideal if information / interpretation panels are setup at several locations giving information of the flora and fauna through out the campus. This would create awareness among both the residents as well as visitors and promote conservation of the flora and fauna in the campus. It would also convert the entire campus into a environment and ecology learning laboratory.

As an awareness creating measure regular campus nature trails for students, the staff and their families should be conducted. A quarterly bulletin can be published on the several important species found in the campus. A student green squad can be set up to patrol and monitor the campus at regular intervals.

In a nutshell

The biodiversity of IIT Bombay campus comprised of a total of 843 species of flora and fauna (including the unidentified forms), excluding the lichens, pteridophytes, bryophytes and mycoflora which was not possible during the present study. Of these the urban sector had 634 species while the vegetated sector had 646 species. Over all the trees were the most dominant flora followed by the herbs and shrubs (Fig. 1) Invertebrate fauna formed a larger percentage with insects being the dominant fauna comprising almost 63%, while the vertebrates were only 30 % of the total fauna with birds comprising 21%. (Fig. 2). Figure 3, 4 & 5 shows the distribution of flora and fauna in the campus, the total picture would be misleading as it shows distribution of flora, invertebrate and vertebrate fauna in proportion. However the comparison of the vegetated and urban sector clearly reveals the imbalance in the urban sector, where the percentage of flora is increasing and it does not support the fauna. This is mainly due to the exotic trees in the urban sector. It is important to know that only 4 acres of vegetated sector was studied, emphasizing the importance of the vegetated sector with its vast diversity. Further more , 84 Alien species were recorded in the campus, most of which were observed in the Urban sector i.e. 80 species while the vegetated had only 43 species. The biodiversity of the campus is important as it is one of the green lungs of the city and hence it is vital that the native and endemic species of flora and fauna are conserved. As per the national and international wild life laws the campus has 100 species which fall under different categories of protection. Though there are many more life forms that need to be identified up to the species level the biodiversity of the campus holds a lot of potential in terms of conservation.

It is necessary in the existing conditions that whatever development takes place in the campus is done in a sustainable manner. The human needs of education and development may be considered or at times given a priority but not at the expense of the vulnerable flora and fauna. As per the old records and observations by campus residents that the campus used to be visited by some large vertebrates, however this was not the case during the present study. The reason is fragmentation of habitat and obstruction in the The vegetated sectors marked during the present study can be accorded special protection and if any development is planned in these areas it should be reconsidered.

Fig. 1: Percentage variation of flora in the IIT-Bombay campus.

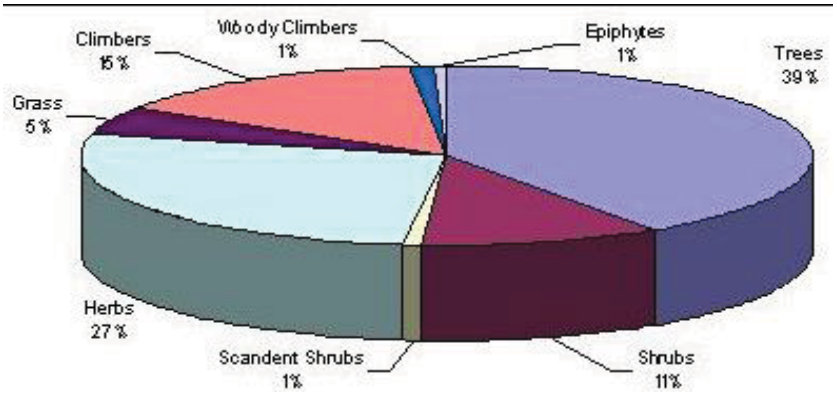


Fig. 2: Percentage variation of fauna in the IIT-Bombay campus.

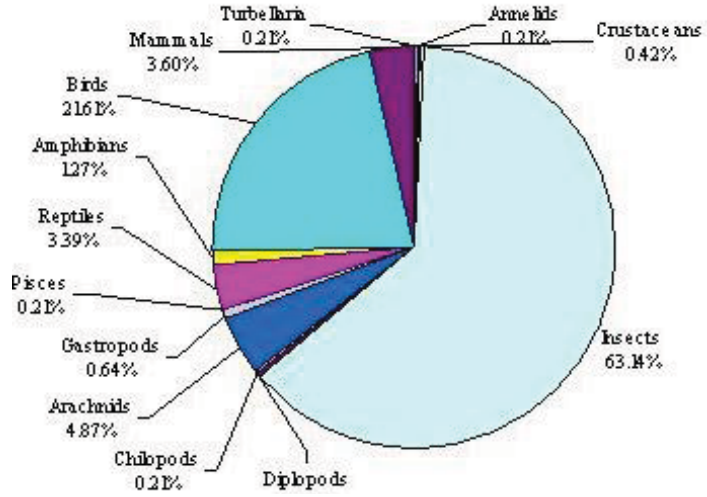
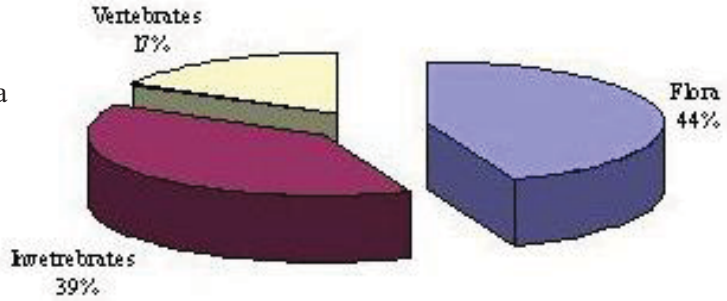


Fig 3: Composition of flora and fauna in IIT-Bombay campus



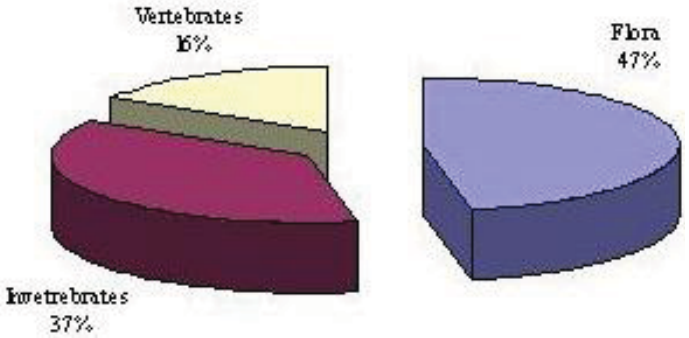
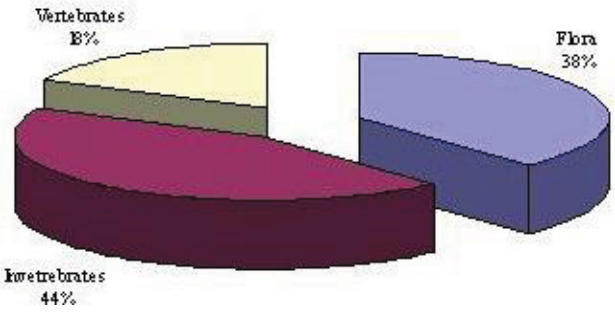


Fig 4: Composition of flora and fauna in the urban sector in IIT-Bombay campus

Fig 5: Composition of flora and fauna in the vegetated sector in IIT-Bombay campus



Species Account
Flora

Acanthaceae – Acanthus family (Plate 2)

The family consists of shrubs, annuals or perennial herbs and some climbers. 15 species (6 Shrubs; 8 Herbs; 1 Climber) belonging to 12 genera from this family were recoded in IIT campus. The flowers are often two lipped. *Acanthus* is derived from *Acanthos* (A thorn) referring to the often spiny leaves and flower bracts. Members of this family are favoured food plants of the Pansy group of butterflies.

Malabar nut tree (*Adhatoda vasica)* Shrub; Hindi: Arusa, Bansa; Marathi: Adulsa
Vasaka is a common shrub indigenous and distributed throughout India. It commonly grows in waste places. Vasaka is a dense pernnial shrub. It is household remedy for various disorders. Charaka Samhita has classified the drug under mucolytic and expectorant drugs.
This species was found only in urbanized area (U1) of the campus during the study.

Crested Philippine violet, Philippine violet (*Barleria cristata)* Shrub;Hindi: Vajra danti
Barleria cristata is native to India and Southeast Asia. It grows into a shapely shrub with minimal pruning. It allegedly acts as a tonic, diuretic and blood purifier.
During our study, it was sighted in the vegetated area other than the quadrat.

Law's Barleria *Barleria lawii* herb; Marathi: Pandhri koranti
Law's Barleria is a branched perennial herb.
During our study, it was found in both urbanized as well as vegetated areas (U2, V1).

Porcupine flower, Barleria (*Barleria prionitis)* Shrub; Hindi: Vajradanti
It grows throughout India. It is an erect armed perennial shrub. Flowers are bright yellow or orange in color. It has numerous medicinal properties including treating fever, respiratory diseases, toothache, joint pains and a variety of other ailments; and it has several cosmetic uses. Because of its antiseptic properties, extracts of the plant are incorporated into herbal cosmetics and hair products to promote skin and scalp health.
During our study, it was found in both urbanized as well as vegetated areas (U2, V5)

Karvi (*Carvia callosa)* Shrub; Hindi: Maruadana; Marathi: Karvi
The Karvy plant grows wild around Mumbai, Madhya Pradesh, parts of Gujarat and in large areas of Konkan and North Kannara Ghats. Each year the plant comes alive with the advent of Monsoon, and once the rains are over, what is left behind is dry and dead-looking stems. This pattern repeats itself for seven years. In the seventh year, the plant explodes into mass flowering. The Karvy plant has many uses as well. The leaves and the stems are also used for thatched roofs after the season is over. Leaves are crushed and the juice is believed to be a sure cure for stomach ailments.
During our study, it was found in vegetated area (V4).

Crossandra, Firecracker Flower (*Crossandra infundibuliformis)* Marathi; Aboli
It grows in the Indian sub continent. In South India, Kanakambaram is the favourite flowers of ladies to put in their hair. It competes strongly with jasmine to adorn the south-Indian hair-do.
During our study, it was found in urbanized area (U1).

Rosy Eranthemum (*Eranthemum roseum)* Herb; Marathi: Dasmuli, Jungli Aboli
It is commonly found on shady forests of the hills of Western Ghats. Rosy Eranthemum is a perennial herb growing up to 1-2 meters high. The flowers have a strong fragrance and fade to a rosy color.
It was found in both urbanized as well as vegetated areas (U1, V4).

Tentacled Haplanthodes, Niligiri Haplanthodes (*Haplanthode neilgherryensis)* Herb; Marathi: Nila jakara
It is an erect annual herb.
The herb was found in the entire campus.

Marsh Barbel (*Hygrophila auriculata)* Hindi; Gokula kanta; Marathi: Talim Khana
Marsh Barbel is a stout aquatic perennial herb. Kokilaksha, as it is known in Sanskrit, was extensively used in Ayurvedic system of medicine for various ailments like rheumatism, inflammation, jaundice, hepatic obstruction, pain, etc.

During the study, it was found in vegetated areas outside the quadrant.

Glaucous Justicia (*Justicia glauca)* herb
Galucous Justicia is an undershrub found in the foothills of Peninsular India.
It was recorded in vegetated area (V4) during the study.

Panicled Peristrophe (*Peristrophe paniculata)* Herb; Hindi: Atrilal, Kakajangha
The plant is distributed throughout India. Panicled Peristrophe is an erect herb. In India it is cut for horse feed and it is ploughed in as green manure.
It was recorded in both urbanized as well as vegetated areas (U1, U2, U3, V2 and V5).

Waterkanon, Watrakanu, Minnie Root, Iron root, Feverroot, Popping pod (*Ruellia tuberose)* Herb; Marathi: Ruwel
Native of Northern America and the West Indies. Minnie Root is a West Indian herb with curiously shaped blue flowers. The ripe fruits, in a pod with 7-8 seeds each, burst open, when they get wet and the black seeds are hurdled away. The root is used against kidney diseases and for whooping cough. An infusion is used for cleansing the blood.
During the study, it was observed in urbanized area (U1, U2, and U3)

Rungia linifolia
During our study, it was found in urbanized area other than quadrat.

Creeping Rungia (***Rungia repens)*** herb; Hindi: Kharmor; Marathi: Ghati-pitpapra
It is commonly found in the grasslands in the Western Ghats. Creeping Rungia is an annual herb.
During the study it was absent in the U2 sub sector only.

Sweet Clock-Vine, White Lady (*Thunbergia fragrance) ;* Hindi / Marathi: Chimine.
Commonly planted in gardens for its attractive white flowers, this slender, herbaceous vine, native to India and Sri Lanka, often establishes itself in thickets, in waste grounds and on roadsides.
During the study, it was found in vegetated area other than quadrat.

Amaranthaceae – cockscomb family (Plate 3)

This is a large family consisting of herbs and shrubs. 6 species (all herbs) belonging to 5 genera from this family were recoded in IIT campus. The scientific name of this family is derived from Greek Amarantos (unfading), referring to the long-lasting flowers.

Prickly Chaff Flower, Chaff-flower, Crocus stuff, Crokars staff, Devil's horsewhip (*Achyranthes aspera)* herb; Hindi: Chirchita, Latjira
Found throughout tropical Asia, Africa, Australia and America. Since time immemorial, it is in use as folk medicine. It holds a reputed position as medicinal herb in different systems of medicine in India. The seeds are often used as a famine food in India, especially in Rajputana, where the plant is called Bharotha (grass).
The plant was recorded in the entire campus during the study..

Mountain Knot Grass (*Aerva lanata)* Herb; Hindi: Chhaya, gorakhbuti, gorakhganja, kapurijadi, khali, khari; Marathi: kapurmadhuri
Aerva lanata is a woody, prostrate or succulent, perennial herb. This herb is described as one of the best known remedies for bladder and kidney stones. Ayurvedic practitioners recommend a decoction of the plant to be taken internally for a few days to dissolves the stone and to clear the urinary path.
It was found in vegetated area other than the quadrat during the study.

Sessile Joyweed, Dwarf copperleaf, Joyweed *(Alternanthera sessilis)* herb; Hindi: Garundi, Guroo; Marathi: Kanchari
Sessile Joyweed is a perennial herb, often found in and near ponds, canals and reservoirs. Stems and leaves useful in eye trouble. Decoction is taken with little salt, to check vomiting of blood.
The plant was recorded in the entire campus during the study.

(Plate 3)

Alligator weed (*Alternanthera philoxeroides)*
Alligator weed is an emergent or rooted floating aquatic weed.
It was recorded in both urbanized as well as vegetated areas other than quadrats (U3).

Prickly Amaranth (*Amaranthus spinosus)* herb; Marathi: kante bhaji, kante
Amaranthus spinosus is native to lowlands in tropical America; at present it is a pantropical weed that also occurs in some warm-temperate regions.
During our study, it was found in vegetated area (V3).

The celosias or cockscombs (*Celosia argentea)* herb
It is a weedy annual or short-lived perennial with erect plumes of silvery white flowers. It may have originated in Asia and then spread to Africa and South America with the help of people. As curry with pulses or other greens.
During the study, it was recorded in U1, U2, U3, V3, V4 and V5 sub sectors.

Anacardiaceae – Sumac family (Plate 3)
The sumac family of flowering plants in the order Sapindales, comprises about 70 genera and 650 species of evergreen or deciduous trees, shrubs, and woody vines. It is native to tropical and subtropical areas of the world, but a few species occur in temperate regions. Members of the family have resin ducts in the bark
Three species (all trees) belonging to three genera from this family were recoded in IIT campus.

Cashew nut tree (*Anacardium occidentale)* Tree; Marathi: Kaju, Duk
It is found throughout India. Fruits green and grey when ripe attached in fleshy yellow colored enlarged pedicel. Plant pacifies vitiated vata, kapha, skin diseases, dysentery, hemorrhoids, anorexia, hair fall, worm infestation and general weakness.
During the study, it was found in U1, U2, U3 and V3 sub sectors.

Indian Ash Tree, Moya, Wodier (*Lannea coromandelica)* Tree; Hindi: Mohin; Marathi: moi, shemat, shimati, shinti
Indian Ash Tree is a deciduous tree.
During the study, it was found in U1, U3, V2, V3 and V4 sub sectors.

Mango (*Mangifera indica)* Tree; Marathi: Amba
It is found throughout India. Medium sized evergreen tree. It is a state tree of Maharashtra. It has medicinal properties like anti-asthmatic, antiseptic, antiviral, cardio tonic, expectorant, laxative.
The plant was recorded in the entire campus except V3 during the study.

Anonaceae – custard apple family (Plate 3)
It consists of trees, shrubs or rarely woody lianas. With about 2300 to 2500 species and more than 130 genera. During the study four species (all trees) belonging to three genera representing this family were recoded in the campus.

Netted Custard Apple, Bullock's heart, Bull's heart (*Anona reticulate)* Tree; Hindi: Ramphal; Marathi: Ramphal
Netted Custard Apple is an edible fruit which is a close cousin of Sugar Apple. The tree that bears these fruits is a small deciduous or semi-evergreen tree sometimes reaching 10 meters tall and a native of Central America.
During the study, it was found in urbanized area (U1, U2 and U3).

Sugar Apple, Custard apple (*Anona sqamosa)* Tree; Hindi: Sharifa, Sitaphal
It is a small tropical tree, indigenous to the Amazon rainforest. The bark and leaves contain annonaine, an alkaloid. In tropical America, a decoction of the leaves is used as a cold remedy and to clarify urine. A bark decoction is used to stop diarrhea, while the root is used in the treatment of dysentery.
During the study, it was recorded in U1, U2, U3 and V5sub sectors.

Ylang Ylang Vine, Climbing lang-lang, Tail grape, Ilang-ilang (*Artabotrys hexapetalus)* Tree; Hindi: Hari champa, Madanmast, Manorangini; Marathi: Hirva chapha
Also known by its common name in India as "Manorangini", Hari Champa has absolutely intoxicating fragrance! This species is native to India and tropical Asia. Flowers are greenish in color and fade to yellow with age, and are extremely fragrant.
During the study, it was found in urbanized area (U1).

Mast Tree (*Polyalthia longifolia)* Tree; Gujarati: *Asopalav*
Polyalthia longifolia is a lofty evergreen tree, native to India, commonly planted due to its effectiveness in alleviating noise pollution. It exhibits symmetrical pyramidal growth with willowy weeping pendulous branches and long narrow lanceolate leaves with undulate margins. The tree is known to grow over 30 ft in height.
During the study, it was recorded in the U1, U2, U3, V1 and V4 sub sectors.

***Apiaceae* – the parsley family** (Plate 3)
It comprises between 300 and 400 genera of plants distributed throughout a wide variety of habitats, principally in the north temperate regions of the world. Most members are aromatic herbs with alternate, feather-divided leaves that are sheathed at the base. One herb belonging to one genus from this family was recoded in IIT campus.

Indian Pennywort, Coinwort, Asiatic coinwort, American coinwort, spadeleaf (***Centella asiatica);*** Hindi: Brahma manduki; Marathi: Karinga Brahmi
Indian Pennywort is a small creeping herb. The seeds are pumpkin-shaped nutlets 0.1-0.2 inches long. In India it is revered as a medicinal herb, and particularly in Manipur the full plant is eaten as food like a leafy vegetable. Indian Pennywort appears to have originated in the wetlands of Asia. China, India, and Malaya were probably within its original range.
During the study, the plant was recorded in vegetated areas other than the quadrats.

Apocynaceae – Oleander family (Plate4)
This family comprises of trees, shrubs, vines, woody climbers and some herbs, which have poisonous milky sap. Flowers are often showy and fragrant. There are several plants of medicinal value. 14 species (10 trees; 4 shrubs) belonging to 10 genera from this family were recoded in IIT campus.

Dita bark, Devil tree (*Alstonia scholaris*) Tree; Marathi: Satvin
This elegant evergreen tree is found in most parts of India. The generic name commemorates the distinguished botanist, Prof. C. Alston of Edinburgh, 1685-1760. The species name scholaris refers to the fact that the timber of this tree has traditionally been used to make wooden slates for school children. It is commonly known as the Devil Tree, as it is considered to be the abode of the devil, in popular imagination.
During the study, it was recorded in urbanized area (U1 and U2).

Karanda (*Carissa karandas)* Shrub; Hindi: Karonda; Marathi: karvand
The karanda is a sprawling semi-vine shrub native to India. If the leaves or stems are injured, the white milky sap is seen, which is characteristic of this group of plants. Fruits can be eaten fresh or used for jellies or jam.
During the study, the plant was recorded in U1, U2, U3, V1, V2 and V4 sub sectors

Crape jasmine, Moonbeam, Carnation of India (*Ervatamea diverigata)* Shrub; Hindi: Chandni
Crepe jasmine is a shrub very common in India. Like many members of the Apocynaceae family, stems exude milky latex when broken. Flowers are commonly used in *pooja* in north India.
It was recorded in urbanized area other than quadrat (U1, U3).

***Holarrhena antidysenterica* Tree;** Marathi: Indrajav, Kutaja, Pandhra kuda
The plant is indigenous to India and found all over the country in deciduous forests up to 900 meters. Indrajav is a deciduous shrub or a small tree. The seeds and the skin of the bark are used for medicinal

purpose. Kutaja is effectively used in various maladies; it works well in the treatment of diarrhea and dysentery, associated with bleeding as well. Since centuries, it has been used as a household remedy for the same.
During the study, the plant was recorded in U1, V3, V4 and V5 subsectors.

Oleander (*Nerium oleander)* Tree; Hindi: Kaner
Beautiful blossoms of fragrant pink flowers in bunch at the tip of branchlets rendering an eye-catching sight that is 'Oleander'. A native of India and the Mediterranean, it is now widely grown in tropical and subtropical gardens, parks, avenues, and is popular for its hue and fragrance. *Nerium oleander* Tree
During the study, the plant was recorded in urbanized area (U2).

Frangipani *Plumeria acutifolia* Tree
There is a lore which says that the name Frangipani derives from a perfume created by an Italian family of the same name. Frangipani, also known as the Plumeria, is native to warm tropical areas of the Pacific Islands, Caribbean, South America and Mexico.
During the study, the plant was recorded in urbanized area (U2).

White Plumeria, White Frangipani (*Plumeria alba)* Tree; Hindi: Gulchin, Champa
White frangipani has beautiful white flowers with yellow centers, and the flower looks fully opened unlike plumera rubra. Frangipani is well-known for its intensely fragrant, lovely, spiral-shaped blooms which appear at branch tips.
During the study, the plant was recorded in urbanized area (U2).

Frangipani (*Plumeria obtuse)* Tree; Hindi: Champa,
Though tropical by nature, when protected from frost, they are well suited to subtropical climates in the United States in states bordered by the Gulf of Mexico, and in Southern California. They are prolific in Hawaii.Plumeria are valued as landscape plants, ornamentals, and for their flowers.
During the study, the plant was recorded in urbanized area (U1).

Frangipani (*Plumeria rubra*)Tree; Hindi: Lal gulachin; Marathi: Chafa
Frangipani, also known as the Lei flower, is native to warm tropical areas of the Pacific Islands, Caribbean, South America and Mexico. They can grow to be large shrubs or even small trees.
During the study, the plant was recorded in urbanized area (U1, U2).

***Plumeria spp** Tree*
During the study, the plant was recorded in urbanized area (U1, U2 and U3).

Wild Snake Root, Devil Pepper, Be Still Tree, American serpentwood, be still tree, devil root, milkbush (*Rauvolfia tetraphylla)* Shrub;Hindi: barachandrika, Chandrabhaga
Native to tropical America, Wild Snake Root is a small tree or shrub. The roots yield the drug deserpidine, which is an antihypertensive and tranquilizer.
During the study, the plant was recorded in urbanized area (U2).

Crape jasmine, Moonbeam, Carnation of India (*Tabernaemontana divaricata)* Herb; Hindi: Chandni
Crepe jasmine is a shrub very common in India. Crape jasmine blooms in spring but flowers appear sporadically all year. Flowers are commonly used in *pooja* in north India. During the study, the plant was recorded in urbanized area (U1, U3).

Mexican oleander, Yellow Oleander, Lucky Nut (*Thevetia peruviana)* Tree; Hindi: Peeli kaner
Mexican oleander is a large shrub or a small tree. Fruit is small, containing two to four flat seeds. If ingested may experience pain in the mouth and lips, may also develop vomiting, cramping, abdominal pain, nausea and bradycardia shortly after ingestion. Mexican oleander is native to tropical America.
During the study, the plant was recorded in urbanized area (U1, U2).

Sweet Indrajao, Pala indigo plant, Dyers's oleander *(Wrightia tinctoria)* Tree; Hindi: Kapar, Dudhi; Marathi: Kala kuda

Sweet Indrajao is a small, deciduous tree with a light gray, scaly smooth bark. Native to India and Burma, Wrightia is named after a Scottish physician and botanist William Wright (1740 - 1827). The hairy seeds are released as the fruit dehisces. The leaves of this tree yield a blue dye called Pala Indigo. Sweet Indrajao is called dhudi (Hindi) because of its preservative nature. Supposedly a few drops of its sap in milk prevent curdling and enhance its shelf life, without the need to refrigerate. It is made into cups, plates, combs, pen holders, pencils and bed stead legs. It is commonly used for making Chennapatna toys.

During the study the plant was observed in the entire campus except V1.

Araceae (Plate 4)

Members of this group are all herbs like taro, suran or elephant foot yam. A typical tall tapering flower is almost enclosed in a green or coloured spathe. This family of 107 genera and over 3700 species is most diverse in the New World tropics, although also distributed in the Old World tropics and north temperate regions.

Two species (2 herbs) belonging to two genera from this family were recoded in the campus.

Dragon Stalk Yam (*Amorphophallus commutatus)* herb; Hindi: Jangli suran; Marathi: Sherla

Dragon Stalk Yam grows from a subterranean tuber. From the top of this tuber a single leaf is produced atop a trunk like petiole followed, on maturity, by a single inflorescence. This leaf consists of a vertical leaf stalk and a horizontal blade, which may consist of a number of small leaflets. The leaf lasts one growing season. This flower appears before the onset of the monsoon and the leaves appear with the rains. Flowers have a fetid smell and attract flies for pollination. Amorphophallus commutatus fruits are eaten by koels and bulbuls.

This plant was observed in the entire campus.

Green Taro, cocoyam, taro, aivi, dasheen (*Colocasia esculenta)* herb; Hindi: Arvi, Ashukachu, Kachalu; Marathi: aaloo, Chempu, Ran aalu

Green Taro is a tuberous bulb plant growing 3-5 ft tall. The large leaves of the plant resemble elephant ears.

During the study, the plant was recorded in U1, U2, U3, V1, V3 and V4 sub sectors.

Araucariaceae (Plate4)

The **Araucariaceae** is a very ancient family of conifers. They achieved maximum diversity in the Jurassic and Cretaceous periods, when they existed almost worldwide. At the end of the Cretaceous, when dinosaurs became extinct, so too did the Araucariaceae in the northern hemisphere. There are three genera with 41 species alive today.

1 tree belonging to 1 genus from this family was recorded in IIT campus.

Araucaria sps Gymnosperm

During the study, it was found in urbanized area (U2, U3).

Arecaceae – (Plate 5)

There are roughly 202 currently known genera with around 2600 species, most of which are restricted to tropical, subtropical, and warm temperate climates. Many common products and foods are derived from palms, and palms are also widely used in landscaping for their exotic appearance, making them one of the most economically important plants.

7 species (all trees) belonging to 7 genera from this family were recorded in IIT campus.

Palm Areca-nut Betel Palm, Areca palm, (*Areca catechu)* Tree; Marathi: pophali

This is the palm which produces the popular betel-nut or supari, which is an essential ingredient of P*aan*. It is grown for its economically important seed crop, the Betel nut. The seed contains alkaloids such as arecaine and arecoline, which when chewed is intoxicating and is also slightly addictive.

During the study, it was found only in the urbanized sector.

Palmyra Palm, African fan palm, borassus palm, tal-palm, toddy palm, wine palm (*Borassus*

flabellifer) Tree; Hindi: Taad
Palmyra palm is a native of tropical Africa but cultivated and naturalized throughout India. The chief product of the palmyra is the sweet sap (toddy) obtained by tapping the tip of the inflorescence, as is done with the other sugar palms and, to a lesser extent, with the coconut.
During the study the plant was observed in the entire campus except V3.

Fishtail Palm, Jaggery Palm (*Caryota urens)*Tree; Hindi: Mari
Fishtail palm is a fast growing feather palm that makes a beautiful addition to the landscape. It has a leaf shape that resembles the lower fin of a fish. When these palms grow to reach 20', they start producing flowers at the top of the trunk with subsequent flowers produced lower and lower on the trunk. When the lowest flower blooms, the tree dies. Fishtail palm is an Asian species that grows from India to Burma and on the island country of Sri Lanka. Plant pacifies vitiated pitta, hyperdipsia, arthritis, burning sensation, migraine and general weakness.
During the study, it was found in U1and V1 sub sectors.

Coconut tree (*Cocos nucifera)* Tree; Hindi: Nariyal
A tall, unbranched palm grows up to 35 meters in height. Fruits are edible. The entire plant has various uses. Plant pacifies vitiated vata, pitta, thirst, dyspepsia, diarrhea, intestinal worms, menorrhagia, general debility, dehydration and renal diseases. Plant has aphrodisiac property.
During the study, it was found in U1, U2, U3, V1 and V4 sub sectors.

Wild Date Palm, date-sugar palm, Indian wild date, Indian winepalm, silver date palm, sugar date palm, sugar palm (*Phoenix sylvestris)* Tree; Hindi: Khajur
A small tree with the trunk marked with rigid scars of the petioles. Flowers many in the inflorescence called spadix covered by a spathe. Fruit is a drupe and edible. It is in scrub jungles and wastelands. Alcoholic beverage is obtained from this palm. It is distributed in India, Srilanka and Malaya.
During the study, it was found in U1, U2, U3, V1, V4 and V5 sub sectors.

Bottle Palm, Royal palm, Cuban Royal Palm *(Roystonea regia)* Tree
This is a tall tree with stem swollen at top. Leaves pinnately compound. It is seen only in cultivation.
During the study, it was found in urban sector only.

Chinese Fan Palm, Fountain Palm (*Livistona chinensis)* Tree;
Chinese Fan Palm is a very popular palm grown in parks and gardens. It has a single straight trunk and large, six-foot-long leaves which have drooping tips. The Chinese fan palm is native to southern Japan, Taiwan and several islands in the South China Sea.
During the study, it was found in urban sector only.

Asclepiadaceae – Milkweed family (Plate 5)
An interesting family of herbs, shrubs and woody climbers, most having distasteful milky sap, hence the name. The fruits are usually in pairs and in some species; they are curved and pointed like a bull's horns. The flattened seeds have a tuft of silky hairs, which helps in their dispersal by wind. 3 species (1 shrub; 2 climbers) belonging to 3 genera from this family were recoded in the campus.

Crown Flower (*Calotropis gigantean)* Shrub; Hindi: Safed aak
It is a perennial shrub. Plant pacifies vitiated tridoshas, skin diseases, joint inflammations, snake poison, asthma and chest infections and rabies. It is a strong purgative drug.
During the study, the plant was recorded in U1, U3, V1, V3, V4 and V5 sub sectors.

Holostemma annularae Climber
It is soothing on the alimentary tract Diarrhea, gastritis & inflammatory Bowel conditions.
During the study the plant was recorded in vegetated area other than the quadrat (V3).

Sneeze Wort, Cotton milk plant, Green milkweed climber, Green wax flower, sneezing silk

(*Wattakaka volubilis)* Climber; Hindi: akad bel, harandodi, nak-chikni; Marathi: harandodi, nakhasikani
It is perennial, spreading liana seen on rocky slopes, trees and thickets. Its distribution is in India and Sri Lanka. It is a food plant of blue tiger butterfly.
During the study, the plant was observed inV1 sub sector.

Asteraceae – Sunflower family (Plate 6)

It is the largest family of dicot plants comprising 950 genera and about 20.000 species including about 1000 from India. 14 species (12 herb; 2 shrubs) belonging to 13 genera from this family were recoded in IIT campus.

Goat weed (*Ageratum conyzoides)* herb
Goat weed is a common tropical annual herbaceous weed. In alternative medicine, ageratum is used against epilepsy and wounds, also used as an insect repellent.
It was observed in U1, U3, V1, V2 and V5 sub sectors.

Baccaroides scabridium
During the study, it was found in vegetated area other than the quadrat.

Spiny Leaved Blumea (*Blumea oxyodonta)* Herb
Spiny Leaved Blumea is an annual herb with slender whitish hairy stem, which is often forked.
During the study, it was recorded in the entire campus except U2.

Panicled Blumea *(Blumea paniculata)* Herb; Hindi: Mharbir
Panicled Blumea is a perennial herb with a slender stem.
The plant was observed only in the V1 sub sector.

Gangotra *(Cyathocline purpurea)* herb; Hindi: Bandhaniya, Marathi: Gangotra
Gangotra is an erect annual herb. Widespread in Himalaya (Kashmir to Bhutan), Assam, India, Burma, Thailand, Indo-China, China.
The plant was observed only in the V2 sub sector.

False Daisy, Trailing eclipta (*Eclipta alba)* herb; Hindi: Bhringaraj, Kesharaj
False Daisy is an annual commonly found growing in waste ground. Eclipta grows abundantly in the tropics and is used with success in Ayurvedic medicine. Bhringaraj was used by Hindus in their Shradh, the ceremony for paying respect to a recently deceased person. This plant is one of the Hindu's "Ten Auspicious Flowers" and is sometimes called, "the king of hair."
The plant was observed only in the V3 sub sector.

Elephant Foot, Prickly-leaved elephant's foot, Bull's Tongue, Ironweed (*Elephantopus scaber)* herb; Hindi: Samdudri, Ban-tambakhu; Marathi: Hastipata
Elephant Foot is a rather coarse, rigid, erect, hairy herb. Roots and leaves are used as emollient for dysuria, diarrhoea, dysentery, swellings and stomach pain. Root is prescribed to prevent vomiting. Powdered with pepper it is applied for tooth-ache. Leaves are used in applications for eczema and ulcers.
During the study, it was recorded in the entire campus except U2.

Eupatorium repandum Shrub
During the study, it was recorded in the entire campus.

Laggera aurita Herb
During the study, it was recorded in the entire campus except V3.

Toothache Plant, Para cress *(Spilanthes acmella)* Herb ; Hindi: Akarkar, Pipulka; Marathi: Pipulka, Akarkara
Toothache Plant or "Paracress" is a flowering herb. Its leaves and flower heads contain an analgesic agent

that may be used to numb toothaches. It is grown as an ornamental (and occasionally as a medicinal) in various parts of the world.
During the study, it was found in urbanized area other than quadrat in U1 & U3 sub sectors.

Cinderella Weed, Nodeweed, Pig grass, Synedrella (*Synedrella nodiflora)* herb
Cinderella Weed is an annual herb. It is native to tropical America, but is now a common weed in corn fields and various other crop fields.
During the study, it was recorded in the entire campus.

Dahan (*Tricholepis amplexicaulis)* Herb; Marathi: Dahan
Dahan is an erect annual herb. Flowers are light purple in color. This herb is occasionally seen in the grasslands in the Western Ghats.
During the study, it was recorded in U1, V1, V2 and V5 subsectors.

Tridax Daisy, Coat Buttons, Mexican Daisy (*Tridax procumbens)* herb
This pretty daisy-like flower is very common and found along paths, roadsides and in the crevices of walls and rocks. It is a great favourite with low flying butterflies. In the areas where there is a great concentration of these flowers one will find plenty of butterflies too.
This plant was recorded in U1, U3 V3, V4 and V5 sub sector.

Little ironweed, Purple fleabane *(Vernonia cinerea)* herb; Hindi: Sahadevi; Marathi: Sadodi
Little ironweed is an annual or short-lived perennial. Originally from Central America, now a pantropical weed, it is sometimes considered native to Western Australia. Found in upland crop areas, waste places and roadsides throughout India.The seeds yield fatty oil and are used as an anthelmintic and alexipharmic; they are said to be quite effective against roundworms and threadworms.
The plant was observed in the entire campus except V2 and V3 sub sectors.

Balsminaceae – Balsam family (Plate 7)

A popular group of succulent herbs, mainly annuals and some perennial. These brittle-stemmed herbs are known for their attractive flowers recognized by a 'spur' on the large pouched sepal. Balsams are used in cosmetics and they have antibacterial properties. Flowers are favored by butterflies, moths and bees. Two species (2 herbs) belonging to 1 genus from this family were recoded in IIT campus.

Balsam, Garden balsam, Rose balsam, spotted snapweed, (*Impatiens balsamina)* herb
This erect, sparsely-branched, tender annual plant is native to Southeast Asia. The attractive flowers of this variety are double and beautiful mix of red and white. They bloom on the leaf axils, close to the stem.
During the study, it was observed in U1, U2, U3, V2, V3 and V4 sub sectors.

Rosemary Leaved Balsam (*Impatiens rosmarinifolia)* herb; Marathi: Lal terda
Rosemary Leaved Balsam is an annual her. The species name *rosmarinifolia* means having leaves like rosemary. Rosemary is a plant with narrow leaves.
The plant was observed only in V3 subsector.

Bignoniaceae – Trumpet Creeper Family (Plate 7)

The family comprising of about 650-750 species in 116-120 genera. Members of the family are mostly trees and shrubs, and more rarely lianas. The family and its genus Bignonia was named after Jean-Paul Bignon by his protégé Joseph Pitton de Tournefort in 1694. 5 species (all trees)belonging to 5 genera from this family were recoded in IIT campus. The number excludes one unidentified tree species.

Sausage Tree, (*Kigelia pinnata)* Tree; Hindi: Balam khira, Jhar fanoos
The blood-red flowers of the sausage tree bloom at night on long, ropelike stalks that hang down from the limbs of this tropical tree. The fragrant, nectar-rich blossoms are pollinated by bats, insects and sunbirds in their native habitat. The mature fruits dangle from the long stalks like giant sausages. They may grow up to two feet long and weigh up to 6.8 kg.

The plant was observed only in U1 subsector.

Indian Cork Tree, Tree Jasmine (*Millingtonia hortensis)* Tree; Hindi: Neem Chameli; Marathi: Kaval nimb,
Indian Cork Tree is cultivated in most parts of India, both in gardens and avenues. Trees do not seed very easily in India. The long, fragrant flowers are commonly woven into an ornamental braid called *Veni* in Maharashtra.
During the study, it was recorded in U1, U2 and V1 sub sectors.

Broken Bones Tree, Indian Trumpet Flower, Tree of Damocles (*Oroxylum indicum)* Tree; Hindi: bhut-vriksha, kutannat, patrorna, putivriksha, shallaka, shuran, son, vatuk
Broken Bones Tree is a native tree often grown as an ornamental for its strange appearance.
The plant was observed only in V1 subsector.

African tulip tree, Fountaintree (*Spathodea campanulata)* Tree
One of the world's most spectacular flowering trees, African tulip tree is a large upright tree with glossy deep green colored leaves and glorious orange scarlet flowers.
During the study, it was recorded in U1, U2, U3 and V5 sub sectors.

Pink trumpet tree, Pink tecoma, Rosy trumpet tree (*Tabebuia rosea)* Tree; Hindi: Basant rani
Native to continental America, Pink trumpet is a tall, fast-growing tree.
During the study, it was recorded in U1 & U3 Sub sector.

Bombacaceae (Plate7)

It includes around 30 genera with about 250 species of tropical trees. Several of the genera are commercially important, producing timber, edible fruit or useful fibres. The family is noted for some of the softest hardwoods. Two species (2 trees) belonging to 2 genera from this family were recoded in IIT campus.

Silk Cotton Tree, Kapok Tree (*Bombax ceiba)* Tree; Hindi: Shalmali, Semal
Silk cotton tree is a type of native cotton tree with large red flowers. Semul trees bear beautiful red-colored flowers during January to March. The phenomenon paints the whole landscape in an enchanting red hue. Bombax species are used as food plants by the larvae of some *Lepidoptera* species including the leaf-miner *Bucculatrix crateracma* which feeds exclusively on Bombax ceiba.
The silk cotton tree was observed in the entire campus except V1 subsector.

Chorisia ventricosa
During our study, it was found in urbanized area (U1).

Boraginaceae – Borage family (Plate7)

In this group, barring a few trees and shrubs, a majority are herbs. Plants are usually hairy and aromatic. Flowers of these herbs are favorite with butterflies, bees and other insects. Milkweed butterflies are seen around these plants, which yield an essential alkaloid that is necessary for the butterflies' reproduction. Three species (2 trees; one herb) belonging to 2 genera from this family were recoded in IIT campus.

Indian cherry, Clammy cherry, fragrant manjack (*Cordia dichotoma)* Tree; Hindi: Lasora; Marathi: Shelu
Indian cherry is a small to moderate-sized deciduous tree with a short bole and spreading crown. It is found in a variety of forests ranging from the dry deciduous forests of Rajasthan to the moist deciduous forests of Western Ghats and tidal forests in Myanmar. In Maharashtra, it grows in moist monsoon forest also.
The plant was observed in the entire campus.

Scarlet Cordia, Orange Geiger Tree, Sebesten plum, (*Cordia sebestena)* Tree
Scarlet cordia is a small shapely tree and is native to the northern coast of South America. This plant, on account of its large tubular scarlet flowers, is one of the most beautiful of the West Indian trees.

During the study, it was recorded in U3 sub sector.

Indian Borage (*Trichodesma indicum)* herb; Hindi: Chhota Kalpa
This is an erect, spreading, branched, annual herb. It is found throughout India, on roadsides and stony dry wastelands, upto 1,500 m. The plant is acrid, bitter in taste. This herb is used in arthralgia, inflammations, dyspepsia, diarrhoea, dysentery, skin diseases and dysmenorrhoea. .
During the study the herb was recorded in U1, U3, V3 and V4 sub sectors.

Burseraceae (Plate 7)

It is composed of about 16 genera of resinous trees and shrubs. They are native primarily to tropical America, but a few species occur in Africa and Asia. One species (1 tree) belonging to 1 genus from this family was recoded in IIT campus.

Garuga, grey downy balsam (*Garuga pinnata)* Tree; Hindi: kharpat; Marathi: kakad
Garuga is a deciduous tree reaching 50 ft in height, with bark pealing off in flakes. The fruits are eaten raw or pickled.
During the study, it was recorded in U1 & V1 sub sectors.

Caesalpinaceae – Peacock flower family (Plate 8)

Orange and yellow flowering shrubs of peacock flowers (*Caesalpinia pulcherima*) and Gulmohor are some of the more prominent members among these legumes. The family is named after Andreas Caesalpini (1519-1603), an Italian botanist. 13 species (9 trees; 2 shrubs and 2 herbs) belonging to 7 genera from this family were recoded in IIT campus.

Bidi Leaf Tree (*Bauhinia racemosa)* Tree; Hindi: katmauli, jhinjheri; Marathi: apta, sona
Bidi Leaf Tree is a small crooked tree with drooping branches.
During the study, it was recorded in U1, U2, U3, V2, V3 and V5 subsectors.

Yellow Orchid Tree, St. Thomas Tree, Yellow Bell (*Bauhinia tomentosa)* Shrub
The bell-shaped yellow flowers have a black marking in the throat and may turn pinkish with age. A food supplement - Kachnar - is made out of this plant as a gargle for sore throats, as a paste for skin diseases, or internally as a remedy for diarrhea.
During the study, it was observed in urbanized area U2 other than quadrat.

Orchid Tree, Varigated Bauhinia (*Bauhinia variegate)* Tree; Hindi: Kachnar; Marathi: kanaraj, kavidara, kanchan, rakta-kanchan
Orchid tree is closely related to peacock flower and to the tree many consider the world's most beautiful, the royal poinciana - and it shows! The flowers often make their first appearance in late winter while the tree is bare of leaves. The blooming period then lasts until early summer. The flowers are 3-5 inches across and carried in clusters at the branch tips.
During the study, it was observed in U1, U2, U3, V2 and V3 sub sectors.

Sankasur (*Caesalpinia pulcherima)* shrub
During the study, it was observed in urbanized area U1 & U2, other than quadrat.

***Cassia absus* Herb**
This herb is common in India. It is found in mainly in western parts of India. In Ayurveda the leaves and the seeds are used for treatment of anemia, asthma and hiccups.
During the study, it was observed in vegetated area V3, other than quadrat.

Amaltas, Golden shower tree, Indian Laburnum (*Cassia fistula)* Tree; Hindi: Amaltas
This native of India, commonly known as *Amaltaas*, is one of the most beautiful of all tropical trees when it sheds its leaves and bursts into a mass of long, grape-bunches like yellow gold flowers. The wood is hard and heavy; it is used for cabinet, inlay work, etc.
During the study, it was recorded in U1, U2, U3 and V3 sub sectors.

Burmese Pink Cassiav (*Cassia renigera)* Tree
Burmese Pink Cassia is an ornamental garden and roadside tree. Native of dry zone of Upper Burma now introduced into India.
The plant was exclusive to U3 sub sector.

Siamese Senna, Siamese cassia (*Cassia siamea)* Tree; Hindi: Seemia, Kassod; Marathi: Kassod
Siamese Cassia is a small to medium sized tree. It originates in India, Burma, Sri Lanka, Indonesia and Malaysia.
During the study, it was recorded in U1, U2, U3, V4 and V5 sub sectors.

Marathi: Takla (*Cassia tora)* herb
It is used as a coffee substitute, Germicide, Mucilaginous & Laxative. It is useful in treating skin diseases like ring worm and itch and psoriasis.
During the study, it was recorded in U1, V2, V3, V4 and V5 sub sectors.

Flame Tree, Royal Poinciana (*Delonix regia)* Tree; Hindi: Gulmohar
Discovered in the early 19th century in its native Madagascar by botanist Wensel Bojer, Gulmohar is a flamboyant tree in flower - some say the world's most colorful tree. For several weeks in spring and summer it is covered with exuberant clusters of flame-red flowers. Gumohar is naturalized in India and is widely cultivated as a street tree.
The plant was observed in U1, U2, U3, V4 and V5 sub sectors.

Copperpod, Rusty shield-bearer (*Peltophorum pterocarpum)* Tree
Copperpod is sometime also called yellow flame tree, because of the resemblance of its fern-like leaves to that of Gulmohar. The copper-pod is a native of Sri Lanka, the Andamans, the Malay Peninsula and North Australia.
The plant was recorded in U1, U2, U3, V1 and V4 sub sectors.

Sita Ashok, Sorrowless tree (*Saraca asoca)* Tree; Hindi: Sita Ashok, Ashok
Ashoka is one of the most legendary and sacred trees of India, and one of the most fascinating flowers in the Indian range of flower essences. Ashok is a Sanskrit word meaning without grief or that which gives no grief. Indigenous to India, Burma and Malaya, it is an erect tree, small and evergreen, with a smooth, grey-brown bark.
During the tudy, it was recorded in U1 sub sector.

Tamarind (*Tamarindus indica)* Tree; Hindi: Imli
Tamarind is very much used in cooking in India, particularly in the south. Contrary to popular belief, Tamarind is not native to India. It originated in tropical Africa, including Sudan and parts of the Madagascar dry deciduous forests. It was introduced into India so long ago that it has often been reported as indigenous here, and it was apparently from India that it reached the Persians and the Arabs who called it "tamar hind" (Indian date, from the date-like appearance of the dried pulp), giving rise to both its common and generic name. The species name *indica* also gives the misleading impression that it originated in India.
The plant was observed in the entire campus except V3 sub sector.

Cannaceae – Canna family (Plate 8)

All species of Canna originally came from tropical and sub tropical America and have naturalized in Asia and Africa. One specie (herb) belonging to 1 genus from this family was recoded in IIT campus.

Indian Shot, Wild canna (*Canna indica)* herb; Hindi: Sarvajjaya; Marathi: Kardal
One of the most commonly used beads in natural seed jewelry comes from a beautiful wildflower of the Caribbean region and tropical America. The seeds are called "Indian shot" because of their superficial resemblance to lead shot ammunition of the 18th and 19th centuries. Throughout tropical regions of the world the shiny black beads are strung into earrings and necklaces, often as spacers between larger beads or mixed with silver trinkets and gemstones. The species name *indica* is a misnomer - this plant is not a native

of India, but West Indies.
The plant was observed only in the U2 sub sector.

Capparaceae – Caper family (Plate8)

This is a mixed group of herbs, shrubs and trees. Capers are known for their backward curving thorn. Butterflies belonging to white and yellow group prefer to lay eggs on plants of this group. Three species (1 tree; 2 shrubs) belonging to 2 genera from this family were recoded in IIT campus.

Caper, Caperbush, Common caperbush, Spiny caperbush (*Capparis spinosa)* Shrub; Hindi: Kabra
Caper is a spiny, trailing, deciduous shrub native to the Mediterranean. The Hebrew word for Caper is tapher which actually means desire. Capers are found in Jerusalem and around Nazareth and are offered as a sort of Hors d'oeuvre to stimulate the appetite or to increase the desire to eat. Capers are essential for several Mediterranean cuisines and are mostly associated with Italian foods. They are mostly applied to tomato or wine sauces and fit well to poultry and fish.
The shrub was observed in the entire campus.

Ceylon caper, Indian caper (*Capparis zeylanica)* Shrub; Hindi: Aradanda
Indian caper is a large shrub. In folk medicine, leaves used for boils, swelling and hemorrhoids. Decoction of root-bark used for vomiting and for improving the appetite. Leaves also used to improve the appetite.
During the study, it was recorded in the U1 sub sector.

Crataeva tapia Tree
During the study, it was recorded in the U1 sub sector.

Caricaceae – (Plate 8)

It forms a very distinctive group with many anatomical features in common. Their stems are stout; the venation of the leaves is palmate; and there are tiny glands at the base of the petiole or on the blade. One specie (shrub) belonging to 1 genus from this family was recoded in IIT campus.

Papaya, Melon tree, Pawpaw, papaya, Tree melon *(Carica papaya)* Shrub; Hindi: Papita; Marathi: Pappayi, Popay
Some papaya bear only short stalked female flower or bisexual flowers, while others may bear only male flowers. Papayas flower and fruit simultaneously throughout the year. Fruits are edible.
The shrub was observed in U1, U3, V1, V4 and V5 sub sectors.

Casuarinaceae – Beefwood family (Plate 9)

This family includes two genera (*Casuarina,* 30 species; *Gymnostoma*, 20 species) of trees and shrubs, many of which have a distinctly pine like aspect when seen from far. They are naturally distributed in tropical eastern Africa, the Mascarene Islands, Southeast Asia, Malaysia, Australia, and Polynesia. One specie (tree) belonging to 1 genus from this family was recoded in IIT campus.

Whistling Pine, Casuarina, Common Ironwood, Beefwood, Bull-oak (*Casuarina equisetifolia)* Tree; Hindi: Junglisaru; Marathi: Suru
Whistling Pine is a common tropical seashore tree and is often planted as a windbreak. Whistling Pine has a conifer-like appearance which is increased by hanging green branchlets and cone-like fruits. The wood is hard and is almost unworkable by carpenters. It also cracks and splits easily and so is more suitable for beams or posts than planks, but does not last long underground. The chief use is as fuel for which a tree may be cut when 10 to 12 years old, although it is better left until about 20.
The tree was recorded only in the urbanized sector.

Cleomaceae – (Plate 9)

These are mostly herbs. Their inflorescence is more or less flat-topped, elongating only after the open flowers have faded. The petals are typically narrowed strongly at the base. Cleomaceae contains 10 genera and about 300 species, which grow in tropical to warm temperate regions, especially in the New World. 2

species (2 herbs) belonging to 1 genus from this family were recoded in IIT campus.

Fringed Spider Flower (*Cleome burmanii)* herb
Fringed Spider Flower is an erect, branched, annual herb. It is native to Tropical Africa, naturalized in India and elsewhere.
The herb was recorded in U2, U3 and V5 sub sectors.

Asian spider flower, Yellow spider flower, Cleome, Tickweed (*Cleome viscose)* herb; Hindi: Bagra
Usually it is tall, annual herb. The leaves are used as an external application to wounds and ulcers. The juice of the leaves has been used to relieve earache.
The herb was recorded in U1, U2, U3, V1 and V5 sub sectors.

Clusiaceae – the Garcinia family (Plate 9)

It is comprise of about 40 genera of tropical trees and shrubs. Several are important for their fruits, resins, or timbers. One specie (tree) belonging to 1 genus from this family was recoded in IIT campus.

Kokam, Goa butter tree, Kokum butter tree, Mangosteen (*Garcinia indica)* Tree; Hindi: Kokum; Marathi: bheranda, bhiranda, kokamba, ratamba
Kokum is a tree with a dense canopy of green leaves and red-tinged tender emerging leaves. It is indigenous to the Western Ghats in India. An average kokum tree bears hundreds of fruits during summer. These are plucked when they are ripe. The tree is a source of kokam butter which is used in cosmetics and confectionary.
The tree was recorded only in the urbanized sector.

Combretaceae – Terminalia family (Plate 9)

The family is known for large tees like arjun, beheda, Indian almond and Ain. Another popular member of this group is Rangoon creeper that a bear bunches of pink and white flowers. The fruits are mostly winged. 6 species (3 trees; 2 woody climbers and 1 climber) belonging to 4 genera from this family were recoded in IIT campus.

Paper flower climber (*Calycopteris floribunda)* Woody climber; Hindi: Kokoray; Marathi: Ukshi
Ukshi is a large climber. The stem and leaves are said to be medicinal. Ukshi is found extensively in the low-lying tropical evergreen forests of the Western Ghats. Ukshi is revered as a life-saver by the forest dwellers that regularly depend on this vine during summer when streams dry up. Sections of the vine store water, which people often use to quench their thirst.
This woody climber was recorded in U1, V1 and V2 sub sectors.

Piluki (*Combretum ovalifolium)* Woody climber Marathi: Piluki, Pewar Wel, Pilokha
This woody climber was recorded in U1, U3 V1 and V2 sub sectors during the study.

Rangoon Creeper, Burma creeper (*Quisqualis indica)* Climber; Hindi: Madhu Malati
Rangoon creeper is found in thickets or secondary forests of the Philippines, India and Malaysia. It has since been cultivated widely in the gardens as an easy to grow plant.
The climber was observed in U2 & V2 sub sectors.

Arjun (*Terminalia arjuna*)Tree; Hindi: Arjun
In Indian mythology, Arjun is supposed to be Sita's favourite tree. Native to India, the tree attracts lot of attention because of its association with mythology and its many uses. Arjuna is a large, evergreen tree, with a spreading crown and drooping branches. Every part of the tree has useful medicinal properties. Arjun holds a reputed position in both Ayurvedic and Yunani Systems of medicine.
During the study, it was found in the U1 sub sector.

Indian almond (*Terminalia catappa)* Tree; Hindi: Jangli badam; Marathi: Jangli badam
Indian almonds are spreading trees with large, leathery, oval leaves which turn red before they fall. The nuts

are edible, taste like almonds and are eaten. A highly ornamental tree, much planted in avenues and gardens.
The tree was recorded in U1, U2, U3, V4 and V5 sub sectors.

Flowering Murdah (*Terminalia paniculata)* Tree; Marathi: Kindal, Kinjal
Flowering Murdah is a tropical tree with a large natural distribution in Western Ghats. Fruit has one large and two small wings. It is the fruits, rather than the flowers, which make the tree more colorful. The tree is extensively utilized in pharmaceutical, timber tannin, leather and silk industries. It is a tall tree. Timber very useful for ship building & is used as substitute for teak. Fruits are used for tanning & dyeing. In winter, the tree may be partially leafless.
During our study, it was found in urbanized area (U1).

Commelinaceae – Spiderwort family (Plate 9)

This is a group of succulent herbs, mainly annuals, seen around human dwellings like the common garden commelina. Flowers are usually surrounded by a boat-shaped bract. Three species (all herbs) belonging to 2 genera from this family were recorded in IIT campus.

Whiskered Commelina (*Commelina benghalensis)* herb; Hindi: Kana, Kankawa; Marathi: Kena
A trailing, weedy herb growing on sandy soils. Important fodder plant that retains moisture long after collecting.
The herb was observed in the entire campus except V5 sub sector.

***Commelina hasskarllii* herb**
The herb was recorded in U1, U3, V3, V4 and V5 sub sectors.

Cyanotis fasciculate herb; Marathi: Nilwanti
Nilwanti (referring to its blue color) is a small annual herb commonly found on dry grasslands and rocks in the Western Ghats.
The herb was recorded in U1, U3, V4 and V5 Sub sectors.

Convolvulaceae – Glory family (Plate 10)

A popular group of vines, climbers, herbs and shrubs with a majority having typical funnel-shaped flowers. Several glories are popular as ornamentals, while those like wooly elephant climber and little glory have been used medicinally. Some like the hedge glory are distasteful to animals. 13 species (1 shrub, 12 climbers) belonging to 7 genera from this family were recorded in IIT campus. The number excludes 3 unidentified species.

Silky Morning Glory, Silky wood rose (*Argyreia sericea)* Climber; Marathi: Gavel
A clambering silky twiner. Occasionally found on high altitudes in Western Ghats.
The climber was observed in U1, V2, V3, V4 and V5).

Giant Dodder (*Cuscuta reflexa)* Climber; Hindi: Amar bel, Akashbel
Amar bel (meaning, immortal vine) is an unusual parasitic vine. It grows in a prolific manner over host plants with inter-twined stems, giving it a common name of Devils Hair. The plant is leafless and rootless. Initially the starter plant would have had some roots. Within a few days of germination, the plant, which is sensitive to touch, finds a host or dies. After establishing itself on a host body, it draws nutrition from the host as a stem parasite and the roots wither away. The twining stem develops Haustoria which are root like and penetrate the host stem to draw water and nourishment.
The climber was recorded in V1 & V3 sub sectors.

Dwarf Morning Glory, Slender Dwarf Morning Glory *(Evovulus alisnoides)* Climber; Hindi: Visnukrantha, Shyamakrantha; Marathi: Vishnukranta
This is a very slender, more or less branched, spreading or ascending, usually extremely hairy herb. The whole plant is used in the Goa territory. It is used extensively as a febrifuge and tonic. With cumin and milk

it is used for fevers nervous debility, and loss of memory; also for syphilis, scrofula, etc.
During the study, it was recorded in urbanized sector U1 & U2 other than the quadrat.

Water Morning Glory, Swamp cabbage, aquatic morning glory, Chinese water spinach (*Ipomoea aquatica)* Climber; Hindi: Nali, Kalmi sag; Marathi: Nalichi-bhaji
Water Morning Glory is a semi-aquatic tropical plant grown as a leaf vegetable. Its precise natural distribution is unknown due to extensive cultivation, with the species found throughout the tropical and subtropical regions of the world. Water Morning Glory grows in water or on moist soil. It is most commonly grown in East and Southeast Asia. Because it flourishes naturally in waterways and does not require much if any care, it is used extensively in Malay and Chinese cuisine.
The climber was recorded in the U2 sub sector.

***Ipomoea batatas* Climber**
During the study, it was observed in urbanized sector U1 other than quadrat

***Ipomoea* sp. Climber**
During our study, it was observed in U2, U3, V3, V4 and V5 sub sectors.

Cairo Morning Glory, Messina Creeper, Ivy-leaved Morning Glory, Coastal Morning Glory, Railway creeper, Mile a Minute Vine (*Ipomoea cairica)* Climber
One of the commonest yet most useful of the evergreen creepers, refreshing the eve in the hottest weather with its clear, green leaves and delicate, mauve blooms, the Railway Creeper is found in gardens, villages, and on practically every railway station, thus earning for itself its nickname.
The climber was recorded in U2, U3 and V2 sub sectors.

Bush Morning Glory, Morning Glory Tree (*Ipomoea carnea)* Shrub; Hindi: Behaya; Marathi: Besharam
Bush Morning Glory is a shrub which grows to 1-5 m high. Originally from tropical America, it is widely naturalized. The hindi/marathi names *besharam/behaya*, means shameless and referes to its rampant spreading.
This shrub was observed in U2 & U3 sub sectors.

Blue Morning Glory, Japanese Morning Glory, White-Edge Morning Glory (*Ipomoea nil)* Climber; Hindi: Jharmaric, Kaladana, Neelkalmi; Marathi: Kaladana, Neelpushpi
Annual or sometimes short-lived perennial, with twining to decumbent-creeping, slender, somewhat angular stems.
During the study, it was found in vegetated sector V3 other than quadrat.

Railway Creeper (*Ipomoea palmate)* Climber
Perennial, creeping vine that can be grown as an annual in temperate climates. Native to India. This is one of the fastest green covers that can be grown, spreading thickly and producing its deep-throated purple trumpet flowers.
This climber was recorded in U2, U3, V1 and V3 sub sectors.

Foot Morning Glory (*Ipomoea pes-tigridis)* Climber; Hindi: Panchpatia; Marathi: Vagh-padi
Tiger Foot Morning Glory is a twining, herbaceous, hairy, annual vine, all parts being more or less covered with rather long, spreading, pale, or brownish hairs. The 5-lobed leaf resembles tiger's paw, which inspired its common name, as well as the botanical species name *pes-tigridis*.
The climber was restricted to the V3 sub sector.

***Ipomoea* Climber**
This climber was observed in the entire campus.

***Merimea vitifolia* Climber**

The climber was recorded in vegetated sector V3 other than quadrat

Transparent Wood Rose, White day glory, Indian jalap (*Operculina turpethum)* Climber; Marathi: Nasottar
Transparent Wood Rose is herbaceous, somewhat hairy vine. In India the fresh bark of the root is rubbed with milk and employed as a purgative.
The climber was recorded in U1, U2, U3, V3, V4 and V5 sub sector.

Midnapore Creeper (*Rivea hypocrateriformis)* Climber; Hindi: Phang; Marathi: Sanjvel
Midnapore Creeper is a robust woody climbing shrub, found in dry subtropical forests of India and Pakistan. Leaves boiled in water, then added to bajri (millet) or jowari flour which is made into bread. Leaves are also boiled together with condiments, i.e. prepared into bhaji. In Rajasthan young shoots and leaves eaten as vegetable.
The climber was recorded in the V1 & V2 sub sectors

Cucurbitaceae – Cucumber family(Plate 11)
A family of herbaceous climbing or trailing plants with tendrils like cucumbers, melons and gourds. Each flower is either male of female, and in some species male and female flower grow on different plants. This is an important family, with wild parent stock of present cultivated varieties of cucumbers, melons and gourds. Nine species (all climbers) belonging to 8 genera from this family were recoded in IIT campus.

Ivy Gourd (*Coccinia indica)* Climber; Hindi: Kunduru; Marathi: Tondli
Ivy gourd is a tropical plant in the pumpkin family. Ivy gourd is an aggressive climbing vine that can spread quickly over trees, shrubs, fences and other supports.
The climber was recorded in the V1, V4 and V5 sub sectors.

Melon, Muskmelon, Cantaloupe, Honeydew, Sugar melon (*Cucumis trigonus)* Climber; Hindi: Kharbooza; Marathi: Chibunda, Tarkaddi
Melon is a very popular summer fruit in northern parts of India and an annual climber growing to 1.5m.
The climber was recorded in the U1, V1, V2, V4 and V5 sub sectors.

Pumpkin ***Cucurbita maxima Climber***
During the study the climber was observed in urbanized sector U3 other than quadrat.

Angled luffa, Ridged luffa, Vegetable Gourd, Silk squash (*Luffa acutangula)* Climber
It is commercially grown for its unripe fruits as a vegetable. Mature fruits are used to make cleaning sponges. Its fruit slightly resembles a cucumber with ridges. It ranges from central Asia and eastern Asia to southeastern Asia.
The climber was recorded in U3 & V4 sub sectors.

Momordica subangulata Climber
It is also dioecious and perennial in nature with short annual vines. It is mentioned as rare in Cook's Flora.
The climber was exclusive to U2 sub sector.

Madras pea pumpkin, Rough bryony (*Mukia maderaspatana)* Climber; Hindi: Aganaki, Agumaki, Bilari; Marathi: Bilavi
An annual, sparse climber that spreads over vegetation.
The climber was recorded in U3 & V4 sub sectors.

Creeping cucumber (*Solena amplexicaulis)* Climber
Root is stimulant and purgative. Leaf has anti-inflamatory properties. It helps in maintaining a healthy skin and is an important ingredient of skin conditioning lotions. During the study the climber was recorded in vegetated sector V3 other than quadrat.

Snake Gourd *Trichosanthes cucumerina* Climber

Scadent herb with tuberous roots Snake Gourd is a tropical or subtropical vine, raised for its strikingly long fruit, used as a vegetable and for medicine. It is most popular in the cuisine of South Asia and Southeast Asia. The shoots, tendrils, and leaves are also eaten as greens. It is a popular vegetable in South India. The white flower is beautiful and lacy, and open at night.
The climber was recorded in the vegetated sub sectors V2 & V3.

Indrayan (*Trichosanthes tricuspidata)* Climber; Hindi: Mahakal, Indrayan; Marathi: Kaundal
Indrayan is a large climber. It has strong, woody and grooved stem, with trailing branches. Tendrils are divided into 2-3 parts.
During the study the climber was recorded in vegetated sector V3 other than quadrat.

Cycadaceae – (Plate11)

Family Cycadaceae is unique among the cycads in not forming seed cones on female plants, but rather a group of leaf-like structures each with seeds on the lower margins, and pollen cones on male individuals. One specie (tree) belonging to 1 genus from this family was recoded in IIT campus.

Cycas circinalis **Gymnosperm**
It is a multiuse cycad endemic to South India. Although reported to be in decline across its limited habitat, no information was available on the extent and nature of harvest and trade of this species or its ecological impacts. Kerala the fruits are heavily harvested and sold locally as medicine.
During the study, the gymnosperm was recorded only in U1 urbanized sub sector.

Cyperaceae – Sedge family (Plate11)

Sedge family of monocotyledonous flowering plants, a division of the order Poales. The Cyperaceae are grasslike herbaceous plants found especially in wet regions throughout the world. One specie (herb) belonging to 1 genus from this family was recoded in IIT campus.

Cyperus sp. herb
The herb was recorded in U1, V1, V3 and V4 sub sectors.

Dioscoreaceae – (Plate 11)

It has 4 genera and 870 species of herbaceous or woody vines and shrubs, distributed throughout tropical and warm temperate regions. Members of the family have thick, sometimes woody roots or tuber-like underground stems and net-veined, often heart-shaped leaves that sometimes are lobed. Two species (2 climbers) belonging to 1 genus from this family were recoded in IIT campus.

Dioscorea bulbifera Climber
It is a large vine 20 ft or more in length. It produces tubers; however the bulbils which grow at the base of its leaves are the more important food product.
The climber was recorded in U2, V2, V3, V4 and V5 sub sector.

Five Leaf Yam, Mountain yam, Wild yam, Prickly yam (*Dioscorea pentaphylla)* Climber; Hindi: Kanta alu, kada kanda
Five Leaf Yam is climbing plant, with compound leaves. Tubers are irregular, usually long ovoid, transverse section white when fresh, becoming brown, roots fibrous. Leaves are alternately arranged on the twining stems.
The climber was recorded in the entire campus except V3.

Ebenaceae – the persimmon or ebony family (Plate 11)

It includes trees and shrubs placed in four genera, with about 490 species found throughout the tropics and also in some temperate regions. One specie (tree) belonging to 1 genus from this family was recorded in IIT campus.

Coromandel Ebony (*Diospyros melanoxylon)* Tree

Fruits are heavily harvested and sold locally as medicine. Coromandel Ebony is a medium-sized tree. Leaves are used for making beedis.
The tree was observed in U1 & U3 sub sector.

Elaeocarpaceae - (Plate 11)

These are mostly tropical and subtropical, with a few temperate-zone species. Most species are evergreen. They are found in Madagascar, Southeast Asia, Malaysia, eastern Australia, New Zealand, West Indies, and Chile. One specie (tree) belonging to 1 genus from this family was recoded in IIT campus.

Jamaica Cherry, Panama Cherry, Strawberry tree, Jam tree, Cotton Candy berry, Calabura (*Muntingia calabura)* Tree; Marathi: Paanchara
Jamaica Cherry is a very fast-growing tree. It has the reputation of thriving with no care in poor soils. It is drought-resistant but not salt-tolerant. The flowers are said to possess antiseptic properties. An infusion of the flowers is taken to relieve headache and the first symptoms of a cold.
The tree was recorded in U1, U2, U3 and V4 sub sectors.

Euphorbiaceae – the castor family (Plate12)

Euphorbiaceae includes more than 300 genera and about 7,500 species. It is world wide in distribution, but particularly well represented in Africa and South America. In India, it is represented by more than 70 genera and about 450 species. This family includes a large number of annual herbs, shrubs, or trees. In several species of Euphorbia, the stem is modified to perform photosynthesis. This modified stem is called cladode and it resembles cactus. This family shows a great range of variation in vegetative and floral characters. Almost all the plants have latex which is either milky or watery. 13 species (6 trees; I shrub and 6 herbs) belonging to 11 genera from this family were recoded in IIT campus.

Pitta Kura (*Acalypha malabarica)* herb
Leafy vegetables, as a curry with pulses or other greens.
The herb was recorded in the V3 sub sector.

Spinous Kino Tree (*Bridelia retusa)* Tree; Hindi: kaji, Khaja, kassi; Marathi: asana
Spinous Kino Tree is identified by rigid leathery leaves with straight parallel lateral veins and strong spines on the bark of young stems. Distributed throughout India, in hotter parts along the base of the Himalayas from Kashmir to Mishmi, southward to Ceylon. Root and bark are valuable astringents.
The tree was recorded in the entire campus except V2 sub sector.

Chrozophora prostrata **Herb**
During the study, it was recorded in vegetated sector V1 other than quadrat.

Cicca acida Tree; Hindi: Chaimeri, harfarauri; Marathi: haraphroti
It is a tree commonly cultivated in South India. Parts that used for medicinal purpose are root, fruit and seeds.
The tree was recorded in U1, U2, and U3 sub sectors.

Amla, Indian gooseberry (*Emblica officinalis)* Tree; Hindi: Aonla
In India it is used for the fruit, which is pickled or made into preserves. Also used in Ayurveda and Unani.
The tree was observed in U1& U2 sub sectotrs.

Wild Poinsettia, Lesser Green Poinsettia (*Euphorbia heterophylla)* Herb
Wild Poinsettia is an erect annual herb to 1.5 m tall (rarely taller). Stems are hollow, usually with scattered hairs. Flowers attract bees and butterflies. Wild Poinsettia is native to Southern United States to Argentina and the West Indies, and widely naturalized in India.
During the study, it was recorded in vegetated sector V4 other than quadrat.

Asthma Weed, Common spurge, Cats hair (*Euphorbia hirta)* herb; Hindi: Bara dudhi
Asthma weed is a slender-stemmed, annual hairy plant with many branches.

The herb was exclusive to the V4 sub sector.

Physic Nut, Jatropha, Barbados nut (*Jatropha curcas)* Tree; Hindi: Jamal ghota, Ratanjot, Jangli arandi; Marathi: Mogli Erand, Maraharalu
Physic nut is a perennial poisonous shrub. It is an uncultivated non-food wild-species. The plant, originating in Central America, whereas it has been spread to other tropical and subtropical countries as well and is mainly grown in Asia and in Africa. It is used as a living fence to protect gardens and fields from animals. Medicinally important parts are the fruits, leaves and roots.
The tree was observed in U1 & U2 sub sectors.

Macaranga peltata Tree; Hindi: Chand Kal: Marathi: Chanda, Chandwar
The tree was on served in U1, U3, V4 and V5 sub sectors.

Carry Me Seed, Black catnip, Child pick-a-back, Gale of wind, Gulf leaf flower, Hurricane weed, Shatterstone, Stone breaker (*Phyllanthus amarus)* herb; Hindi: Bhui aonla, Jaramla, Jangli amli; Marathi: bhuiavali
Carry Me Seed is a small herb. When the plants are picked, the feathery leaves fold in, completely closing themselves.
During the study, the herb was recorded in U1, U3, V2, V4 and V5 sub sectors.

Phyllanthus reticulata herb; Hindi: Pancholi, Makhi
A large shrub grows up to 2 meters in height. It is found throughout India growing wild and as a hedge plant. Plant pacifies vitiated vata, pitta, diabetes, burning sensation, burns, skin diseases, obesity and urinary retention.
During the study, the herb was recorded in U1, U2, U3, V2, V3 and V4 sub sectors.

Putranjiva, Lucky Bean Tree (*Putranjiva roxburghii)* Tree; Hindi: Putijia; Marathi: Jivanputra, Patravanti
Putranjiva is a famous, moderate-sized, evergreen tree.
The tree was exclusive to the U1 subsector..

Castor bean, Castor oil plant, Wonder tree *(Ricinus communis)* Shrub Hindi: Arandi
The castor bean plant, an erect, tropical shrub or small tree. Plant pacifies vitiated vata, pitta, diabetes, burning sensation, burns, skin diseases, obesity and urinary retention. During the study, the herb was recorded in U1, U2, V1, V3 and V5 sub sector.

Fabaceae – Pea family (Plate 13 & 14)

Plants may be herbs, shrubs, climbers and even trees; leaves generally compound, usually trifoliate, modified partly or wholly into tendril with pulvinate leaf base. Inflorescence is raceme rarely solitary axillary. 34 species (8 trees; 1 shrub; 7 herbs and 10 climbers) belonging to 22 genera from this family were recoded in IIT campus. This number excludes 2 unidentified species.

Coral bead vine, Rosary pea (*Abrus precatorius)* Climber; Hindi: Ratti; Marathi: Gunja
A high-climbing, twining, or trailing woody vine with alternately compound leaves, indigenous to India. Roots, Leaves are medicinally important.
During the study the climber was recorded in U1, V1 and V4 sub sector.

Red Sandalwood, Coral-wood, Peacock flower fence, Red beadtree (*Adenanthera pavonina)* Tree; Hindi: Rakt chandan, Badi gumchi; Marathi: Thorla goonj
Red Sandalwood is a timber tree. This plant is found in the wild in India. A red powder made from the wood is also used as an antiseptic paste. In Ancient Indian medicine, the ground seeds are used to treat boils and inflammations. A decoction of the leaves is used to treat gout and rheumatism. The bark was used to wash hair.
During the study the tree was recorded in U1, U2, V1 and V4 sub sector.

Alyce clover *Alysicarpus vaginalis* herb;
Alyce clover is a more or less prostrate, somewhat hairy branching herb, commonly found in lawns, by roadside ditches, and in waste ground exposed to the sun.
The herb was recorded in U1, U3, V2, V3, V4 and V5 sub sectors.

Atylosia platycarpa Climber
It is a more or less prostrate, somewhat hairy branching herb, commonly found in lawns, by roadside ditches, and in waste ground exposed to the sun.
The climber was recorded in U3 & V3sub sectors

Flame of the Forest (*Butea monosperma)* Tree; Hindi: Palash, Dhak; Marathi: Palas
Native to India, Flame of the Forest is a medium sized tree. In olden days, the flowers of ***Palash*** were used to make color for the festival of ***Holi***.
The tree was recorded in U1, U2, U3, V3, V4 and V5 sub sectors.

Horse Bean, Jack bean, Sword bean (*Canavalia ensiformis)* Climber; Marathi: Abai
Horse Bean is a fast-growing, usually erect, sometimes shrubby twining annual.The seeds are edible but somewhat toxic if consumed in large quantities. Mostly used for human food or green manure, but in some countries cultivated under irrigation as fodder. The forage is palatable only when dried. Due to toxicity, caution is required in feeding herbage and pods of jack bean.
The climber was recorded in U3, V1, V2, V3 and V5 sub sectors.

Butterfly Pea (*Clitoria ternatea)* Climber; Hindi: Aparajita
This wonderful twining plant generously bears quite large flowers which are a beautiful shade of vivid cobalt blue with a white throat. A native of subtropical America and Asia. The climber was recorded in U3, V3, V4 and V5).

Creeping Hemp (*Crotalaria filipes)* herb; Marathi: Phatphati
Creeping Hemp is a low growing, silky hairy, creeping, annual herb. Flowers have red-purple veins on them. Flowers attract small butterflies.
The herb was recorded in V1, V3 and V4 sub sectors

Sunn hemp, Indian hemp, Madras hemp (*Crotalaria juncea)* Hindi: San
Sunn hemp is a rapid growing crop that is used for fiber production in Indo-Pakistan. It is also good for use as a green manure in many tropical and subtropical areas in the world as an organic and nitrogen source. It suppresses weeds, slows soil erosion, and reduces root-knot nematode populations. Commonly grown in India for fodder. The seeds and pods are sometimes toxic and should therefore be removed before feeding.
This plant was recorded in U2, U3, V3, V4 and V5 sub sectors.

Crotalaria madurensis herb
Variety: kurnoolica is endangered. The species is listed in endangered category by BSI. The herb was exclusive to V3 & V4 sub sectors.

Takoli (*Dalbergia lanceolaria)* Tree; Hindi: Takoli
Takoli is a very conspicuous and handsome tree when flowering, which appear very protusely during the months of May and June. The sweet blackish pulp of the seedpod is used as a mild laxative.
The tree was observed in U1, U3 and V5 sub sectors.

Black Rosewood, Blackwood tree, Bombay Blackwood, East Indian rosewood, Indian blackwood, Indian palisandre, Indian rosewood, Malabar rosewood, Roseta rosewood. *(Dalbergia latifolia)* Tree; Hindi: kala-shisham, vilayati shisham; Marathi: kalarukh, sisau
Black Rosewood is predominantly a single-stemmed deciduous tree with a dome shaped crown of lush green foliage.
The tree was observed in U1, U3 and V5 sub sectors..

Indian rosewood (*Dalbergia sissoo)* Tree; Hindi: Shisham
Shisham is a medium to large deciduous tree, native to India. After teak, it is the most important cultivated timber tree in India, planted on roadsides, and as a shade tree for tea plantations.
The tree was observed in U1 & V4 sub sectors.

Pongam Tree, Indian Beech Tree, Pongame Oil Tree (*Derris indica)* Tree; Hindi: Karanj
Fast-growing deciduous tree that is thought to have originated in India and is found throughout Asia.A thick brownish oil can be extracted from the large seeds, and is used industrially and in medicine, notably for the treatment of rheumatism.
The tree was observed in the entire campus except V5.

Jewel Vine, Hog Creeper, Malay Jewelvine (*Derris scandens)* Climber; Hindi: Gonj, Tup-bel; Marathi: garudvel, mota-sirili
Jewel Vine is an evergreen climbing branched shrub having twining habit. It has a tap root system without aerial roots.
The tree was observed in the U1, V1 and V2 sub sectors.

Asian Tick Trefoil, Carpon Desmodium, Asian ticktrefoil (*Desmodium heterocarpum)* herb; Marathi: Jambhli Dashmi
Asian Tick Trefoil is a nearly erect subshrub.
The herb was exclusive to V2 sub sector.

Creeping Tick Trefoil, three-flower beggarweed, tropical trefoil, three-flower beggarweed, matty desmodium (*Desmodium triflorum)* herb; Hindi: Kudaliya, motha; Marathi: chipti, ran-methi
Creeping Tick Trefoil is a much branched, mat-forming creeping herb, with clover-like leaves.
During the study, it was recorded in the vegetated sub sectors V3, V4 and V5).

Trefle Gros (*Desmodium triquetrum)* herb
Trefle Gros is a subshrub with erect stems which are almost woody.
The herb was observed in the U1, V1, V2, V3 and V4 Sub sectors.

Horse Bush (*Desmodium umbellatum)* Shrub; Marathi: Pandhra chikta
Horse Bush is a large shrub.
During the study, the shrub was observed in vegetated sector V1 other than quadrat.

Indian Coral Tree (*Erythrina indica)* Tree
Indian Coral Tree is a showy, spreading tree legume with brilliant red blossoms. This highly valued ornamental has been described as one of the gems of the floral world.
During the study the tree was observed in the entire campus except V3.

Mexican lilac, Mother of cocoa, Quickstick (*Gliricidia sepium)* Tree
Tree from Mexico and South America that is used both to provide shade to chocolate trees and also enrich the soil; hence the common name meaning "mother of cocoa." The wood is durable and useful for posts and railway ties. In various parts of America, the bark is used as rat poison.
During the study the tree was observed in the entire campus except V1.

Heart-Leaf Indigo (*Indigofera cordifolia)* herb; Hindi: Gokhru, Bekara; Marathi: Bechka, Bekria
Heart-Leaf Indigo is a prostrate annual herb.
During the study, the herb was recorded in U1 & V3 sub sectors.

Sheild Indigo, Dalzell's Indigo (*Indigofera dalzelli)* herb; Marathi: Dhal godhadi
Sheild Indigo is a perennial herb with short stem and a woody rootstock. Slender, prostrate branches, about a foot long, are covered with silvery hairs.
During the study, the shrub was observed in vegetated sector V3 other than quadrat.

Indigofera glandulosa herb
Erect annual or perennial (short-lived), herb.
During the study, the herb was recorded in U3, V3 and V4 sub sectors.

Narrowleaf Indigo (*Indigofera linifolia)* Herb; Hindi: Torki, Ratnamala, Ratanjot Marathi: Lal godhadi, Pandarphalli
Narrowleaf Indigo is slender much-branched prostrate or erect annual or bushy perennial. The plant is used as famine food. The plant is threshed, and the seeds ground into flour for making bread - either unmixed or combined with other cereals e.g. bajra (millet) or jowar.
During the study, the herb was observed in urbanized sub sector U1 other than quadrat.

Velvet bean, Cowitch, Cowhage, Kapikachu, Nescafe, Sea bean (*Mucuna pruriens)* Climber; Hindi: Kiwach; Marathi: Khaj-kuiri
Velvet bean is an annual, climbing shrub with long vines that can reach over 15 m. Fruits are curved. The longitudinally ribbed pod is densely covered with loose orange hairs which cause a severe itch if they come in contact with skin. The beans are shiny black or brown. It is found in tropical Africa, India and the Caribbean.
During the study the tree was observed in the entire campus.

Paracalyx scariosus Climber; Marathi: Ran ghevada
Raan ghevda is a climbing shrub.
During the study, the climber was observed in the vegetated sub sector V1.

Indian kudzu (*Pueraria tuberose)* herb; Hindi: Sural, Bilaikand, Bharda, Tirra, Bankumra; Ghorbel (Marathi),
Indian kudzu is a large perennial climber with very large tuberous roots, distributed nearly throughout India, except in very humid or very arid regions, and ascending up to l,200 m.
During the study, the herb was observed in the vegetated sub sector V1 & V5).

Sensitive Smithia (*Smithia sensitive)* herb; Hindi: Odabirni; Marathi: Lajalu kavla
Sensitive Smithia is a low-gowing annual herb, common along the roads. It appears at waning of the monsoons. Compound leaves are slightly sensitive to touch.
During the study, the herb was observed in the vegetated sub sector V1, V3 and V4.

Taverneria cuneifolia **Climber**
During the study, the climber was observed in the vegetated sub sector V3.

Wild Indigo, Fish Poison, Tephrosia (*Tephrosia purpurea)* herb; Hindi: Sarphonk, Sharpunkha; Marathi: Unhali
Native to East India, Wild Indigo grows as common wasteland weed. In many parts it is under cultivation as green manure crop. This plant contains a mild toxin called tephrosin which chemically stuns fish but does not affect mammals. This system of fishing using the plant toxin is called hola.
During the study, the herb was observed in vegetated sub sector V3 other than quadrat.

Blue Wiss, Rabbit vine, horse vine (*Teramnus labialis);* Hindi: kalyan, lomashparnini, mashani, mashaparni, pandu-loma; Marathi: ran-udid
Blue Wiss is an extremely variable perennial, climbing or trailing to prostrate legume, sometimes with a woody rootstock.
During the study, the plant was observed in vegetated sub sector V3 other than quadrat.

Wild Moong, Mung bean, Wild black gram (*Vigna radiate)* climber; Hindi: Ban Urad; Marathi: Vel mung
It is an annual, herb or climber.
During the study, the climber was observed in U1, U3, V2, V3, V4 and V5 sub sector.

Zombi pea, Wild Mung, Wild cowpea (*Vigna vexillata)* Climber; Marathi: Halunda
Zombi pea is a fairly strong twiner, stems usually clothed with spreading silky hairs. In Africa, the roots are eaten in times of severe hunger. The tubers are soft, easy to peel, and possess a creamy, white, tasty interior. They are eaten boiled or raw. Protein content of the tubers is near the 15%, which is high compared to the 1-7% for potatoes and yams. During the study, the plant was observed in urbanised sub sector U1 other than quadrat.

Flacourtiaceae – (Plate15)

Two species (2 trees) belonging to 2 genera from this family were recoded in IIT campus.

Casearia tomentosa Tree
A tomentose **shrub or a tree**, reaching 7 m in height. **Bark** dark brown, exfoliating in square flakes.
During the study the tree was recorded in U3 & V5 sub sector.

Governor's Plum, Batoka Plum, flacourtia, Indian plum, Madagascar plum, Mauritius plum (*Flacourtia indica)* Tree; Hindi: bilangada; Marathi: athruna, tambut
Governor's Plum is a small tree or large shrub. The genus name *Flacourtia* honours E. de Flacourt (1607-60), a governor of Madagascar.
During the study, the tree was found in urbanized sub sector U2 & U3.

Gentianaceae – gentian family (Plate 15)

It contains 87 genera and nearly 1,700 species of annual and perennial herbs and, rarely, shrubs, native primarily to northern temperate areas of the world. Members of the family have leaves that are opposite each other on the stem. The leaves often lack leafstalks and have smooth margins. One species (herb) belonging to 1 genus from this family was recoded in IIT campus.

Little Persian Violet (*Exacum pumilum)* herb; Marathi: Jambhli Chirayat
Little Persian Violet is a small herbaceous plant. The plant occurs in monsoons.
During the study, the herb was exclusive to the V3 sub sector.

Hypoxidaceae (Plate 15)

Hypoxidaceae is the botanical name of a family of flowering plants. The APG II system, of 2003 (unchanged from the APG system, of 1998), does recognize this family and places it in the order Asparagales, in the clade monocots.
The members of the family are small to medium herbs, with grass-like leaves and an invisible stem, modified into a corm or a rhizome. The flowers are born on leafless shoots, also called scapes. The flowers are trimerous, radially symmetric. The ovary is inferior, developing into a capsule or a false berry. One species (herb) belonging to 1 genus from this family was recoded in IIT campus.

Golden Eye Grass, Orchid palm grass (*Curculigo orchioides)* herb; Hindi: Kali musli
Golden Eye Grass is herbaceous, tuberous perennial. The rhizomes of the plants are used for the treatment of decline in strength, jaundice and asthma.
During the study, the herb was observed in vegetated sub sector V3.

Lamiaceae – Mint family (Plate 15)

This is a family of strong smelling herbs and shrubs. Well known among them is tulsi and mint or pudina. Tulsi is a sacred plant of Hindus and mint is used in many food flavors. Three species (all herbs) belonging to 3 genera from this family were recoded in IIT campus.

Western Hill Catmint (*Anisomeles heyneana)* Herb; Hindi: Chandhara; Marathi: Gopali
It is a rigid, aromatic undershrub. The flowers resemble cow's earlobes, which gives it its Marathi name.
During the study, the herb was observed in vegetated sub sector V3 & V4.

American Mint, Bush mint, Chan, Horehound, Pignut, stinking Roger, Wild spikenard *(Hyptis suaveolens)* herb; Hindi: vilaiti tulsi; Marathi: bhustrena, darp tulas, jungli tulas

American Mint is a rigid annual herb of aggressive nature. American mint is native to the American continent, but now naturalized almost throughout the world.
During the study, the herb was observed in U1, U2, V3 and V4 sub sectors.

Bengal Pogostemon (*Pogostemon benghalensis)* Herb*;* Marathi: Pangli
Bengal Pogostemon is a large herb which looks like a shrub 1-2 m tall. Stem and branches are quadrangular, purplish and shining. The whole plant has a strong odour. During the study, the plant was observed in vegetated sub sector V3 other than quadrat.

Lauraceae – Laurel family (Plate 15)

It comprises a group of flowering plants included in the order Laurales. The family contains about 55 genera and over 2000 (perhaps as many as 4000) species world-wide, mostly from warm or tropical regions, especially Southeast Asia and Brazil. Most are aromatic evergreen trees or shrubs. There are three main economical uses for this family. A high content of essential oils are found in many Lauraceae that oils are important for spices and perfumes. The hard wood of several species is a source for timber around the world. One specie (tree) belonging to 1 genus from this family was recoded in IIT campus.

Bay Leaf, Indian cassia, Indian cassia bark, Tamala cassia (*Cinnamomum tamala)* Tree; Hindi: tejpatta
Indian bay-leaves are the leaves of a tree closely related to Cinnamon. Leaves are collected in dry weather every year from vigourous plants, dried in the sun and tied up into bundles for marketing.
During the study, the plant was observed in Urbanised sub sector U1 other than quadrat.

Lecythidaceae – the Brazil nut family(Plate 15)

It is a pantropical group of evergreen trees of about 25 genera and 310 species. A family of about 20 genera and 250-300 species of woody plants native to tropical South America and Madagascar. Two species (2 trees) belonging to 2 genera from this family were recoded in IIT campus.

Wild Guava, Ceylon Oak, Patana Oak (*Careya arborea)* Tree; Hindi: Kumbhi; Marathi: Kumbha
Wild Guava is a medium sized deciduous tree. It is the *Kumbhi* of Sanskrit writers, and appears to have been so named on account of the hollow on the top of the fruit giving it somewhat the appearance of a water-pot. Wild pigs are very fond of the bark, and that it is used by hunters to attract them. An astringent gum exudes from the fruit and stem. During the study, the tree was observed in U1. V4 & V5 sub sectors.

Cannon Ball Tree (*Couroupita guianensis)* Tree; Hindi: Nagalinga, Tope gola; Marathi: Shivalingam
This large deciduous tropical tree, 75' tall and indigenous to the Amazon rainforest, is listed as a rare tree and flower in India. Large globose woody fruits; they look like big rusty cannonballs hanging in clusters, like balls on a string. Cannon ball flowers are considered of special significance in Buddhist culture in Sri Lanka. In Tamil Nadu, it is called Nagalingam flower. The sivalingam shape is visible at the center of the flower and snake shaped pollen is the specialty of this flower and it has very good fragrance.
During the study, the tree was observed in the urbanized sector.

Leeaceae (Plate 15)

Two species (2 shrubs) belonging to 1 genus from this family were recoded in IIT campus.

Bandicoot Berry (*Leea indica)* Shrub; Hindi: Kukur jihwa
Bandicoot Berry is a shrub with straight branches. A decoction of the root is cooling and relieves thirst. The roasted leaves are applied to the head in vertigo. The juice of the young leaves is a digestive.
During the study, the shrub was observed in U1, V1, V2, V3, V4 and V5 subsector.

Hathikana, Leea (*Leea macrophylla)* Shrub; Hindi: Hathikana; Marathi: Gajakarni, Dinda
Hathikana, literally meaning, having elephant ears, is an erect shrub, or perennial herbs, large leaves lend it many of its common names. Leaves are eaten as famine food.
During the study, the shrub was observed in U1, U3, V3, V4 and V5 subsector.

Liliaceae – Lily family (Plate 15)

Liles are mainly perennial herbs that grow from underground stems belonging to a very large mixed group. *Asparagus*, *Aloe* and Glory lily are some of the important medicinal plants from this group. Two species (2 climbers) belonging to 2 genera from this family were recoded in IIT campus.

Wild Asparagus (*Asparagus racemosus)* Climber; Hindi: satawari, bojhidan, shatavir; Marathi: Satawari
Satawari is a woody climber with leaves like pine needles, small and uniform and the flowers white, in small spikes. Within India, it is found growing wild in tropical and sub-tropical parts of including the Andamans; and ascending in the Himalayas up to an altitude of 1500 m. In Ayurvedic medicine, the root of Satavari is used in the form of juice, paste, decoction and powder to treat various diseases.
During the study, the plant was observed in Urbanised sub sector U3 other than quadrat.

Glory Lily, Gloriosa lily, Tiger claw, claw *(Gloriosa superba)* Climber; Hindi: bachnag, kadyanag, Kari hari, languli, ulatchandal; Marathi: Kal-lavi, indai, khadyanag, vaghachabaka
Glory Lily is a most unusual and splendid flower, which is a sight to behold. In bud, the pale green petals face downward. As the blossom matures, the petals elongate and wrinkle and gradually arch backward while sequencing through a spectrum of color from green to yellow to scarlet. The stamens are extremely prominent and spread outward in graceful curves that follow the petals in their backward progression.
The climber was exclusive to the V3 sub sector.

Loranthaceae – Mistletoe family (Plate 15)

This family contains parasitic (partial) plants. Butterflies like Common Jazebel and Gaudy Baron lay eggs on these plants. One species (epiphyte) belonging to 1 genus from this family was recoded in IIT campus.

Honey Suckle Mistletoe (*Dendrophthoe falcate)* Epiphyte; Hindi: Banda, Banda Patha; Marathi: Vanda, Bandgul
Honey Suckle mistletoe is a popular hemiparasitic plant and is used in folklore medicine. During the study the epiphyte was found in V4 sub sector.

Lythraceae – Henna family (Plate 16)

A small group of herbs, shrubs and creepers. Henna which is a member of this family has been used in cosmetics since ancient time. Lagerstromia species are preferred food plant of the Atlas moth while the Moon moths lay eggs on henna. Four species (3 trees; one herb) belonging to 2 genera from this family were recoded in IIT campus.

Blistering Ammannia, Acrid weed, Monarch redstem, Tooth cup (*Ammannia baccifera)* herb; Hindi: Aginbuti, Ban mirich, Dadmari, Jungli mehendi; Marathi: aginbuti, bharajambhula, dadmari
Blistering Ammannia is annual herb, found in open, damp, waste places. The common names comes from the fact that the leaves are exceedingly acrid, irritant, and vesicant, and are being used by the village-folk to raise blisters, being applied to the skin for half an hour or a little longer. The leaves or the ashes of the plant, mixed with oil, are applied to cure herpetic eruptions. The fresh, bruised leaves have been used in skin diseases as a rubefacient and as an external remedy for ringworm and parasitic skin affection.
The herb was exclusive to the V1 sub sector.

Lagerstromea flos-reginae Tree; Marathi: Bondara
Lagerstroemia flos-reginae, is a very beautiful flowering tree with red, strong wood. It is state flower of Maharashtra.
The tree was observed in U1& U3 sub sector.

Crape myrtle (*Lagerstromea indica)* Tree; Hindi: Saoni; Marathi: Dhayti
Crape myrtle is the smaller version of *Lagerstroemia speciosa*, commonly known as Pride of India or Queen crape myrtle. Seeds are narcotic. In Manipur, flowers and leaves are used as purgatives. Bark is stimulant and febrifuge (fever removing) Roots are astringent and used as gargle.
The tree was observed in U1, U2 sub sector.

Pride of India, Queen Crape Myrtle (*Lagerstromea speciosa)* Tree; Hindi: Jarul; Marathi: Taman
This tropical flowering tree is one of the most outstanding summer bloomers. Seeds are narcotic; bark and leaves are purgative; roots areastringent, stimulant and febrifuge (fever removing). Decoction of dried leaves is used in diabetes.
The tree was exclusive to the U3 sub sector.

Magnoliaceae – magnolia family (Plate 15)

It contains two genera and 227 species, including many handsome, fragrant-flowering trees and shrubs. One species (tree) belonging to 1 genus from this family was recoded in IIT campus.

Champa, Joy Perfume Tree (*Michelia champaca)* Tree; Hindi: Champa; Marathi: Son Champa
Champa is native to Indonesia, India and other neighbouring areas. The most interesting part of the tree are its flowers which are not very showy with few narrow yellowish white petals, but have an extremely heady fragrance. This fragrance has made Champa flowers very popular and they have been part of the culture in India from time immemorial. Champa flowers are used to make the world's most expensive perfume 'Joy' in America. During the study, the tree was recorded in U1 & U3 sub sectors.

Malvaceae - the cotton family (Plate 16)

This family includes about 82 genera and more than 1,500 species. The plants are cosmopolitan in distribution, more abundant in tropical and subtropical regions. In India, Malvaceae is represented by 22 genera and 125 species. Plants may be annual herbs or perennial shrubs or trees. The members of this family have mucilagenous substance. Stellate hairs occur on their young parts. 11 species (1 tree; 2 shrubs and 7 herbs) belonging to 6 genera from this family were recoded in IIT campus.

Sweet Hibiscus, Edible Hibiscus, Manihot-mallow, Sunset Hibiscus, Yellow Hibiscus (*Abelmoschus manihot)* Shrub; Hindi: jungli bhindi; Marathi: raan bhendi
Sweet Hibiscus is characterized by big and glorious flowers. The importance of this plant is that it is one of the world's most nutritious leafy vegetables because of its high protein content. The leaves are tender and sweet and can be served raw or steamed.
The shrub was observed in the entire campus.

Indian mallow, Country Mallow, Abutilon, Indian abutilon (*Abutilon indicum)* herb; Hindi: Kanghi; Marathi: Petari
Indian Mallow is an erect shrub. The plant is a weed commonly found on disturbed land. Extract of water-soaked dried seeds is used as purgative. Leaves are used as tonic. Roots are taken as infusion in fever.
During the study, the herb was recorded in U3 sub sector.

Lesser Mallow (*Hibiscus hirsutus)* Herb; Marathi: Dupari, Nareri
Lesser mallow is a small tropical subshrub or perennial which can grow upto 2 feet. It has extraordinary small, but beautiful, blooms for a Hibiscus. The flowers are 1-1.5 inch across, with five overlapping petals. Its Marathi name *Dupari* (noon) come from the fact the flowers open fully at noon.
During the study the herb was recorded in vegetated sub sector V3 other than the quadrat.

China rose, Chinese hibiscus (*Hibiscus rosa-sinensis)* Shrub; Hindi: Gurhal
Nobody knows whether the hibiscus really is a native of China as its Latin name, *Hibiscus rosa-sinensis*, (*rosa-sinensis* = Chinese Rose) suggests or not. Many believe that it comes from India.
During the study the shrub was recorded in the urbanized sector.

Grape Leaved Mallow, Tropical Fanleaf (*Kosteletzkya vitifolia)* Shrub; Marathi: van kapus
Grape Leaved Mallow is a herb, almost a shrub. Leaves look like grape leaves, hence the species name vitifolia.
The shrub was recorded in vegetated subsector V3 other than the quadrat.

Brazil Jute, Malachra, Yellow leafbract (*Malachra capitata)* herb; Hindi: Van bhindi, Vilayati bhindi; Marathi: raan bhendi

Brazil Jute is annual herb which is covered with hairs.
The herb was recorded in U1, U3, V1, V3 and V4 sub sectors.

Common Wireweed, Morning mallow, Common Fanpetals (*Sida acuta)* herb; Hindi: Baraira; Marathi: Chikana
This is a much branched shrubby plant growing to a height of a feet or a little more.
The herb was recorded in the entire campus except V4 sub sector.

Heart-Leaf Sida, Long-stalk sida, country-mallow, flannelweed, Heartleaf Fanpetals (*Sida cordifolia)* herb; Hindi: bhuinii; Marathi: Bhumi petari, Bhoybal
Native to India, Heart-Leaf Sida is a weed that grows wild in wastelands and along roadsides. They are found throughout the tropical and sub-tropical plains all over India and Srilanka. The entire plant is used in making medicine.
The herb was recorded in the entire campus during the study.

Cuban jute, Jelly leaf, Queensland hemp (*Sida rhombifolia)* herb; Hindi: Sahadeva
This is a weed very common in India and Sri Lanka in the dry country.
The herb was recorded in the entire campus during the study.

Indian tulip tree, Aden apple, Portia tree (*Thespesia populnea)* Tree; Hindi: Paras pipal
Indian tulip tree is an evergreen bushy tree. In India Ground up bark is used to treat skin diseases, and its leaves are applied to inflamed and swollen joints. There is some modern investigation of the plant's effects on high blood pressure.
During the study, the plant was exclusive to the U2 sub sector.

Caesarweed (*Urena lobata)* herb ; Hindi: Bachita, Unga, Lapetua; Marathi: Vanbhendi
Caesarweed is a pantropical weed, having pink flowers like miniature hollyhocks. Many taxonomists now believe it evolved somewhere in Asia. Naturalized in India.
The herb was recorded in the entire campus during the study.

Martyniaceae (Plate 16)

It is characterized by having mucilaginous hairs, which give the stems and leaves a slimy or clammy feel and fruits with hooks or horns. Some members of the genus Proboscidea are known as "unicorn plant" or "devil's claw" because of their horned seed capsules. One species (herb) belonging to 1 genus from this family was recoded in IIT campus.

Martynia diandra Herb
Martynia diandra (*wagnak*) is found in waste fields, field borders and deserted village sites. *Martynia diandra*, the *bagnak,* an American introduction, is common in waste places and field borders.
During the study, the herb was recorded in vegetated sub sector V4.

Meliaceae – the mahogany family (Plate 16)

It comprises of 51 genera and about 575 species of trees and (rarely) shrubs, native to tropical and subtropical regions. Most members of the family have large compound leaves, with the leaflets arranged in the form of a feather, and branched flower clusters. Three species belonging to 3 genera from this family were recoded in IIT campus.

Neem (*Azadirachta indica)* Tree; Hindi: Neem; Marathi: Nimbay
Neem is native to India and Burma. It is the state tree of Andhra Pradesh. Among its many benefits, the one that is most unusual and immediately practical is the control of farm and household pests. Some entomologists now conclude that neem has such remarkable powers for controlling insects that it will usher in a new era in safe, natural pesticides.
During the study the tree was found in U1, U2, U3 and V4 sub sectors.

Indian mahogany, Red cedar, (*Cedrela toona)* Tree; Hindi: Toon; Marathi: Kunant

Toon is a large deciduous tree generally with a wide spreading and handsome crown. Also known as Red Cedar, Toon is famous for it's fragrant red wood that is much sought after for use in furniture making, building and ornamental woodwork.
During the study the tree was recorded in vegetated sub sector V3.

Chinaberry tree, Persian lilac, Pride of India, Bead tree, Lilac tree (*Melia azedarach)* Tree; Hindi: Bakain; Marathi: Bakan-nimb
The Persian lilac tree is frequently confused with Neem. However, the structure of the leaves and the color of the flowers, white in Neem and lilac in Persian lilac, are sufficient to distinguish between the two. A large evergreen tree native to India, growing wild in the sub-Himalayan region. All parts of Persian lilac tree are poisonous. Birds that eat too many seeds have been known to become paralyzed.
During our study the tree was recorded in urbanized sub sector U1, U3.

Menispermaceae – the moonseed family (Plate 17)

It contains 70 genera and 420 species, most of which are woody climbers in tropical forests, although some genera extend into temperate regions in North America and Japan. Three species (1 scandant shrub and 2 climbers) belonging to 2 genera from this family were recorded in IIT campus.

Cocculus hirsutus Scandent shrub
Used in folklore remedies in south India.
The scandent shrub was observed in the entire campus.

Cocculus villosus Climber
During the study the climber was recorded in urbanized sector U1 other than the quadrat.

Gulbel, Indian Tinospora (*Tinospora cordifolia)* Climber; Hindi: Giloy, Gulancha, Gulbel; Marathi: Gulvel
Gulbel is a native plant from India, also known to be found in Far East, primarily in rainforests. The plant is climbing shrub with heart-shaped leaves. The herb has a long history in use by practitioners of Ayurved.
During the study, the climber was recorded in U2, V1, V2 and V3 sub sectors.

Mimosaceae – Touch-me-not family (Plate 17)

It is an interesting group having touch-me-not, thorny acacia, rain tree and shirish. Many of these have flower heads like powder puff. 12 species (10 trees; one scandant shrub and one herb) belonging to 7 genera from this family were recorded in IIT campus.

Earleaf Acacia, Ear-pod Wattle, Papuan Wattle, Auri, Northern Black Wattle (*Acacia auriculiformis)* Tree
Earleaf Acacia is an evergreen tree. Fruit is a flat, oblong pod, twisted at maturity. This plant is native to Southeast Asia, Indonesia, Papua New Guinia and Australia.
The tree was observed in U1, U2, U3, V1, V4 and V5 sub sectors.

Cutch Tree, black catechu, black cutch, cashoo, catechu, wadalee gum (*Acacia catechu)* Tree; Hindi: dant-dhavan, gayatrin, khair, khayar, madan; Marathi: khair, khayar, yajnavrksa
Cutch tree is a small tree. The stem is dark brown to black, with rough bark which peels off in long strips in mature trees; young trees have corky bark.
The tree was observed in U1, U3, V1, V2, V4 and V5 sub sectors.

Acacia chundra Tree
Acacia chundra is a perennial, deciduous tree found in Asia, India and in the Indian Ocean area.The wood is used for certain applications in shipbuilding. The tree is used for timber, for cutch (catechutannic acid) from its wood and for tannin. It is also used as food for bees.
The tree was exclusive to the U1sub sector.

Black Wattle, Hickory Wattle, Mangium. (*Acacia mangium)* Tree

It is native to northeastern Queensland in Australia, the Western Province of Papua New Guinea, Papua, and the eastern Maluku Islands.
During the study the tree was observed in U3 & V3 sub sectors.

Gum Arabic (*Acacia nilotica)* Tree; Hindi: Babool, Kikar; Marathi: Babul
Babool is a medium to large tree, native to West Asia, that can reach a height of 10 m, with an average of 4-7 m in height. The crown is somewhat flattened or rounded, with a moderate density.
During the study the tree was observed in U2 & U3 sub sectors.

Climbing Acacia, climbing wattle, feather acacia, narrow-leaved soap pod (*Acacia pennata)* Woody Climber; Hindi: Agla bel, Biswal; Marathi: shembarati, shembi
Climbing Acacia is a perennial climbing shrub or a small tree. The stem is thorny. In India, leaf juice mixed with milk is used for treatment of indigestion in infants. Some people use boiled tender leaves for cholera treatment, digestive complaints, relief of headache, body pain, snake bites, and even to cure fish poisoning.
The climber was recorded only in V5 sub sector.

Siris tree, Woman's tongue, (*Albizzia lebbeck)* Tree; Hindi: Saras
It is a medium to large tree with gray-brown bark. Flowers are mimosa-like, in showy, rounded clusters near stem tips.
During the study the tree was observed in U3, V1, V2 and V4 sub sectors.

Wild tamarind, White Babool, Leucaena, Lead tree (*Leucaena leucocephala)* Tree; Hindi: Safed babool
It is a low scrubby tree of tropical and subtropical North America having white flowers tinged with yellow resembling mimosa and long flattened pods. Leaves are like that of tamarind.Very fast grower. Grows in practically any soil type.
During the study the tree was observed in U1, U2, U3, V1, V4 and V5 sub sectors.

Sensitive Plant, Touch-me-not (*Mimosa pudica)* herb; Hindi: Chui-mui; Marathi: Lajalu
Native to Brazil, this short lived evergreen sub shrub is usually treated as an annual. It is grown for its curiosity value- the fern like leaves close up and droop when touched, usually re-opening within minutes. It has prickly stems and small, fluffy, ball shaped pink flowers in summer.
During the study the herb was observed in U2, U3 and V1 sub sectors.

Badminton Ball Tree, African locust tree, Gong-Stick Tree (*Parkia biglandulosa)* Tree; Hindi:Chendul-Ka-jhar;Marathi:Chenduphu l
African locust tree is a tall handsome tree, native of W. Africa. Large trees are frequently found in old Mahomedan gardens about the city of Hyderabad, Golconda and elsewhere. The farinaceous pulp which surrounds the seeds is edible and so also are the seeds, which taste like garlic. For most part of the year, this tree is very easily confused with Delonix or Jacaranda species. It is only during December-January, appearance of tennis-ball shaped fluffy flower heads makes one realise that this tree has to be Parkia! In the winter season, 1½ - 2 ft branches, hanging from the leaf axil, bear rust coloured bead-like flower heads, which gradually gain size of a tennis ball - and the "flowers" bloom to spectacular white electric bulbs! The flowers in round white heads are prominent, hence the native name 'Chendul', or ball.
The tree was exclusive to the U1 sub sector.

Manilla Tamarind, Madras Thorn, Sweet tamarind (*Pithecolobium dulce)* Tree; Hindi: Jangal Jalebi; Marathi: Vilayatichinch
It is a large, nearly evergreen tree. Pods are irregular in shape and flattened, set in spirals of 1 to 3 whorls and strangled between the seeds - looks like the north Indian sweet, *Jalebi*, hence its common Hindi name.
The tree was observed in the entire campus except V3 sub sector.

Rain Tree, Coco tamarind, Acacia preta, French tamarind, Saman, Monkey pod (*Samanea saman)* Tree; Hindi: Gulabi Siris, Vilaiti siris
Large, handsome and spreading, the Rain Tree is easily recognised by its umbrella like canopy of

evergreen, feathery foliage and puffs of pink flowers. It is frequently planted in groups or as an avenue because of its ability to keep its symmetrical conformation in spite of prevailing winds. It is a tree of rapid growth, brought originally from Central America to Sri Lanka and forwarded from there because it was considered to be a tree of great value for railway fuel.
The tree was observed in the entire campus.

Moraceae – the mulberry family (Plate 18)

This is family with about 40 genera and some 1,000 species of deciduous or evergreen trees and shrubs, distributed mostly in tropical and subtropical regions. Plants of the family contain a milky latex and have alternate or opposite leaves and small, petal-less male or female flowers. The fruits of many species are multiple because fruits from different flowers become joined together. 14 species (13 trees, one climber) belonging to 3 genera from this family were recorded in IIT campus.

Indian Rock Fig, rock pipal, waved-leaved fig tree, wild papal (*Ficus arnotiana)* Tree; Hindi: bassari, palhi, paras pipal, pilkhan; Marathi: payar, kadak payer, pipli
Indian Rock Fig is a tree which is commonly mistaken for Peepal (Ficus religiosa). Leaves are typical peepal like, but with wavy margins. One of the common ways of recognizing Ficus arrnottiana from Ficus religiosa is to examine the color of the leaf-stalk and the veins which are bright Pink to red in colour.
The tree was recorded only in the U3 sub sector.

Banyan tree (*Ficus bengalensis)* Tree; Hindi: Barh
Barh or Banyan, a remarkable tree of India and tropical Africa sends down from its branches great numbers of shoots, which take root and become new trunks. A single tree thus may spread over a large area and look like a small forest. This tree is considered to be sacred in some places in India. Various parts of this plant are considered medicinal. The bark of this therapeutically valuable tree is attributed with tonic, astringent, cooling and diuretic properties in Ayurveda. A postal stamp was issued by the Indian Postal Department to commemorate this tree.
During the study the tree was observed in U1, U2, U3 and V5 sub sectors.

Anjeer, Common Fig (*Ficus carica)* Tree; Hindi: Anjeer; Marathi: Anjeer
Anjeer is a beautiful small tree with a interesting spreading habit. The species name carica means having papaya-like leaves. The edible fruit is called anjeer is widely grown throughout its natural range Iran and also in the rest of the Mediterranean region and other areas of the world. Originally from the Persian region, common fig has been cultivated by humans for over 5000 years.
The tree was recorded only in the U1 sub sector.

Rubber Tree, Rubber Plant, India Rubber Tree, Indian Rubber Bush (*Ficus elastica)* Tree; Marathi: Rabracho-vad
Rubber Tree is a beautiful tree native to NE India, the eastern Himalayas, and SE Asia. Rubber Tree is popular because it is very easy to grow and care for. This is a popular house-plant, and grows in all Indian conditions. The tree can yield milky white latex, which has been used to make rubber.
During the study the tree was observed in the urbanized sector.

Dye Fig, Humped Fig (*Ficus gibbosa)* Tree; Marathi: Datir
Dye Fig is a climbing strangler, forming a tree with prop-roots. The fruits of dye fig are the source of a red dye used in traditional fabric making in parts of Indonesia.
The tree was recorded only in the U2 sub sector.

Cluster fig (*Ficus glomerata)* Tree; Hindi: Goolar; Marathi: Umber
Goolar is an attractive fig tree with a crooked trunk and a spreading crown. Unlike the banyan, it has no aerial roots. Goolar is a tree commonly found in cities and towns. It has evergreen leaves, if it is close to a water source. Otherwise it sheds its leaves in January. Figs have been traditionally used by children to play. Thin sticks can be joined by inserting them in goolar figs to make interesting shapes.
During the study, the tree was recorded in the entire campus except V2.

Hairy Fig, devil fig, opposite-leaved fig-tree, rough-leaved fig (*Ficus hispida)* Tree; Hindi: gobla, kagsha, kala umbar, katgularia, phalgu; Marathi: bokeda, bokhada, bokheda, dhed umbar, kala umbar, karavati
During the study, the tree was recorded in the entire campus.

Mysore Fig, Brown woolly fig (*Ficus mysorensis)* Tree; Marathi: Burali-Wad
The tree was recorded only in the U1 & U2 sub sectors.

Peepal, Bo tree, bodhi tree, holy tree, scared fig (*Ficus religiosa)* Tree; Hindi:papal; Marathi: pimpal
Peepal is unrivalled for its antiquity and religious significance. No other tree is claimed to have such long life - one in Sri Lanka, said to have been planted in the year 288 B.C., still lives and flourishes. The Prince Siddhartha is known to have sat in meditation under a Bodhi tree and there found enlightenment from which time he became known as the Buddha. So, from then on the tree was sacred to Buddhists. Hindus associate the tree with the three gods Brahma, Vishnu and Shiva, Vishnu being reputed to have been born under a Peepul, which is therefore Vishnu himself in the form of a tree. A grand peepal tree is a perfect shade tree, and village meetings are often conducted under a peepal tree.
The tree was recorded in the U1, U2, U3 and V1 sub sectors.

Indian ivy *Ficus repens* Climber
Ficus repens is the most popular and widely grown plant for covering bare walls or pedestrals. No support is needed as the roots from the node grip the walls.
During the study the climber was observed in urbanized sector U1 other than the quadrat.

White Fig (*Ficus virens)* Tree; Hindi: Pilkhan, Pakhad; Marathi: Bassari, Gandhaumbara
White Fig is a large strangling fig with a spreading canopy. The aerial roots commonly wrap around the main stem instead of forming props. The pea-sized figs are in pairs and greenish-white to brown with spots. It is a beautiful shade tree. Leaves begin to drop mid February. New leafs emerge in March with colors of purple and red and bronze, giving the tree a wonderful look.
The tree was recorded only in the U3 sub sector.

***Ficus sp* Tree Nandruk**
The tree was recorded only in the U1 sub sector.

White Mulberry, Russian Mulberry, Silkworm Mulberry (*Morus alba)* Tree; Hindi: Shahtoot
A beautiful large leaved, naturally well shaped tree, offers dense shade. Berries are mildly sweet, reminiscent of watermelon. The mulberry tree is used to feed silkworms. Birds love the berries.
The tree was recorded in the U1, U2, V1 and V4 sub sectors.

Sand Paper Tree, Siamese rough bush, Toothbrush tree (*Streblus asper)* Tree; Hindi: Daheya, Dahia, Karchanna, Rusa, Sahora, Sihora; Marathi: poi, karera, kharoli, kharota.
True to its name, the leaves of Sand Paper tree are rough and are utilized for cleaning cooking utensils and as a substitute for sandpaper.
During the study, the tree was observed in the entire campus.

Moringaceae – the horseradish tree family (Plate 18)

These are woody, often quite stout-stemmed shrubs or trees. Foliage of Moringaceae often smells unpleasant when crushed. One species belonging to 1 genus from this family was recoded in IIT campus.

Drumstick tree, Horseradish tree (*Moringa oleifera)* Tree; Hindi: Senjana; Marathi: Shevga
Drumstick tree is a small, deciduous tree, native to tropical Asia but also naturalized in Africa and tropical America. Seed pods are used as a vegetable, especially in south Indian cuisine. Oil is derived from the seeds, which is used for cooking and lubrication. The leaves are extensively used as vegetable in many parts of the world.
During the study, the tree was observed in U1, U2, U3, V4 ans V5 sub sectors.

Musaceae – banana family (Plate 18)

Musaceae includes about 6 genera and about 150 species. The members of this family are widely distributed over tropical regions of the world. In India it is represented by 2 genera and about 25 species. These are mostly perennial herbs attaining considerable height, perennating by means of rhizome, rarely trees and Watery sap is present. One species (herb) belonging to 1 genus from this family was recoded in IIT campus.

Banana (*Musa paradisiacal)* herb; Hindi: Kela
Banana is a tropical tree-like herb, with large leaves of which the overlapping bases form the so-called false trunk. In India, almost every part of the banana plant is used, either for food, or for wrapping food. The unripe fruit of banana, rich in starch, is commonly dried and fried as chips in India. The banana stem is also eaten after cooking. The ripe fruit is commonly eaten.
During the study, the herb was observed in urbanized sector other than quadrats.

Myrtaceae – myrtle family (Plate 17)

It contains about 150 genera and 3,300 species that are widely distributed in the tropics. They have rather leathery evergreen leaves with oil glands. Some members of economic importance are the *Eucalyptus*, guava, rose apple, Surinam cherry, and feijoa. Allspice, clove, and oil of bay rum are spices derived from plants of this family. Five species (all trees) belonging to 4 genera from this family were recoded in IIT campus.

Eucalyptus (*Eucalyptus globules)* Tree; Hindi: Safeda
Eucalyptus is a diverse genus of trees, the members of which dominate the tree flora of Australia. All eucalypts are evergreen, although some species have deciduous bark. Eucalyptus oil is highly flammable and bush fires can travel easily through the oil-rich air of the tree crowns. Eucalyptus oil has medicinal properties - the well known Vicks vapo-rub is made out of eucalyptus oil.
During the study, the tree was recorded in urbanized sector.

Broad-leaved paper bark, Paper Bark Tea Tree (*Melaleuca quinquenervia)* Tree
It is a small to medium sized tree. The plant is native to New Caledonia, Papua New Guinea and coastal Eastern Australia, from Botany Bay in New South Wales northwards, into Queensland and the Northern Territory. It has become naturalised in the Everglades in Florida where it is considered a serious weed.
During the study, the tree was recorded in urbanized sub sector U1.

Guava (*Psidium guyava)* Tree; Hindi: Amrood
One of the most gregarious of fruit trees, the guava of the Bottlebrush family, is almost universally known by its common English name or its equivalent in other languages. During the study, the tree was recorded in urbanized sector.

Java plum, Jamun (*Syzygium cumini)* Tree; Hindi: Jamun
The evergreen jamun plant is originally from Indonesia and India. Indian mythology describes the Indian subcontinent as an island, 'situated in the centre of the world', and called Jambudweep. Because of a majority of Jamun (black berry) trees, this island was named as Jambudweep. The leaves are antibacterial, and are used for strengthning the teeth and gums. The fruit and seeds are sweet, acrid, sour, tonic, and cooling, and are used in diabities, diarrhoea and ringworm. The bark is astringent, sweet sour, diuretic, digestive and anthelmintic.
During the study the tree was recorded in the entire campus except U1.

Syzygium jambosa Tree
During the study, the tree was recorded in urbanized sub sectors U2 & U3.

Nyctaginaceae – Four o'clock family(Plate 19)

This family consists of herbs, shrubs and trees. Herbs like Punarnava (*Boerhaavia*) and shrubs and climbers like Gulbaxi and *Bougainvillea* belong to this family. Four species (1 tree; 1 shrub; 1 herb and 1

woody climber) belonging to 4 genera from this family were recorded in IIT campus.

Red hogweed, Tar Vine, Red Spiderling, Wineflower (*Boerhavia diffusa)* herb; Hindi: Punarnava, Satha
Red Spiderling is a prostrate herb with very diffuse inflorescences. It is a weed found throughout India. Tender young leaves and shoots are cooked and used as a vegetable. This herb is popular in Ayurveda, known for its anti-inflammatory and analgesic properties.
During the study, the tree was recorded in U1, U3, V3, V4 and V5 sub sectors.

Great Bougainvillea (*Bougainvillea spectabilis)* Woody Climber; Hindi: Booganbel; Marathi: Booganvel
Named after Louis de Bougainvillea, a French navigator who came across it in Brazil during the 18th century, Bougainvillea has gained popularity all over the world, due to its versatility, richness and suitability to thrive in degrading environmental conditions. Great Bougainvillea is a spectacular species of Bougainvillea. It is a woody perennial vine, with stout spines.
During the study, the tree was recorded in U1, V1 and V4 sub sectors.

Four O'clock, Beauty-of-the-night, Marvel of Peru (*Mirabilis jalapa)* Shrub; Hindi: Gul abbas, Gulbakshi; Marathi: Gulabas or Gulabaas, saayankaale
Four o'clock flowers are trumpet shaped. They open in the evening and wilt the next morning. Four o'clocks plants are leafy, shrublike, multi-branched perennials which bloom throughout summer and are introduced in India.
During the study the climber was observed in urbanized sector U3 other than the quadrat.

Cabbage Tree, Hawaiian Papala Kepau, Lettuce Tree (*Pisonia alba)* Tree
Pisonia is a genus of flowering plants in the four o'clock flower family, Nyctaginaceae. Certain species in this genus are known as Catchbirdtrees because their sticky seeds reportedly trap small birds.
During the study, the tree was recorded in U1 & U3 sub sector.

Oleaceae – Jasmine family (Plate 19)

Also called Olive family, this is a mixed group of shrubs, woody climbers and trees. Among this group, Jasmine species are most prominent, known for their sweet fragrance. Several varieties are cultivated commercially on large scale and popular as garden ornamentals. Two species belonging to 2 genera from this family were recorded in IIT campus.

***Jasminum indicum* shrub**
During the study, the shrub was recorded in U2 sub sector.

Har singar, Coral Jasmine, Tree of Sorrow, Queen of the night (*Nyctanthes arbor-tristis)* Tree; Hindi: Har singar, Shefali, Paarijat
Nyctanthes arbortristis literally means night-blooming sad tree which grows as large shrub or small tree. The sweet scented flowers are small, attractive with white petals and an orange-red tube in center and bloom profusely, opening at night and drop off in the morning, thus making a carpet of flowers in the morning. Used for worship.
During the study, the tree was recorded in urbanized sector.

Onagraceae – evening primrose family(Plate 19)

It is comprised 21 genera concentrated in the temperate region of the New World. The family is characterized by flowers with parts mostly on the plan of four (four sepals, four petals, four or eight stamens), but there are some exceptions. One species (shrub) belonging to 1 genus from this family was recorded in IIT campus.

Kabokhaji (*Jussiaea suffruticosa)* Shrub
During the study, the shrub was recorded in U1, U3, V1, V2 and V5 sub sector.

Orchidaceae – Orchid family

This is the second largest group of perennial flowering plants that grow on land and on trees. The tree dwellers are non-parasitic (epiphyte) and have aerial roots that absorb moisture and nutrients. One species (epiphyte) belonging to 1 genus from this family was recorded in IIT campus.

***Unid* Epiphyte**

During the study the epiphyte was observed in the entire campus in other than the quadrat.

Orobanchaceae – Broomrape family (Plate 19)

It is a group of parasitic plants that lack green leaves but instead have coloured, fleshy, scale-like leaves. One species (herb) belonging to 1 genus from this family was recorded in IIT campus.

Forest Ghost Flower; (*Aeginetia indica)* herb; Hindi: Aankuri bankuri

Native to India, Forest Ghost Flower is a gregarious root parasite seen on shaded forest floor during monsoon. Leafless flowers are in one group. Flowers look like rose-buds in brownish holders, which, literally is what the Marathi name, *Gulabdani* means. Occurs on forest floor covered with decayed leaves.
During the study the herb was recorded in the V2 sub sector.

Oxalidaceae - Wood-Sorrel family (Plate 19)

A small group of annuals as well as perennial herbs that usually go unnoticed in untended gardens and backyards. *Oxalis* is derived from Greek oxys (acid), referring to the presence of oxalic acid. Three species (2 trees and one herb) belonging to 2 genera from this family were recorded in IIT campus.

Bilimbi, Cucumber-Tree (*Averrhoa bilimbi)* Tree; Hindi: Bilimbi; Marathi: Bilambi

The bilimbi tree is long-lived. The bilimbi fruit's form ranges from ellipsoid to almost cylindrical. If unripe, it is bright green and crispy. It turns yellowish as it ripens. The flesh is juicy, green and extremely acidic. The fruit's skin is glossy and very thin. The bilimbi is too acid for eating raw but the green uncooked fruits are prepared as a relish in Suriname. Originated seemingly from the Moluccas, in India, where it is usually found in gardens, the bilimbi has gone wild in the warmest regions of the country. In Malaysia the leaves of bilimbi are used as a treatment for venereal disease. A leaf decoction is taken as a medicine to relieve rectal inflammation. It seems to be effective against coughs.
During the study the tree was recorded in U1 & U2 sub sectors.

Carambola, Star fruit (*Averrhoa carambola)* Tree; Hindi: Karmal

A slow growing small tropical tree, originally from Southeast Asia (Indonesia). The tree flowers and bears fruit almost year-round. When the fruit is sliced in cross section a perfect star is formed. Carambola is eaten fresh or in fruit salads. The carambola tree seems to be used for bonsai.
The tree was exclusive to the V4 sub sector during the study.

Creeping Wood Sorrel, Creeping Oxalis (*Oxalis corniculata)* Herb; Hindi: Amrul

Creeping wood sorrel is a world-wide weed which is almost impossible to get rid of. So, one might as well enjoy it - it has beautiful yellow flowers. Creeping woodsorrel is of uncertain origin just because it became so wide spread so long ago.
During the study, the herb was observed in urbanized sector other than quadrats.

Pandanaceae – (Plate 19)

The four genera of the family Pandanaceae—Pandanus (screw pine), Freycinetia, Sararanga, and Martellidendron are distributed in coastal or marshy areas in the tropics and subtropics. One species (shrub) belonging to 1 genus from this family was recorded in IIT campus.

Kewda, Fragrant Screw Pine, Umbrella tree, Screw pine, Screw tree (*Pandanus odorifer)* Shrub; Hindi: gagan-dhul, jambala, keora, ketaki, kevara; Marathi: kegad, ketaki, kevada

Fragrant Screw Pine is a small branched tree or shrub with fragrant flowers, found wild in southern India, Burma and the Andamans. It is a small, slender, branching tree with a flexuous trunk supported by brace

roots. With rosettes of long-pointed, stiffly leathery, spiny, bluish-green, fragrant leaves, it bears in summer very fragrant flowers. It is used as perfume. Male flowers are almost exclusively used in the form of a watery distillate called kewra water.
During the study, the shrub was observed in urbanized sub sector U1 other than quadrats.

Papaveraceae – Poppy family (Plate 19)

This family has plants that are ready colonizers of vacant land. The best example is the Mexican poppy, a native of Central America that has spread throughout the warm countries of the world. This group has both annuals as well as herbaceous perennials, some of them are poisonous. The Opium poppy is used in making pain killing medicines as well as narcotic drugs. One species (herb) belonging to 1 genus from this family was recorded in IIT campus.

Mexcian prickly poppy (*Argemone mexicana)* Herb; Hindi: Satyanashi; Marathi: Firangi dhotra
It is a prickly, glabrous, branching herb with yellow juice and showy yellow flowers, In India it is introduced and naturalised and occur as wasteland weed in almost every part of India. In many parts it is reported as crop weed also. The plant is toxic to animals and cattle avoid grazing this plant.
The herb was observed in the U3 sub sector.

Passifloraceae – Passion flower climber (Plate 19)

A group of vines with tendrils to climb like Krishna kamal *Passiflora edulis* and *Passiflora foetida* that are native to tropical South America, and have now totally naturalized in Asia and Africa**.** One species (climber) belonging to 1 genus from this family was recorded in IIT campus.

Passiflora foetida Creeper
During the study, the creeper was observed in vegetated sub sector V5 other than quadrats.

Pedaliaceae – Sesame family (Plate 19)

A small family of herbs and small shrubs, with sticky sap and tubular bell-shaped flowers. It includes the economically important oil crop sesame or til. One species (herb) belonging to 1 genus from this family was recorded in IIT campus.

Sesame (*Sesamum orientale)* herb; Hindi: Safed til
This is a small bush found in India. There are three varieties; black, white, red (or brown) White has most oil, black is best for healing. There are several variants and the flower differs in color from one variety to the other. The herb is cultivated extensively in many regions of the world. From their seeds an oil is expressed, called benne oil, used mostly for making soap. In the southern United States the seeds are used in candy.
During the study the herb was recorded U3, V3 and V4 sub sectors.

Periplocaceae (Plate 19)

There are about 40 genera and almost 200 species all over the world. These are distributed in the tropics and the warm temperate region of the old world. In India this family is represented by 12 genera, 19 species and one variety, of which 4 genera are endemic to India. One species (climber) belonging to 1 genus from this family was recorded in IIT campus.

Indian Sarsaparilla (*Hemidesmus indicus)* Climber; Hindi: Anantamul, Dudhli; Marathi: Anant vel
Indian Sarsaparilla is a vine, which trails on the ground and climbs by means of tendrils. It is one of the Rasayana plants of Ayurveda, as it is anabolic in its effect. It is used for skin diseases, arthritis, rheumatism, gout, epilepsy, insanity, chronic nervous diseases, abdominal distention, intestinal gas, debility, impotence and turbid urine.
During the study the climber was observed in the entire campus except V1.

Piperaceae – the pepper family (Plate 19)

This is a commercially important family because of *Piper nigrum,* the source of black and white pepper. The family comprises about 5 genera, of which 2—*Piper* (about 2,000 species) and *Peperomia* (about

1,600 species) are the most important. The plants grow as herbs, vines, shrubs, and trees and are widely distributed throughout the tropics and subtropics. Two species (one herb and one shrub) belonging to 2 genera from this family were recoded in IIT campus.

Shiny Bush, Slate pencil plant, pepper elder, rat's ear, shiny bush, silverbush (*Peperomia pellucida)* herb
Shiny bush is a common fleshy annual herb, growing by roadside and in wasteland. Shiny bush has mustard like odor.The plant can be utilized as vegetable and in salads. Shiny Bush is native to South America, but widely naturalized and cultivated.
During the study the herb was observed in U3 & V5 sub sectors.

Long Pepper, Indian long pepper (*Piper longum);* Climber Hindi: Pipli; Marathi: Pimpli
Long Pepper is a climber, of South Asian origin (Deccan peninsula), cultivated for its fruit, which is usually dried and used as a spice and seasoning. Pippali is certainly one of the most widely used of all Ayurvedic herbs. It is one of the best herbs for enhancing digestion, assimilation and metabolism of the foods we eat.
The climber was recorded in the V1 sub sector.

Plumbaginaceae – Sea Lavender family (Plate 19)

This group has herbs, shrubs and climbers that are well adapted to grow in coastal areas. The name is derived from Latin Plambul (lead). One species (herb) belonging to 1 genus from this family was recoded in IIT campus.

Chitrak, Plumbago, White leadwort (*Plumbago zeylanica)* Herb; Hindi: Chitrak
Chitrak is a herb that grows wild in India and has been used by rural and tribal people for hundreds of years as a traditional system of medicine. Chitrak is native to SE Asia. During the study, the herb was observed in urbanised sub sector U1 other than quadrats.

Poaceae – (Plate 20)

These are the world's single most important source of food. They rank among the top five families of flowering plants in terms of the number of species, but they are clearly the most abundant and important family of the Earth's flora. They grow on all continents, in desert to freshwater and marine habitats, and at all but the highest elevations. Plant communities dominated by grasses account for about 24 percent of the Earth's vegetation. 16 species (16 grasses) belonging to 15 genera from this family were recoded in IIT campus, the number excludes 2 unidentified grasses.

Aploch-monas Grass
This grass was recorded in the entire campus except V3 sub sector.

Apluda mutica Grass
This grass was recorded in U2, U3, V3, V4 and V5 sub sectors.

Brachiaria sp. Grass
During the study, this grass was recorded only in V1 sub sector.

Chloris sp. Grass
During the study, this grass was recorded in U1, U3 and V5 sub sector.

Job's Tears (*Coix lacryma-jobi)* Grass; Hindi: Samkru, Gurlu; Marathi: Ran-maka, Kasai
Job's tears is a coarse annual herb. The root is used in India for menstrual disorders. In Liberia the juice from the stem is squeezed into the eye to relieve irritation due to injury. During the study, this grass was recorded in U2, V2 sub sector.

Dhub grass, Bermuda grass, Bahama grass, Durva (*Cynodon dactylon)* Grass
It is a hardy perrenial grass with creeping culms. Decoction of plant is diuretic.

During the study, this grass was recorded in U1, U2, U3, V3, V4 ans V5 sub sectors.

Calcutta Bamboo, hard bamboo, iron bamboo, male bamboo, solid bamboo, stone bamboo (*Dendrocalamus strictus)* Grass; Hindi: bans; Marathi: bans, udha, velu
Calcutta Bamboo is a deciduous densely tufted. The most peculiar aspect of the plant is the solid culm as there is no hollow part in it.
During the study, this grass was recorded in U2, V1, V3 and V4 sub sectors.

Dichanthium assimile Grass
Dichanthium assimile a perennial grass.
During the study, this grass was recorded in V3& V4 sub sectors.

Eleusine indica Grass
This grass was recorded in the entire campus except U2 sub sector.

Eragrostis unioloides Grass
During the study, this grass was recorded in U1, U3, V1 and V3 sub sectors.

Indian muraina grass (***Ischaemum indicum)*** Grass
During the study, this grass was recorded in U1, U2, V1, V3 and V5 sub sectors.

Paspalidium sp. Grass
During the study, this grass was recorded in U3 sub sector.

Pennisetum pedicilatum Grass
During the study, the grass was observed in vegetated sub sector V1 other than quadrats.

Pennisetum typhoides Grass
During the study, the grass was observed in urbanised sub sector U1 other than quadrats.

Pseudanthistiria sp. Grass
During the study, the grass was observed in vegetated sub sector V3 other than quadrats.

Themeda cymbaria Grass
During the study, this grass was recorded in U1, U3, V3 and V4 sub sectors.

Polygonaceae – Buckwheat family (Plate 20)

This is a mixed group of herbs and shrubs. Family name is derived from Greek poly (many) and gony (a knee) referring to the jointed stems. One species (herb) belonging to 1 genus from this family was recorded in IIT campus.

Denseflower Knotweed, Common marsh buckwheat (*Persicaria glabra)* herb; Marathi: Sheral
Denseflower Knotweed is an annual or perennial herb with red, ascending, swollen stems, often rooting at the nodes.
During the study the herb was recorded in U1, V4 sub sectors.

Pontederiaceae – Water Hyacinth family (Plate 20)

This group is also known as Pickerel Weed family. Best known among this family is the water hyacinth which is one of the most troublesome plants, clogging waterways and other water bodies. One species (herb) belonging to 1 genus from this family was recorded in IIT campus.

Water hysinth *Echorrnia crassipes* Herb
This freshwater plant is creating a problem in major parts of the world.
The herb was recorded in U1, U2, U3, V1 and V2 sectors other than quadrat.

Portulacaceae – Purselane family (Plate 20)

These are succulent, sun-loving, low growing herbs. Short lived flowers remain open during hottest part of the day. One species (herb) belonging to 1 genus from this family was recorded in IIT campus.

Purslane (*Portulaca oleracea)* herb; Hindi: Lunia

This common 'weed' is native to India. It can be found growing wild and/or cultivated in much of the world. It existed in the New World before the arrival of Columbus, and was found in Europe by the late 16th century. It can be found growing in almost any unshaded area, including flower beds, corn fields, and waste places. Purslane can be found growing in cold climate areas as well as warm areas. It has been used in salads and as a medicinal plant for hundreds of years Purslane is eaten throughout much of Europe and Asia. It can be eaten fresh or cooked and has no bitter taste at all. Since it has a mucilaginous quality it is great for soups and stews.

During the study the herb was recorded in urbanized sub sector U1.

Proteaceae – (Plate 20)

80 genera and 1,600 species, confined predominantly to the Southern Hemisphere, mostly in Australia, South Africa, and Madagascar. Platanaceae has a single Northern Hemisphere genus Platanus (10 species). Similarly, Nelumbonaceae has just one aquatic genus, Nelumbo (lotus). One species (tree) belonging to 1 genus from this family was recorded in IIT campus.

Silver oak, Silk oak (*Grevillea robusta)* Tree

Reaching a height of 75 feet or more with a 25-foot spread, Silver Oak is pyramidal to oval in shape, eventually developing a few heavy horizontal limbs and a thick trunk. It is a fast growing evergreen tree.

During the study the tree was recorded in urbanized sub sectors U2 & U3.

Punicaceae – (Plate 20)

Fruit of *Punica granatum*, a bush or small tree of Asia, which with a little-known species from the island of Socotra constitutes the family Punicaceae. The plant, which may attain 5 or 7 metres (16 or 23 feet) in height, has elliptic to lance-shaped, bright-green leaves about 75 millimetres (3 inches) long and handsome axillary orange-red flowers borne toward the ends of the branchlets. One species (tree) belonging to 1 genus from this family was recorded in IIT campus.

Pomegranate (*Punica granatum)* Tree; Hindi: Anar; Marathi: Dalimb

The pomegranate is a shrub. Pomegranates have beautiful orange-red trumpet shaped flowers with ruffled petals.

During the study the tree was recorded in urbanized sub sector U3.

Ranunculaceae – Buttercup family(Plate 21)

It includes herbs and some climbers. These are mostly perennial and have primitive flowers with many separate parts spirally arranged and divided leaves. One species (climber) belonging to 1 genus from this family was recorded in IIT campus.

Clematis sp **Climber**

During the study the climber was recorded in U1, U3, V3 and V5 sub sectors.

Rhamnaceae – the buckthorn family (Plate 21)

It includes 52 genera and more than 900 species of shrubs and trees, is distributed worldwide, especially in the tropics and warm temperate region. Four species (1 tree; 1 scandant shrub; one shrub and one woody climber) belonging to 2 genera from this family were recoded in IIT campus.

Cat Thorn, Droog-my-Keel (*Scutia indica)* Scandant Shrub; Marathi: Cheemat

Cat Thorn is a large shrub, armed with recurved prickles, growing to 2-3 m tall. Prickles are hooked.

During the study the scandant shrub was recorded in U1, U3, V2 and V4 sub sectors.

Indian jujube, Indian plum (*Zizyphus mauritiana)* Tree; Hindi: Ber
Ber is a small or medium sized subtropical tree, popular for its small berry like fruit. It grows wild in forests. The small fruits are liked by children as well as by adults.
During the study the tree was recorded in the entire campus.

Jhar Beri (*Zizyphus rotundifolia)* Tree; Hindi: Jhar Beri, Jhar ber; Marathi: Chanya-bor, Gangar, Junglebor
Jhar Beri is a bushy, much branched shrub, with zigzag branches. Spines are in unequal pairs, bigger straight, smaller one are recurved. Fruits are edible, although not very popular due to small size.
During the study the tree was recorded in vegetated sub sector V1 other than the quadrat.

Wild Jujube, wrinkled jujube (*Zizyphus rugosa*) Woody Climber; Hindi: Churna, Suran; Marathi: toran, turan
Wild Jujube is a small tree or straggling shrub, armed with stipular spines, solitary or paired with a broad base.
During the study the woody climber was recorded in U1, U3, V1 and V5 sub sectors.

Rubiaceae – Coffee family (Plate 21)
A large group, mainly of shrubs, climbers, trees and some herbs. Some of well known plants are coffee, *Gardenia* and *Exora*. Gardenia is preferred foodplant of the Bee Hawkmoth. Nine species (7 trees, 1 shrub and 1 herb) belonging to 9 genera from this family were recoded in IIT campus.

Brilliant Gardenia, cambi resin tree, white emetic nut (*Gardenia resinifera)* Shrub; Hindi: dekamali; Marathi: dikamali
Brilliant Gardenia is a small, unarmed tree, up to 3 m tall. It exudes gum from the buds. During the study the shrub was recorded in urbanized sub sector U1.

Haldu (*Haldina cordifolia)* Tree; Hindi: Karam, Kadami; Marathi: Haldu, Hedu
Haldu is a deciduous tree. The bark of the tree acts as an antiseptic.
During the study the shrub was recorded in U1, V3, V4 and V5 sub sectors.

Firebush *Hamelia patens* Shrub
Firebush is a showy, fast-growing, semi-woody evergreen shrub. Throughout the year, firebush produces showy terminal clusters (cymes) of bright reddish-orange or scarlet tubular flowers.
During the study the shrub was recorded in urbanized sub sector U1.

Ixora, Jungle geranium (*Ixora coccinea)* Shrub; Hinda: Rugmini
Ixora is said to be native to Asia and whose common name derives from an Indian deity. During the study the shrub was recorded in vegetated sub sector V1, V2 and V4.

Mitragyna parvifolia Tree; Hindi: Kaim, Kadamb; Marathi: Kalam
Kaim is a tree native to India. Mitragyna species are used medicinally as well as for their fine timber throughout the areas they grow.
During the study the tree was recorded in urbanized sub sectors U1& U3.

Indian Mulberry, Morinda tree (*Morinda pubescens)* Tree; Hindi: Aal; Marathi: Aseti, Dhaula
Indian Mulberry is an evergreen small tree. Stem is short and crooked, with rough bark with deep longitudinal cuts. Plant is extensively cultivated in India in order to make the morindone dye. Morindone is used for the dyeing of cotton, silk and wool in shades of red, chocolate or purple. The colouring matter is found principally in the root bark and is collected when the plants reach three to four years of age.
During the studythis tree was present in the entire campus except V2 sub sector..

Kadam (*Neolamarckia cadamba)* Tree; Hindi: Kadamb
In Hindu mythology, Kadam was the favourite tree of Krishna. It is believed to have medicinal value in curing astringent, ulcer, digestive, diarrhoea, expectorant, fever & vomiting. A postal stamp was issued by

the Indian Postal Department to commemorate this tree.
During the study the tree was recorded in U1, U2, U3 and V5 sub sectors.

Diamond Flower, corymbose hedyotis, flat-top mille graines, old world diamond-flower, wild chayroot (*Oldenlandia corymbosa)* herb; Hindi: Daman pappar, pitpapra; Marathi: pitpapda
Diamond Flower is an annual herb with ascending or erect stems which are 4-angled. During the study the tree was recorded in U1, U3 and V3 sub sectors.

Muyna (*Vangueria spinosa)* Tree; Hindi: Muyna, Pundrika; Marathi: Huloo, alu
Muyna is a large common shrub. Riped fruit is eaten raw.
During the study the tree was recorded only in urbanized sub sector U1.

Rutaceae – Citrus family

It is valuable as a source of edible fruit and as ornamentals. The Rutaceae includes woody shrubs and trees (and a few herbaceous perennials) and consists of 160 genera and 1,700 species distributed throughout the world, especially in warm temperate and tropical regions. The largest numbers are found in Africa and Australia, often in semiarid woodlands. Four species (all tree) belonging to 3 genera from this family were recorded in IIT campus.

Bel, Beli fruit, Bengal quince, Stone apple, Wood apple (*Aegel marmelos)* Tree; Hindi: Bel; Marathi: Maredu
Bel is a fruit-bearing tree which is cultivated throughout India, as well as in Sri Lanka, northern Malaya, Java and Philippines. The tree, which is the only species in the genus Aegle, grows up to 15 meters tall and bears thorns and fragrant flowers. The fruit is eaten fresh or dried. The juice is strained and sweetened to make a drink similar to lemonade, and is also used in making Sharbat. It is a sacred tree, dedicated to Lord Shiva. The offering of bael leaves is a compulsory ritual of the worship of Lord Shiva in the hills. This importance seems largely due to its medicinal properties. All parts of this tree, viz., root, leaf, trunk, fruit and seed, are used for curing one human ailment or another.
During the study the tree was recorded in U1, U2, U3 and V3 sub sectors.

Lemon (*Citrus limon)* Tree; Hindi: Nimbu
Lemon is an extremely common fruit in India. The lemon has a white, fragrant flower with five petals.
During the study the tree was recorded urbanized sector.

Citrus pseudolimon Tree
During the study the tree was recorded in urbanized sub sector U2.

Curry Leaf (*Murraya koenigii)* Tree; Hindi: Kari patta; Marathi: Kudianim
Curry Leaf tree is a small or medium sized tree, most famous for its aromatic leaves that provide curry spice. Curry leaves are extensively used in Southern India and Sri Lanka. Leaves are digestive, tonic, stimulant, rich in vitamin A and calcium. Leaves are also used for diarrhoea, dysentry and checking vomitting. Bark-paste is antisceptic, applied to skin eruptions. Root extract is taken for relief from renal pain.
During the study the tree was recorded in U1, U2, U3 and V5 sub sectors.

Sapindaceae – the soapberry family (Plate 21)
This is a family with about 135 genera and some 1,600 species, occurs mainly in the tropical areas of the world and is especially abundant in the American tropics. Species range from trees and shrubs to lianas or herbaceous vines. The family is found throughout the wetter tropics and subtropics. Two species (2 trees) belonging to 2 genera from this family were recorded in IIT campus.

Fern Tree, fern leaf tree, soapberry (*Filicium decipiens)* Tree
Fern Tree is a medium-sized tree, native to the Western Ghats.
During the study the tree was recorded in urbanized sub sector U3.

South India Soapnut, three-leaf soapberry, trijugate-leaved sop-nut (*Sapindus trifoliatus)* Tree; Hindi: phenil, risht, rishtak; Marathi: phenil, rinthi, ritha
South India Soapnut is a large tree. Seed is what is popular as a traditional washing soap. During the study the tree was recorded in urbanized sub sector U1 & U2.

Sapotaceae – (Plate 21)
It is a largely tropical family of evergreen trees and shrubs. There are 53 genera and about 1,100 species in the family. Four species (4 trees) belonging to 3 genera from this family were recorded in IIT campus.

Indian Butter Tree (*Madhuca indica)* Tree; Hindi; Marathi: Mahua
Mahua is one of the most important of Indian forest trees, because of its delicious and nutritive flowers. It is large and deciduous with a thick, grey bark, vertically cracked and wrinkled. It is a tree of abundant growth and, to the people of Central India; it provides their most important article of food as the flowers can be stored almost indefinitely.
During the study the tree was recorded in urbanized sub sector U3.

Ceylon Iron Wood, milk tree, wedge-leaved ape flower *(Manilkara hexandra)* Tree; Hindi: drirh, khirni, kshiri, rayan; Marathi: karani, khirni, rajana, ranjana, rayan, rayani
Ceylon Iron Wood is a tree or a shrub with gray bark and smooth branchlets. Alternately arranged leaves are often closely clustered towards the end of branchlets, with conspicuous scars.
During the study the tree was recorded in U3 & V1 sub sectors.

Chikoo, Sapodilla plum, Chico sapote, Noseberry (*Manilkara zapota)* Tree; Hindi: Chikoo; Marathi: chiku
Chikoo is a fairly slow-growing, long-lived tree, upright and elegant, distinctly pyramidal when young. It is strong and wind-resistant, rich in white, gummy latex.
During the study the tree was recorded in urbanized sector.

Spanish cherry (*Mimusops elangi)* Tree; Hindi: Maulsari; Marathi: Bakuli
Spanish cherry is a lovely green small tree of the Indian subcontinent. In the morning the flowers spread their fragrance to their surroundings, fall to the ground in the evening hours. People love to collect them as they retain their odour for many days after they fall. They are offered in temples and shrines throughout the country. It appears in Indian mythology as *Vakula.*
During the study the tree was recorded in urbanized sub sector U1& U2.

Scrophulariaceae – Figwort family (Plate 22)
A group having a strange mixture of aquatic and marsh herbs, like the *Bacopa* and *Limnophila* and root parasites like the purple witch (*Striga* sp.), while some like the dainty *Sophubia* are partial parasites. Four species (all herbs) belonging to 4 genera from this family were recorded in IIT campus.

Bonnaya oppositifolia herb
During the study the herb was recorded in U1, U2, U3, V1, V4 and V5 sub sectors.

Lindernia antipoda herb
Sparrow false pimpernel
During the study the herb was recorded in vegetated sub sector V2 other than the quadrat.

Sweet Broom Weed, Sweet Broom Wort (*Scoparia dulcis)* herb; Hindi: Mithi patti, Ghoda tulsi
Sweet Broom Weed is a branched herb with wiry stems. It is traditionally used in treatment of diabetes, dysentery, earache, fever, headaches, jaundice, snake bite, stomach problems, toothache, and warts.
During the study the herb was observed in the entire campus except V2 sub sector.

Common Sopubia (*Sopubia delphinifolia)* herb; Marathi: Dudhali
Common Sopubia is widely found root-parasite herbage in India. Its juice is reported to possess healing properties for sores caused by moisture and is also reported to be an abortifacient. Erect herb, stem grooved,

branched, spotted with purple. As the name delphinifolia suggests, its leaves are like those of Delphihiums. Rosy white trumpet shaped flowers with long necks, appear along the stem. It is common in moist grasslands. It is distributed in Western Peninsular India, Sri Lanka and Shimoga.
During the study the herb was recorded in U1 & V3 sub sectors.

Smilacaceae – the greenbrier family(Plate 22)

It includes 315 species in two genera (*Smilax* and *Heterosmilax*), is the second largest family in the order. These herbaceous or woody climbers are found around the world. One species (climber) belonging to 1 genus from this family was recorded in IIT campus.

Kumarika (*Smilax zeylanica)* Climber; Hindi: Kumarika, Jangli aushbah, Bhitura; Marathi: Ghotvel
Kumarika is an armed or unarmed climber. It is found from the Himalayan region in the north to Peninsular India. The roots of Kumarika are used for veneral diseases. Also applied in rheumatic swellings and given in urinary complaints and dysentery.
During the study the climber was recorded in vegetated sub sectors V1, V2 and V4.

Solanaceae – Potato family (Plate 22)

It is a large family with 90 genera, and 2000 species including 60 from India. It includes mostly herbs, rarely shrubs and trees. Five species (3 shrubs and 2 herbs) belonging to 3 genera from this family were recorded in IIT campus.

Capsicum, Sweet Pepper, Chilli Pepper, Cayenne Pepper, Paprika (*Capsicum annum)* Shrub; Hindi: Shimla mirch, Marathi: Simla mirchi
Capsicum is a popular species cultivated world wide. Despite being a single species, the capsicum annum has many forms, with a variety of names, even in the same language. In American English it is commonly known as the chili pepper, although not all varieties would be recognised by most speakers under this name. In British English, they are all called peppers, whereas in Australian and Indian English there is no commonly-used name encompassing all its forms, the name capsicum being commonly used for bell peppers exclusively.
During the study the shrub was recorded in urbanized sub sector U1.

Ground Cherry, Sunberry (*Physalis minima)* herb; Hindi: Rasbhari, Ban Tipariya, Chirpati; Marathi: Chirboti, Nanvachivel, Ran-popti
This is a popular wild fruits to pick and eat. The taste of the ripe berry is sweet and distinctive.
During the study the herb was recorded in U1 & V4 sub sectors.

Nightshade (*Solanum indicum)* Herb; Hindi: Barhati, Barhatta
A much branched shrub. In Manipur, a paste of Indian nightshade fruit with honey is administered as a medicine for high fever.
During the study the herb was recorded in urbanized sub sector U2 other than the quadrat.

Black nightshade, Black-berry night shade, Nightshade, Poisonberry (*Solanum nigrum)* Shrub; Hindi: Mokoi; Marathi: Laghukavali
Black nightshade is an annual weed. Black nightshade is used for skin diseases, rheumatism, and gout. It can cure ear, and eye diseases.
During the study the shrub was recorded in U1, U2, U3, V2 and V5 sub sectors.

Turkey Berry, susumber *(Solanum torvum)* Shrub; Hindi: Bhurat, Bhankatiya; Marathi: Marang
Turkey berry is a broadleaved, evergreen, shrub or small tree. The stems are armed with stout, straight or lightly curved prickles. Turkey berry is found throughout the world's tropical regions.
During the study the shrub was recorded in U1, U2, V1, V2 and V3 sub sectors.

Sterculiaceae – Sterculia family (Plate 22)

This family has mainly shrubs, trees and very few herbs. Five species (4 trees; one shrub) belonging to 3

genera from this family were recorded in IIT campus.

East-Indian screw tree, Nut-leaved screw tree (*Helicteres isora)* Shrub; Hindi: Maror phali; Marathi: Murud sheng
East-Indian screw tree is a sub-deciduous shrub or small tree with grey coloured bark. The roots and stem barks are considered to be expectorant and astringent. Bark is used in diarrhoea and dysentery. Root juice is used in antidiarrhoeal and antidysenteric formulations. Fried pods are given to children to kill intestinal worms.
During the study the shrub was recorded in U3, V1 sub sectors.

Maple-leaved Bayur tree (*Pterospermum acerifolium)* Tree; Hindi: Kanak Champa, Muchkund; Marathi: Karnikar
Kanak Champa is a tree of Indian origin. It has large fragrant nocturnal white flowers. It yields a reddish wood used for planking; often grown as an ornamental or shade tree. During the study the tree was recorded in urbanized sub sector U1.

Buddha Coconut (*Sterculia alata)* Tree
Buddha Coconut is a tall tree, which gets is name from its coconut like fruit. In India, seeds are eaten, and plant used medicinally. Buddha Coconut is native to India, and found variously in S.E. Asia.
During the study the tree was recorded in urbanized sub sector U1 & U3.

Java Olive, Peon, Poon Tree, Wild Indian Almond, Sterculia nut (*Sterculia foetida)* Tree; Hindi: Jangli badam; Marathi: Goldaru, Jangali badam
Java Olive is a tall, straight tree. Originally from East Africa and North Australia, it grows freely down the West of the Peninsular, in Burma Ceylon and South India. The seeds are edible after roasting and taste like chestnuts (Castanea sativa). They also contain oil that is used medicinally, while the timber is used for making furniture and the bark for rope.
During the study the tree was recorded in U1, U2, U3, V1 and V4 sub sectors.

Indian-tragacanth, gum karaya, Indian gum tragacanth (*Sterculia urens)* Tree; Hindi: Kulu; Marathi: Sardol
Gum karaya is a medium-sized, deciduous tree. Bark is greyish-white or reddish, smooth, shining with a thin, white transparent outer coat, peeling off in papery flakes. Trees exude gum karaya used in foodstuffs as emulsifiers, stabilizers and thickeners. Seeds are eaten after roasting. Seeds and young tender roots are eaten in times of famine.
During the study the tree was recorded in U2, U3, V3 and V4 sub sectors.

Strelitziaceae – (Plate 22)
It includes three genera, all occurring in tropical to subtropical regions: Strelitzia with 5 species in southern Africa, Ravenala with a single species in Madagascar, and *Phenakospermum* with a single species in northern South America. The best known species is the bird-of-paradise flower *Strelitzia reginae*, grown for its flowers worldwide in tropical and subtropical gardens, and a well-known flower in floristry. One species (tree) belonging to 1 genus from this family was recorded in IIT campus.

Traveler's Palm, Traveler's tree (*Ravenala madagascarensis)* Tree
Endemic to the island of Madagascar, Traveler's Palm is one of the most interesting tree-like plants. Traveler's palm is not a true palm. The small white flowers, in a foot long inflorescence, are held in bracts. In these bracts and leaf folds, rainwater is collected. It is this rainwater collecting property of this tree, which can be consumed by thirsty travelers, what gives it the name traveler's palm. The fruits are brown while the seeds are blue.
During the study the tree was recorded in urbanized sub sectors U2 & U3.

Tiliaceae – Jute family (Plate 22)
A small but important family of herbs, shrubs and trees. Phalsa tree is known for Phalsa sherbet made from

its fruits. The well known fiber is obtained from *Corchorus capsularis* and *C. olitorius*. Four species (1 tree; 2 shrubs and 1 herb) belonging to 3 genera from this family were recorded in IIT campus.

Nalta Jute, Jew's Mallow, Tossa jute (*Corchorus olitorius)* herb; Hindi: Pat, Pat-sag, Mithapat; Marathi: Motichhunchh, Banpat
Nalta Jute is a variety of jute grown for its young edible shoots, which are used in cooking. Native to India, nalta jute is cultivated in warm regions, including Egypt and the southern United States. Jew's Mallow is also a medicinal "vegetable", eaten from Tanganyika to Egypt. In India the leaves and tender shoots are eaten. The dried material is known as "nalita."
During the study the herb was recorded in the entire campus.

Dhaman (*Grewia tiliaefolia)* Tree; Hindi: Dhamani
Dhaman is a moderate-sized to large tree.
During the study the tree was recorded in the entire campus except U3.

Triumfetta pentaphylla shrub
During the study the shrub was recorded in urbanized sub sector U2 other than quadrat.

Burr Bush, Chinese Burr, Diamond Burrbark (*Triumfetta rhomboidea)* Shrub; Hindi: Chiriyari; Marathi: Thinjhira
Erect woody herb or shrub. Stem is glabrous, longitudinally grooved.
During the study the shrub was recorded in the entire campus.

Ulmaceae – Elm family (Plate 23)

It comprises 15 genera of trees and shrubs, distributed primarily throughout temperate regions. Members of the family have watery sap, and its leaves alternate along the stem. The leaves usually have toothed edges and often are lopsided at the base. The flowers lack petals. Male and female flowers are borne together or apart on the same plant. One species (tree) belonging to 1 genus from this family was recorded in IIT campus.

Indian Elm, entire-leaved elm tree, jungle cork tree, south Indian elm tree (*Holoptelea integrifolia)* Tree; Hindi: chilbil, kanju, papri; Marathi: ainasadada, or vavala
Indian Elm is a large deciduous tree. The bark of Indian Elm is used in rheumatism. Seed and paste of stem bark is used in treating ringworm.
During the study the shrub was recorded in the entire campus.

Urticaceae – the nettle family (Plate 23)

It is comprised of about 45 genera of herbs, shrubs, small trees, and a few vines, distributed primarily in tropical regions. The leaves are varied and the sap is usually watery. The small, greenish flowers often form clusters in the leaf axils. Both male and female flowers may be borne on the same plant. Four species (3 trees; one herb) belonging to 3 genera from this family were recorded in IIT campus.

Breadfruit (*Artocarpus incisa)* Tree
This tree may grow up to 9 meters tall. It has dark green, deeply divided leaves. It is native to the South Pacific region but has been widely planted in the West Indies and parts of Polynesia. The fruit pulp is edible raw. The fruit can be sliced, dried, and ground into flour for later use. The seeds are edible when cooked.
During the study the tree was recorded in urbanized sub sector U1 & U3.

Jackfruit, Jackfruit tree (*Artocarpus integrifolia)* Tree; Hindi: Katahal, Kathal; Marathi: Phanas
Jackfruit is a tree which is unique in the fact that it produces huge fruits directly from its stem. Jackfruit is most probably native of the rain-forests of the Western Ghats. When fully ripe, the unopened jackfruit emits a strong disagreeable odour, resembling that of decayed onions, while the pulp of the opened fruit smells of pineapple and banana. During the study the tree was recorded in U1, U2, U3, V2, V4 and V5 sub sectors.

Boehmeria caudata herb
During the study the herb was recorded in U1, U3, V1, V2, V3, V4 and V5 sub sectors.

Indian Charcoal Tree, Indian Nettle, Oriental nettle, Pigeon wood, Poison peach (*Trema orientalis)* Tree; Hindi: Gio, Jivan; Marathi: Ghol, Kapshi, Khargol
Indian charcoal tree is a fast-growing shade tree with soft foliage. Depending on climatic conditions, trees may be evergreen or deciduous. The name Trema is based on the Greek word for hole and pertains to the pitted stone of the fruit. The common name pigeon wood is derived from the fact that pigeons are frequently seen nesting or roosting in these trees.
During the study the tree was recorded in the entire campus except V3.

Verbenaceae – Vervain family (Plate 23)
A mixed family of herbs, shrubs, lianas and trees that range from creeping low bank mat to the mighty teak tree. The most well known member is the common *Lantana*, the most successful among the alien invaders. Seven species (2trees; 4 shrubs and 1 climber) belonging to 6 genera from this family were recorded in IIT campus.

Glory Bower, Indian privet, Seaside clerodendrum, Wild Jasmine, Sorcerers Bush (*Clerodenrum inermae)* Climber; Hindi: chhoti-ari, sankuppi, sangan-kuppi, vilayati mehendi, batraj; Marathi: sangam, vanajai, sirit-mari
Glory bower is a much branched, straggling shrub. The plant is tough - takes trimming well, and hence, is commonly used as a hedge plant in India. It also grows well on the beach, tolerating all the salty water sprays. Within India, it is found throughout particularly near coastal regions.
During the study the climber was recorded in urbanized sub sector U1 other than the quadrat.

Pagoda flower (*Clerodendrum paniculata*) Shrub
Pagoda flower is an erect, open semiwoody shrub with large evergreen leaves and huge showy clusters of orange-red or scarlet flowers held above the foliage. Pagoda flower is native to India, Sri Lanka, Malaysia and much of southeastern Asia. It is widely cultivated in tropical gardens throughout the world.
During the study the shrub was recorded in vegetated sub sector V1.

Variegated Sky Flower, Duranta, Honey drops, Golden Dewdrop, Pigeon Berry (*Duranta erecta)* Shrub; Hindi: Nilkanta
This is a form of sky flower with variegated leaves - these do not bloom so profusely and are usually grown primarily for their foliage.
During the study the shrub was recorded in urbanized sub sector U1.

Gamhar (*Gmelina arborea)* Tree; Hindi: Gamhar; Marathi: Sivan
Gamhar is a beautiful fast growing deciduous tree occurring naturally throughout greater part of India. The root and bark of *Gmelina arborea* are stomachic, and anthelmintic; improve appetite, useful in hallucination, piles, abdominal pains, burning sensations, fevers, 'tridosha' and urinary discharge.
During the study the tree was recorded in U1, U3, V3 and V4 sub sectors.

Lantana (*Lantana camara)* Shrub; Hindi: Raimuniya; Marathi: Tantani, Ghaneri
Common lantana is a rugged evergreen shrub from the tropics.
During the study the shrub was recorded in the entire campus except V3.

Teak (*Tectona grandis)* Tree; Hindi: Sagun; Marathi: Sagwan
A very popular timber tree, teak is native to India and Burma to Java. It is a deciduous tree attaining a very large size. However, in cities it might be seen on the roadside as a medium sized tree with large leaves. Teak is considered a good quality wood for furniture.
During the study the tree was recorded in the entire campus except V1.

Chaste Tree (*Vitex negundo)* Shrub; Hindi: Nirgundi, sindvar
Chaste tree can be described as a cross between a shrub and a tree with a single woody stem (trunk). It can

grow up to five meters tall. It is an effective herbal medicine with proven therapeutic value.
During the study the shrub was recorded in U1, U2, U3, V2, V3 and V4 sub sectors.

Vitaceae – Vine family (Plate 23)

This is the family to which the grape vine belongs. Plants in this group are mostly woody climbers and few shrubs. Typical vines, several of these climbers have tendrils for support. Fruits are typical grape-like fleshy berries. Several species of Hawkmoths lay eggs on some of these plants. One species (climber) belonging to 1 genus from this family was recoded in IIT campus.

***Ampelocissus sp.* climber**
During the study the climber was recorded in U1, V1, V2, V3, V4 and V5 sub sectors.

Zingiberaceae – Ginger family (Plate 23)

These are the herbs with fleshy, branched underground rhizome. Many economically important crops like Turmeric, Ginger and Cardamom belong to this family. Two species (2 herbs) belonging to 2 genera from this family were recorded in IIT campus.

Crepe Ginger, Malay ginger (*Costus speciosus)* herb; Hindi: Kusht, Keokanda; Marathi: Koshi
Despite its common name, crepe ginger is only a distant relative of the edible ginger family. It is tall and dramatic landscape plant with large dark green leaves arranged on the stalk in a spiral.
During the study the herb was recorded in U1, U2, U3, V1, V3 and V4 sub sectors.

Hill Turmeric (*Curcuma pseudomontana)* herb; Hindi: Kachura; Marathi: raan halada, shindalavana or shindalavani
Hill Turmeric is an erect herb, found on moist, shaded areas of wet forests and along sluggish grassy slopes of higher altitude. The Savara tribes in the Eastern Ghats of Andhra Pradesh use tuber extracts to cure jaundice. Jatapu and Kaya tribes apply warm tuber paste to treat body swellings. Women of Jatapu and Savara tribes eat boiled tubers to increase lactation. Khand tribes apply tuber paste on the head for cooling effect.
During the study this herb was exclusive to vegetated sub sector V3.

Species Account
Fauna

Insects

Insects are an ancient group of animals and amongst the most fabulous creations of nature; they are the first air breathing land animals. As individuals and as species, the insects far out number all the other groups of animals combined. Of the approximately 1,392,485 described species of animals, plants and microbes on earth, over 800,000 are insects (Wilson, 1988). This species diversity is the result of a wide array of forms and functions that the insects display. Insects are found every where on the earth including the cold Artic and Antarctic regions. The body sizes are usually small, ranging from less than a millimeter to 40 mm. According to Kunte (2000), in many terrestrial communities their collective biomass is superior to all the vertebrate animals put together.

The insects found during the present study is as per the major Orders is detailed below.

Order Thysanura (Plate 24)

Thysanura are usually found in moist locations around houses or out-of-doors under stones, bark and boards. They are fast run rapidly and hide in cracks and crevices. Occasionally they damage book bindings, curtains, wallpaper, etc. Silverfish can be a nuisance in houses. They are secretive and usually are most active at night.

Thysanura are wingless insects with flattened elongate bodies, long antennae and usually with three, long, tail like appendages. Mouth parts are formed for chewing. Metamorphosis is minimal (young resemble adults except for size). They are up to 3/8 inches long.

Insect in this order observed during the study in the IIT-Bombay Campus is **Silverfish**. Silverfish are so called due to the silvery glitter of the scales covering their bodies. Their movement is "fish-like" and makes it look as if they are swimming. Silverfish feed on cereals, paste, paper, starch in clothes, rayon fabrics and dried meats.
The silverfish was recorded in the U1 section of the Urban area and in the V1, V4 and V5 section of the vegetated areas.

Order Odonata (Plate 24 & 25)

Odonata are large insects with two pairs of membranous, many-veined wings; the hind pair is as large as or larger than the front pair. Mouthparts are formed for chewing. They have large conspicuous eyes. Aquatic immature stages, called nymphs (or naiads) live in flowing or still water and do not resemble the adults in appearance. Adults are common around ponds, lakes and streams.

Immature Odonata have chewing mouthparts. Naiads have elongated extensible labium with piercing jaws used to capture prey. Odonata have incomplete metamorphosis. They are 1/4 inch to over 1 inch in length.

Odonata is an order of insects, encompassing dragonflies (Anisoptera) and damselflies (Zygoptera). Although generally fairly similar, dragonflies differ from damselflies in several, easily recognizable traits. Dragonflies are strong fliers with fairly robust bodies and at rest hold their wings either out to the side or out and downward (or even somewhat forward). Damselflies tend to be less robust, even rather weak appearing in flight, and when at rest most species hold their wings folded back over the abdomen. They act as significant indicators of a healthy or polluted habitat
During the present study **36** species of odonata were recorded comprising of 25 species of dragonflies and **11** species of damselflies. The odonata were mostly observed around the water bodies and grass patches. The family wise distribution is given below.

Family Calopterygidae

Glories are large damselflies with broad head and conspicuous round eyes. These iridescent coloured damselflies have broad rounded hindwing. Wings are transparent, amber or iridescent coloured. Abdomen is longer than the hindwing. Glories are found in temperate and tropical regions. Worldwide 169 species are known. Within Indian limits 10 species are known of which 3 species are found in peninsular India. Glories are associated with forested streams and they breed in them.
In the campus only one species was observed.

Clear-winged Forest Glory ***(Vestalis gracilis)*** A large iridescent green damselfly with transparent wings. Commonly found along hill streams. Large numbers usually rest among bushes in forest paths in association with Black-tipped Forest Glory.
The damsel fly was exclusive to the V1 sub sector only.

Family Coenagrionidae

Marsh darts are slender and small damselflies with varied colouration. These non-iridescent damselflies rest with wings closed over their body. The wings are transparent and rounded at the tip. The long and slender abdomen is slightly longer than the hind wing. Marsh Darts are found throughout the world. World over, this family is represented by about 1147 species. Within Indian limits, 65 species are known and in peninsular India 25 species are recorded. The marsh darts breed in a variety of aquatic habitats like ponds, marshes, streams and rivers.
During the study six species were recorded in the campus.

Pigmy Dartlet (*Agriocenemis pygmaea)* A small apple green damselfly with black thoracic stripes orange coloured terminal abdominal segments. The f***emale s***hows range of colour variations, some even resemble the males. In red form the head, thorax and abdomen are dark brick red in colour. Thorax has a broad, dorsal black band. Common in marshes, ponds, and sea shore. Darts among vegetation and flies very close to the ground.
The damselfly was observed through out the campus except at V3 and V5 sub sectors. The female red form was also observed.

Coromandel Marsh Dart ***(Ceriagrion coromandelianum)*** A medium sized pale green damselfly with bright yellow (male) or plae green tail (female) Common along the banks of ponds, rivers and canals. Also found frequently far away from water bodies.
This was the most abundant damselfly in the campus except in V3 and V5 sub sectors.

Golden Dartlet ***(Ischnura aurora)*** A small apple green damselfly with black thoracic stripes and blue tipped yellow tail It is the smallest of Damselflies. Found among vegetation along the banks of ponds, rivers, canals and estuaries.
The damselfly was observed in the U1 and V3 subsectors.

Senegal Golden Dartlet ***(Ischnura senegalensis)*** A small pale green damselfly with black and yellow thoracic stripes. Abdomen is yellow and has basal and terminal blue spots. Very common in marshes, ponds and wet grasslands.
The damselfly was more common in the Urban sector except that the morph was observed in the V1 sub sector.

Blue Grass Dartlet ***(Pseudagrion microcephalum)***A small blue damselfly with broad blue medial thoracic stripe. A species of the plains. Found commonly among vegetation covered banks of ponds, canals and rivers.
The damselfly was observed in the entire urban sector and the V1 sub sector.

Family Platycnemididae

Bush Darts are small, slender damselflies. They are predominantly black damselflies with blue, red or yellow markings. The narrow, transparent wings are rounded at the tip. Abdomen is longer than the hindwing. Bush Darts are found only in Old World and 197 species are known from this region. Within Indian limits 30 species are known. Only two species are known from peninsular India and the rest of the species are found in the eastern Himalayas. Bush darts breed in small mountain streams and adults usually dart among riparian vegetaion. Newly emerged Bush Darts are conspicuously white and without any marking.

Blue Bush Dart ***(Copera vittata)*** A black band extend from eye to eye. Eyes have a black cap above, olivaceous green below with a black equatorial belt. Found along ponds, puddles, canals and streams. Flies

very close to the ground (<1m).
Was observed in the entire campus except V3 and V5 subsectors.

Yellow Bush Dart ***(Copera marginipes)*** A black band extend from eye to eye. Found along ponds, puddles, canals and streams. Flies very close to the ground (<1m).
Quite abundant in the campus but absent inU2, V2 and V3 sub sectors.

Family: Protoneuridae

Bambootails are small to medium sized slender damselflies. They are usually black coloured and marked with blue, red, yellow or rarely iridescent. Wings are transparent and rounded or pointed at the tip. Abdomen is long and never twice the length of the hindwing. Bamboo Tails are highly diverse family with 244 known species. Within Indian limits 24 species are known of which 15 are found in peninsular India. All the species breed in running waters and they are restricted to forested landscapes.
One species of the Bambootail was identified in the campus

Black-winged Bambootail ***(Disparoneura quadrimaculata)*** A medium sized brick red damselfly with black banded wing. Found along streams and rivers. Perches on emergent boulders and aquatic plants.
The damselfly was observed in the U1, V2 and V4 sub sectors only.

Family:Aeshnidae

Darners are large or medium sized, non-iridescent coloured dragonflies. Eyes meet broadly overhead. The wings are transparent, the abdomen is longer than the wings and often tumid at the base. Most of the darners inhabit marshes, ponds and lakes. Most of the species are diurnal. However a few species are crepuscular. Darners have cosmopolitan distribution and 412 species are known world wide. Within Indian region 42 species are known, of which 8 species are found in peninsular India.

Blue Darner ***(Anax immaculifrons)*** Face is pale uniform pale green. Frequents slow flowing streams. It breeds in hill streams.
The Blue darners were observed in U3, V2, V3 and V5 sub sectors.

Brown Darner ***(Gynacantha dravida)*** Face is olivaceous brown with a broad black T-shaped mark on the upper surface. Wings are transparent and lightly tinted with reddish brown throughout. A crepuscular dragonfly. Common around weed covered ponds and tanks. Occasionally this dragonfly comes to light at night.
The dragon fly was exclusive to the V3 sub sector.

Parakeet Darner ***(Gynacantha bayadera)*** A large green dragonfly. Face is pale olive green; Eyes are deep blue to blue grey above which fade to yellowish green below. Frequents reed covered ponds and tanks. A crepuscular insect, often visiting light immediately after the rains.
The dragon fly was exclusive to the U3 sub sector.

Family:Libellulidae

Skimmers are the most diverse group of odonates. They are large, medium or small dragonflies and non-iridecently coloured. Eyes are always broadly confluent. The wings vary in size, shape, width and colouration. This family has worldwide distribution and is represented by 1139 species. They breed in wide variety of aquatic habitats like puddles, ponds, marshes, rivers, domestic storage tanks and aquaria. Within Indian limits, 95 species are known, of which 50 species are found in the peninsular India.
During the study 18 species were observed in the campus.

Trumpet Tail ***(Acisoma panorpoides)*** A small blue dragonfly with bluged abdomen. Face is pale blue. Eyes *are* Blue, glossy brown spotted with black behind. A species closely associated with water. Commonly found among reeds in ponds and tanks. The species has a very weak and short flight.
The dragonfly was observed in U3, V1 &V2 sub sectors.

Ditch Jewel ***(Brachythemis contaminata)*** Face is olivaceous. eyes are Olivaceous brown above bluish grey below. Thorax is Olivaceous brown to reddish brown above with two reddish brown lateral stripes. A dragonfly of polluted waters. This species is very common along sewage canals, tanks, ponds and ditches. Sometimes huge congregations (>1000) gather in sewage treatment ponds. Flies very close to the ground and perches on aquatic weeds.
The dragonfly was observed in the entire campus except V5 subsector.

Granite Ghost ***(Bradinopyga geminata)*** A medium sized grey dragonfly with black and white markings. This species is usually seen perched on compound stone walls, boulders etc. It easily merges with such perching sites because of its colouration extremely varied species quite impossible to catch with bare hands. The species is commonly found near rock pools and other similar small water collections. It is common in the urban landscapes and breeds in overhead tanks and garden ponds. In aquaria larvae tend to destroy fish hatchlings. After sunset it comes for roosting to the same locality day after day.
The dragonfly was observed in the U3 and V4 sub sector.

Ruddy Marsh Skimmer ***(Crocothemis servilia)*** A medium sized blood red or reddish yellow dragonfly with amber coloured patch at wing base. One of the commonest red dragonflies. Frequently found in ponds, puddles, rivers, big wells, tanks, ditches and paddy fields. This dragonfly perches on aquatic weeds and chases any passing by dragonflies.
Most common dragonfly in the campus.

Ground Skimmer ***(Diplocodes trivialis)*** A small greenish yellow or blue dragonfly with black markings. Face is pale azure blue. One of the commonest dragonflies in gardens, fields, playgrounds, etc. This dragonfly usually perches on the ground and rarely flies above 1m.
The dragonfly was observd in the entire campus except V2 sub sector.

Asiatic Blood Tail ***(Lathrecista asiatica)*** A medium sized dark brown dragonfly with blood red tail. Face is yellow below and upper surface of frons is steel black or iridescent blue black. This shy dragonfly is found in ponds, tanks and marshes. When disturbed, it flies very rapidly.
The dragonfly was observed only in the vegetated subsectors.

Green Marsh Hawk ***(Orthetrum sabina)*** Face is yellowish green. Eyes are Green mottled with black. A common dragonfly of gardens and fields. This dragonfly perches motionless on shrubs and dry twigs for a long time. Hawks feed on flying insects such as flies, small butterflies and dragonflies. This species can be seen far away from water and occasionally enters houses at night attracted by the light.
The dragonfly was observed in the entire campus except the U2 subsector.

Blue Marsh Hawk ***(Orthetrum glaucaum)*** A medium sized dragonfly with bluish black thorax and blue tail. Face is pale olivaceous brown in young adults changing to glossy black in old individuals. Commonly found in marshes associated with forest streams, plantations and canals.
The dragonfly was exclusive to the V4 sub sector.

Crimson-tailed Marsh Hawk ***(Orthetrum pruinosum)*** Face is ochreous to pale reddish brown. Eyes are blue black above and bluish grey below. A very common dragonfly of wells, ponds, ditches, tanks and rivers. Males are very conspicuous and can be seen perched on shrubs, stones etc.
Except for V2 and V3 sub sectors it was observed in the campus.

Blue-tailed Yellow Skimmer ***(Palpopleura sexmaculata)*** A small dragonfly with greenish yellow thorax and blue abdomen. Face is creamy yellow with brilliant iridescent blue frons. This dragonfly is usually found in marshes associated with bamboo brakes. It resembles wasps in appearance and with slow, circling flight.
The dragonfly was absent in U1, V1 and V2 sub sectors.

Wandering Glider ***(Pantala flavescens)*** A medium sized dragonfly with rusty thorax and yellow abdomen. Face is bright golden yellow or orange. Most common dragonfly. Huge swarms can be seen just

before and after monsoon. Thousands of them swarm over harvesting fields and playground during early morning and evening. They are ubiquitous and migrate in large numbers with the monsoon winds. The swarms usually use clearings such as railway tracks, highways and rivers to migrate. These swarms frequently bump into passing vehicles and die on road.
The dragonfly was observed in the entire campus except in V2 subsector.

Yellow-tailed Ashy Skimmer ***(Potamarcha congener)*** A medium sized dragonfly with bluish black thorax and yellow tail with black markings. Found in weedy ponds and marshes. Large colonies are often found in woods associated with ponds and marshes.
The dragonfly was exclusive to the V4 subsector.

Common Picture Wing ***(Rhyothemis variegata)*** A medium sized dragonfly with butterfly like yellow and brown wings. Frons iridescent green. Eyes are dark reddish brown above. A prominent dragonfly of marshes, paddy fields and ponds. This species is easily mistaken for a butterfly. A weak flier and frequently perches on aquatic weeds. This dragonfly is rarely seen away from water.
The dragon fly was observed in the campus except U 3 and V3 sub sectors.

Coral-tailed Cloud Wing ***(Tholymis tillarga)*** A medium sized red dragonfly with brown and white hindwing patch. Face is rusty brown with a crimson flush. A crepuscular dragonfly, active at the time of sunset and flies at night. Frequently comes to light at night. This fast flying dragonfly is very difficult to follow. Commonly found in ponds, marshes and tanks.
Observed in the campus except in U3 and V4 subsectors.

Red Marsh Trotter ***(Tramea basilaris)*** A medium sized red or yellow dragonfly with brown and yellow hindwing patches. Wings are Transparent. The hindwing base has a reddish brown marking surrounded by golden amber at the base. The veins in this area are bright golden yellow. Breeds in marshes and ponds.
The dragonfly was exclusive to V4 subsector.

Long-legged Marsh Glider ***(Trithemis pallidinervis)*** A medium sized yellowish brown dragonfly with long spider like legs. Face is yellow or pale brown in front and iridescent purple above. A dragonfly partial to the marshes and weedy ponds. Usually perches on tall aquatic weeds or bare ends of shrubs. The long legs are very noticeable at this time.
The dragonfly was observed in the V1 and V5 subsectors.

Rufous Hawk Marsh (*Rhodothemis rufa)* The extremely prominent and robust spines present on the femora and tibiae of *R. rufa* is the most obvious distinguishing feature.
The dragonfly was observed in U3, V1 and V4 sub sectors.

Skimmer (*Neurothemis intermedia)* A medium sized rusty coloured dragonfly with transparent wing tips. A conspicuous species of ponds, marshes and paddy fields. Flight is slow and weak. Usually perches on twigs, aquatic weeds and other plants.This species is very common along irrigation canals in paddy fields.
This dragonfly was found only in the U1 subsector.

Order Phasmida (Plate 26)

The **Phasmatodea** (sometimes called **Phasmida**) are an order of insects, whose members are variously known as **stick insects.** The ordinal name is derived from the Greek "phasma" meaning an apparition or phantom, and refers to the resemblance of many species to sticks or leaves. Phasmida have extremely elongate and stick-like bodies with long legs and long antennae. These insects have chewing mouthparts and feed on foliage They have one generation per year and are slow-moving and are generally found on trees or shrubs. Large females may be over 7 inches long. Stick insects, in plague proportions can cause significant defoliation.

Insects recorded in this order during the present study were the stick insects were restricted to the vegetated area only.

Most **stick insect** species seem to be nocturnal and, with a few exceptions, rare in nature. Most species are found in foliage upon which they feed but a few are wholly terrestrial. They are entirely plant feeders and are unusual in their ability to develop on a wide variety of unrelated plant species. They exhibit cryptic postures and perform rhythmical swaying when disturbed. A few species can produce sound when disturbed by rubbing the hind wings against tubercles on the legs. There is no indication that they can hear any of the sounds they produce.

The stick insects were observed only in the vegeteted sub sector.

Order Orthoptera (Plate 26)

Orthoptera generally have two pairs of wings with many veins and range in size from 1/4 inch to 2 inches long. The front pair is usually slender and the hind pair is broad and fan-like. Wings are reduced to small pads in some grasshoppers and crickets. Mouthparts are formed for chewing. Nymphs resemble the adults. Antennae may be long and thread-like (crickets and katydids) or shorter (most grasshoppers). Front wings are generally elongate and the hind wings are usually wider. Wings may be held tent-like over the body or more flattened and overlapping (crickets). Hind legs are generally long and robust, fitted for jumping. Adults in several groups in this order never develop wings. Many insects in this order produce sound (known as a "stridulation") by rubbing their wings against each other or their legs, the wings or legs containing rows of corrugated bumps. These organisms use vibrations to locate other individuals. They have a tendency to swarm in ideal weather conditions and thus act as pests.
Five species of Insects were observed from this order during the present study. Except for the Painted Grasshopper that was observed only in the vegetated area, the others viz. Cricket, Grasshopper, Ground hopper and Katydid were seen in the entire campus, with the dominance of Grasshopper.

Cricket - live under rocks and logs in meadows, pastures and along roadsides. Many are nocturnal. They are brown to black in colouration, front wing varying in length, covering half to entire abdomen, Antennae about as long as distance from head to end of abdomen, Wings held flat over body, Hind wings folded and hidden under leathery front wings. Female with long ovipositor (ventrally attached) in rear (may appear as two pieces); both sexes have cerci (segmented, tail-like appendages attached dorsally). The wings are fully extended over the abdomen. Some species may not have wings. Immatures look like adults, but do not have fully developed wings. To attract mates, males produce a sound made by rubbing their forewings against each other. The resulting chirping sound is picked up by the female's ears on her front legs. The chirp sounds are different for each species so that individuals can find their own species.
Crickets are omnivores and scavengers feeding on organic materials, as well as decaying plant material, fungi, and seedling plants. Crickets may injure seedlings and large numbers can be destructive. Crickets breakdown plant material, renewing soil minerals. They are also an important source of food for other animals, like spiders, some wasps, ground beetles, birds, small rodents and lizards.
In the present study the crickets were recorded more number of times in the urban sector than the vegetated sector.

Grasshopper – Brown in colour, with some darker markings, Big hind legs for jumping, 2 pairs of wings: forewings narrow and relatively hard; hind wings large, membranous, Antennae not very long, 20-24 segments, Conspicuous eyes, Cerci (pair of appendages at end of abdomen) unjointed. Males have a single unpaired plate at the end of abdomen. Female has two pairs of valves (triangle shapes) at end of abdomen used to dig in sand when egg laying. In very young stage, the grasshopper has no wings. In later stages, wings are visible as small pads at end of thorax. Grasshoppers are generally herbivores feeding on a variety of plants. Some species only like grasses.
As herbivores, sometimes some species of grasshopper occur in very large numbers and cause serious crop damage and loss of plants in pastures. However, grasshoppers link plants to the rest of the ecosystem. Frass (droppings) contribute to nutrient turnover by returning nutrients as fertilizer for the plants. They provide food for reptiles, birds, mammals and other arthropods.
The grasshoppers were recorded throughout the campus, but dominated the vegetated sector and were found in large numbers in the V3 sector.

Painted Grasshopper a short horned grasshopper (Family Acrididae) that feeds on Calotropis is one of the most common grasshoppers of India. The presence of the insect on the crop and the characteristic form of leaf damage can easily confirm the damage caused by short-horned grasshoppers and locusts. The symptoms can be confused with the damage caused by other insect defoliators on the rice crop.
The painted grass hopper as only observed in the V3 and V5 subsectors.

Ground hopper -. It is very variable with a mottled colour-patterning giving the ground-hopper an overall appearance of being light grey, sandy, dirty greenish or various shades of brown to almost reddish or black, approximately 10 mm in body length. The thorax of this species is strongly keeled and extends backward over, but not beyond, the entire abdomen. It cannot fly. It is an active species which is often overlooked on account of its size. Populations can be quite large and concentrated in a relatively small area. They feed on grasses, mosses and lichens. They can be found in any unshaded area with bare earth or sparse vegetation, particularly in woodland glades and rides; not uncommonly found in gardens.

The ground hopper was observed in U1, U3 and V1 subsectors only.

Katydid - The katydid derives its name from the male's repetitive call, which has been phoneticized as "katydid, katy-didn't." Katydids have large hind legs and are distinguished by their extremely long, threadlike antennae and the thick, upwardly curved ovipositor (egg-laying structure) of the females. Often large and green, many katydids have long wings, but some common species are nearly wingless. Katydids are most abundant in the tropics.
The katydids were observed throughout the campus during the study but were more in the vegetated sector compared to the urban sector.

Order Mantodea (Plate 26)

Mantodea are rather large, elongate and slow-moving insects, usually found in foliage. They may be up to 4 inches long. Their front legs are greatly modified for grasping prey. Mantids have chewing mouthparts and unusually elongated prothorax. The wings are held over the back and overlap.

They are predaceous on a large variety of insects and other arthropods. They usually wait motionless for their prey to venture within striking distance. Mantids are well known as biological control agents. However, they do not distinguish between useful and destructive species but feed on any insects that come near.

Three species of mantises were observed during the present study.

Praying Mantis: A colloquial name **"praying mantises"** is because of the typical "prayer-like" stance, although the term is often mis-spelled as "preying mantis" since mantises are notoriously predatory. The word *mantis* is Greek for "prophet" or "fortune teller". Praying mantids are highly predacious and feed on a variety of insects, including moths, crickets, grasshoppers and flies. They lie in wait with the front legs in an upraised position. They intently watch and stalk their prey. They will eat each other.
Praying mantids are often protectively colored to the plants they live on. This camouflage facilitates their predaceous behavior. The adult female usually eats the male after or during mating. Mantid's grasping response is incredibly rapid, so that you see it before it catches the insect and when the insect is in its front legs. The motion is barely a blur if it is perceived at all. The compound eyes are capable of seeing images and colors. The three simple eyes perhaps tell the differences between light and dark.
The praying mantis were recorded through out the campus except in the V1 sector during the study.

Ant mimicking praying mantis: These are the praying mantis which morphologically mimics the ants.
The ant mimicking praying mantis was only recorded at V-3 i.e. Hill side area during the study. All the three mantisis observed during the study were observed at V3.

Bark Mantis: The name is given to various species of praying mantis that have cryptic colouration resembling the bark of a tree.
Bark mantis was generally observed through out the campus except the U3 and the V4 sectors which are

adjacent to each other.

Order Blattaria (Plate 26)

Blattaria are cursorial (adapted for running) and move rapidly. They have flattened bodies and their head is concealed from above. They have two pairs of wings, but in some species the wings are greatly reduced.

Cockroaches (or simply "roaches") are insects of the order **Blattaria**. This name derives from the Latin word for "cockroach", *Barata*. The spines on the legs were earlier considered to be sensory, but observations of their locomotion on sand and wire meshes has demonstrated that they help in locomotion on difficult terrain. The structures have been used as inspiration for robotic legs. Cockroaches leave chemical trails in their feces as well as emitting airborne pheromones for swarming and mating. Other cockroaches will follow these trails to discover sources of food and water, and also discover where other cockroaches are hiding.
Cockroaches are somewhat general feeders. They do have a preference for materials high in fats and starches. They deposit their eggs in a capsule called an ootheca. Several species invade homes where they can contaminate food. They have an unpleasant odor and can be very annoying in the home.
In the campus two species of cockroaches were observed during the study other than the domestic ones. The forest cockroach was observed in the entire campus except in the V1 sector.

Forest Cockroach: are flattened insects with an oval outline, long antennae and walking legs all similar in form. They somewhat resemble the beetles but are distinguished by their short caudal appendages. They are mostly inconspicuous brownish colour. It lives on the ground in the forests.

Unid Cockroach: The unidentified form of the cockroach was black and white was found in the leaf litter in the campus in both the vegetated and the urban sector.

Order Isoptera (Plate 26)

Isoptera are small, soft-bodied, yellowish, whitish, tan or black insects that live in colonies in wood. Colonies consist of three castes: workers, soldiers and swarmers. Workers and soldiers are wingless and never leave the colony. Swarmers, or the reproductive forms, have dark bodies and four long, veined wings. The insects belonging to this order are the termites.

Termites have beadlike antennae and thick waists which distinguish them from ants. Termites have chewing mouthparts. The front and hind wings of termites are nearly identical in size and venation. Most termites are under 1/4 inch long. Swarmers leave the colonies on sunny days to mate and search for new homes. Termites are important to man. They do millions of dollars in damage to houses each year. Termites eat wood but cannot digest the cellulose. They rely on one-celled animals (protozoans) in their intestine to digest the cellulose.

12 colonies of termites were observed during the study with one colony each in the U1 and the V4 region, while the hill side had the maximum of 6 colonies.

Order Dermaptera (Plate 26)

Dermaptera are medium size insects usually with four wings. The front pair of wings is short, leathery and meet down the center of the back, which leaves most of the abdomen exposed. The hind wings are folded under these. A pair on non-poisonous pinchers are found at the end of the abdomen. The pinchers are not segmented but consist of a single piece. The pinchers often are asymmetric, i.e., the right and left sides are shaped differently. They have chewing mouthparts. Insect found in this order is the earwig.

Earwig is characterized by membranous wings folded underneath short leathery forewings. Most earwigs

are about 1/2 - 3/4 inch in length as adults. Usually earwigs are found outdoors hiding under leaves, boards or in cracks during the day. Earwigs are omnivores that are predisposed to hiding in warm humid crevices. Earwigs can be destructive in greenhouses and rarely in field crops. They are a nuisance when they enter homes. They release a bad smelling substance when disturbed.
During the study the earwigs were observed in the U1 and V5 sector only.

Order Hemiptera (Plate 26 & 27)

Hemiptera usually have four wings folded flat over the body. There is often a visible triangle at the center of the back that the wing bases do not cover called the scutellum. The front pair is thickened and leathery at the base with membranous tips or ends. Mouthparts are formed for piercing and sucking and the beak arises from the front part of the head. Most are under 1/2-inch long but some forms especially aquatic ones may be over 2 inches long.

They are found on plants and animals, or in water. Some true bugs cause considerable plant damage by their feeding. Some are beneficial because they prey on other insects. A few bite humans on occasion.

During the study 19 species including two unidentified species of Hemiptera were observed. Five species were exclusive to vegetated sector while three were exclusive tot the urban sector. Density wise the urban sector was slightly higher due to the abundance of Shield bug and silk cotton bug.

Leaf Bug: The large and diverse insect family Miridae contains the plant bugs, leaf bugs, and grass bugs, and may also be known as capsid bugs. It is the largest family of *true bugs* belonging to the suborder Heteroptera, with over 10,000 known species and new ones constantly being described. They are small, terrestrial insects, usually oval-shaped or elongate and measuring less than 12 mm in length. Some are brightly colored, others drab or dark. Some genera are ant mimics at certain stages of life. Most of the more well-known mirids have received attention because they are agricultural pests. They pierce plant tissues and feed on the juices.
The leaf bug was observed through out the campus but were more in number in the vegetated sector.

Leaf footed Bug: They generally resemble shield bugs which are fairly, but not extremely close relatives. The hindlegs in members of this family are often modified, sometimes in elaborate ways; hence the common name. It appears that males of at least some species use these hind legs in combat over territories. All members of the family (Coreidae) are exclusively phytophagous. Leaf-footed bugs enter houses only by accident, when they seek hibernation quarters for the cold season
The leaf footed bug was observed in a few subsectors in both the vegetated and urban sectors.

Cotton Strainer Bug: The adult cotton stainer is a "true bug" with piercing, sucking mouthparts. The head and pronotum are bright red; the remainder of the body is dark brown crossed with pale yellow lines. The length is ½ inch or slightly longer. Immature stages are smaller but resemble adults without wings. Cotton stainer eggs are small, pale and laid singly on cotton plants or dropped on the ground near cotton plants. They are called cotton stainers because their red bodies get crushed along with the cotton they eat when it is harvested, and these stains are difficult to remove. Their feeding mechanism also cuts the fibres and hence affects the growth of the cotton ball.
During the present study the cotton strainer bug was found only in the U3 area of the urban sector.

Red Silk Cotton Bug This is a type of a Cotton strainer bug and during the present study was observed through out the campus except at the V2 sector. The red silk cotton bug were dominant in the U2 region.

Shield Bug: This beautiful insect has colourful wing cases which look like a shield on its back. It has mouthparts modified for sucking plant sap. Shield Bugs, so called from the general shape of the adults.

Shield bugs were observed through out the campus but were dominant in the urban sector.

Stink Bug: All adult stink bugs are shield-shaped, most are plant feeders (a few are predators). Farming areas can yield good numbers in crops like cabbage, cotton, etc. or in nearby roadside vegetation. Many species come to lights at night. Stink bugs have some natural enemies, including several common species of birds. As their name implies, stink bugs emit an unpleasant odor and repel many predators. The openings for these glands are readily seen on the last thoracic segment towards the sides of the insect. Nymphs hatch from these eggs and pass through five instars before becoming adults.
The stink bug was observed in almost the entire campus except the U1 subsector.

Spit Bug: The nymphs are commonly known as spittlebugs, or spit bugs, and their froth as cuckoo spit or snake spit. The froth serves a number of purposes. It hides the nymph from the view of predators and parasites, it insulates against heat and cold, thus providing thermal control and also moisture control. Without the froth the bug would quickly dry up. The nymphs pierce plants and suck sap causing damage, and much of the excess filtered fluids go into the production of the froth. A few species are serious agricultural pests. Adults normally are brown or green and dull colored, however, there are a few forms which are bright and attractively colored. All spittle bugs have a ring of spines on the apex of the tibia which distinguishes them from leafhoppers.

The spit bug was sporadically sighted in U1, V1 and V3 sectors only.

Jewel Bug: They can be distinguished from other bugs by their scutellum which completely covers the whole abdomen and wings. This is why sometimes they are miss-recognized as beetle. They are easily distinguished from beetles by having sucking mouthparts and the shield on the back is continuous, not the divided wings cover with separation at the middle.
The jewel bug was observed in the vegetated sectors i.e V2 & V3 only.

Assasin Bug: this is the predaceous hemiptera (true bugs) has front legs modified for grasping prey. It preys on other insects and benefits people.They use the long rostrum to inject lethal saliva that liquefies the insides of the prey, which are then sucked out. The legs of some of these bugs are covered in tiny hairs that serve to make them sticky to hold onto their prey while they feed. The saliva is commonly effective at killing substantially larger prey than the bug itself. As nymphs, some species will cover and camouflage themselves with debris, or the remains of dead prey insects. Some species have been known to feed on cockroaches or bedbugs (in the case of the masked hunter) and are regarded in many locations as beneficial. Some people breed them as pets and for insect control.

During the study the assasin bug was observed through out the campus except in the V3 sector. They were highly abundant in the U2 sector.

Cicada: have large eyes wide apart on the head and usually transparent, well-veined wings. Male cicadas have loud noisemakers called "timbals" on the sides of the abdominal base. Their "singing" is not the stridulation (where two structures are rubbed against one another) of many other familiar sound-producing insects like crickets: the timbals are regions of the exoskeleton that are modified to form a complex membrane with thin, membranous portions and thickened "ribs". Contracting the internal timbal muscles produces a clicking sound as the timbals buckle inwards. As these muscles relax, the timbals return to their original position producing another click. The interior of the male abdomen is substantially hollow to amplify the resonance of the sound. A cicada rapidly vibrates these membranes, and enlarged chambers derived from the tracheae make its body serve as a resonance chamber, greatly amplifying the sound. They modulate their noise by wiggling their abdomens toward and away from the tree that they are on. Average temperature of the natural habitat for this species is approximately 29°C (84°F). Cicadas like heat and do their most spirited singing during the hotter hours of a summer day. There are about 2,500 species of cicada around the world, and many remain unclassified. Cicadas live in temperate to tropical climates where they are among the most widely recognized of all insects, mainly due to their large size and remarkable acoustic talents.

Cicada were recorded only in V1 and V4 sector during the study.

Leaf Hopper: Leafhoppers are found all over the world and constitute is the second-largest family in the Hemiptera. They have at least 20,000 described species. Leafhoppers have piercing-sucking mouthparts, enabling them to feed on plant sap. A leafhoppers' diet commonly consists of sap from a wide and diverse range of plants, but some are more host-specific. Leafhoppers mainly are herbivores but some are known to eat smaller insects such as aphids on occasion. A few species are known to be mud-puddling, but as it seems females rarely engage in such behavior. Found almost anywhere such plants occur, from tropical rainforests, to arctic tundra. Leafhoppers range in size from 2 - 30 mm in length. Several leafhopper species are important agricultural pests. Leafhoppers can transmit plant pathogens such as viruses, phytoplasmas and bacteria.

The leaf hoppers were observed in the entire campus during the study, but were abundant in the vegetated sector.

Flatid: Members in this family usually have the triangular and broad fore wings. They include the Plant hoppers. They are small plant-feeding insects ranging in colour from green, through yellow-green to brown. All of them jump, so their name hoppers.

There were just a few sporadic sightings in U1 and V4 sector during the study.

Tree Hopper: They are best known for their enlarged and ornate pronotum, which most often resembles thorns, apparently to aid camouflage. But in some species, the pronotum grows to a horn-like extension, and even more bizarre and hard-to-describe shapes. They pierce plant stems with their beaks, and feed upon sap. The immatures can frequently be found on herbaceous shrubs and grasses whereas the adults more often frequent hardwood tree species. Excess sap becomes concentrated as honeydew, which often attracts ants. Some species have a well developed ant mutualism, and these species are normally gregarious as well, which attracts more ants. The ants provide protection from predators. Many species are gregarious, forming large and often conspicuous groups of adults and immatures. Some of these are ant-mutualistic and may also exhibit presocial behavior. Most species are solitary and these are often cryptic, at least as immatures. True to their name, treehoppers are most abundant in forest particularly in the tropics, where they utilize a wide variety of tree species as host plants.

The tree hopper was observed in the practically less disturbed V1 sub sector in the campus.

Horned Tree Hopper: They are best known for their enlarged and ornate pronotum, which most often resembles thorns, apparently to aid camouflage. But in some species, the pronotum grows to a horn-like extension, and even more bizarre and hard-to-describe shapes are also found. It feeds on the sap of the plants. This sap on digestion is converted into sweet honeydew and excreted out. Ants are attracted towards this honeydew naturally and they extract it for themselves. In exchange ants provide the hopper the protection from its predators.

Horned tree hopper was observed in the entire Urban sector while only in the V3 and V4 sector.

Water Skater: Water striders can vary in length from 1.6 mm to 36 mm. Similarly, their body shape ranges from slender and elongate to almost completely round. One common feature is their elongated legs (only the first pair is short and stubby) which the animals use for moving over the water surface. The body and legs are covered with tiny hairs. These are predatory insects which rely on surface tension to walk on top of water. They live on the surface of ponds, slow streams, marshes, and other quiet waters. There they hunt for insects and other small invertebrates on top of or directly below surface using their strong forelegs which end with claws. They can move very quickly, up to 1.5 m/s. They paddle forward with the middle pair of their legs, using fore- and hind legs as a rudder.

The water skater was observed only int V4 sub sector of the vegetated sector.

Scale insects: The **scale insects** are small insects and there are about 8,000 species of scale insects. Most

scale insects are parasites of plants, feeding on sap drawn directly from the plant's vascular system. A few species feed on fungal mats and fungi, Scale insects vary dramatically in their appearance from very small organisms (1-2 mm) that occur under wax covers (some look like oyster shells), to shiny pearl-like objects (about 5 mm), to creatures covered with mealy wax. Adult female scales are almost always immobile (aside from mealybugs) and permanently attached to the plant they have parasitized. They secrete a waxy coating for defense; this coating causes them to resemble reptilian scales or fish scales, hence the name. Scale insects feed on a wide variety of plants, and many scale species are considered pests.

The scale insects were observed thourgh out the campus except in the V2 subsector.

Derbid Plant hoppers : This is the least studied from the family and are most abundant in the tropics. There is very little information on the biology and life cycle of planthoppers. Planthoppers suck plant juices from the phloem of a plant, or feeds from leaf tissues. They are often found feeding along the underside midrib of leaves of large-leaved plants such as banana. The planthoppers produce honeydew, a sweet and watery excrement that serves as the substrate for the growth of sooty mold. Sooty mold blackens the leaf, decreases photosynthesis activity, decreases vigor, and often causes disfigurement of the host.

In the present study the plant hoppers were observed only in the urban subsector.

Order Diptera (Plate 27)

Diptera are usually winged, but have only one pair of wings with few veins. Hind wings are represented by a pair of slender, knobbed structures called **halteres**. A few forms are wingless as adults, primarily parasites. Mouthparts are formed for sucking or piercing and sucking.

Fly larvae are entirely different from the adults and are usually found in different habitats. Immatures usually are known as maggots. Immature Diptera have mouthparts, modified for sucking or for piercing and sucking. Primitive flies including midges and mosquitoes which have head capsules but most immature flies have poorly formed heads. Many fly larvae are associated with aquatic habitats or very moist areas with organic matter. Some are internal parasites of mammals. Larvae may be thin and elongate or thin and wide. Some are elaborately ornamented.

True flies or Diptera occur in many shapes and sizes and are a very important group. Flies can be very small to over 1 inch in length. The order includes forms that are parasitic, predaceous and others that live on either living or dead plant or animal material. Some members of the order cause a great amount of damage to crops. Many harmful flies spread diseases, such as mosquitoes that carry yellow fever and malaria, and are responsible for millions of human deaths. This is one of the most important orders from the standpoint of human health because of the species that carry diseases. 20 types of Dipteran forms were observed of which 10 were unidentified.

Mosquitoes could be the most encountered insects, they usually find us first before we find them. However, only a few species of mosquitoes suck human blood. Some species suck blood from other vertebrate animals, such as birds, reptiles and frogs. Some species do not suck blood at all. For those blood-sucking species, only the females suck blood. They require a blood meal before their eggs can mature. They suck blood using their elongated mouth-parts to pierce the host's skin. Males do not suck blood and usually have the slender body. The mosquitoes can be distinguished from flies of other families by their scales on wing veins. Most of them also possess a long piercing proboscis. Their larvae are all aquatic. The slightest accumulation of water after rain suffices for some species.
The mosquitoes were found through out the campus.

House flies (Family Muscidae) are 3/16 to 1/4 inch long with robust bodies and two clear wings. The thorax is marked with four dark stripes. Larvae are called maggots and are creamy-white and cone-shaped, with the hind end blunt and bearing breathing holes (spiracles) tapering to the head which bears black hook-like mouthparts.
They can be attracted to various substances including sugar, sweat, tears and blood. Larvae occur in various habitats including decaying vegetation, dry and wet soil, nests of insects and birds, fresh water, and carrion.

Adults of many species passively vector pathogens for diseases such as typhoid fever, dysentery, anthrax, and African sleeping sickness.
House flies were observed in the entire campus and were more in the vegetated sector compared to the urban sector.

Hoverflies Flies in the family Syrphidae are commonly known as hoverflies, flower flies, or syrphid flies. As their common names suggest, they are often seen hovering or nectaring at flowers; the adults of many species feed mainly on nectar and pollen, while the larvae (maggots) eat a wide range of foods. The larvae are insectivores and prey on aphids, thrips, and other plant-sucking insects. Aphid-feeding hoverflies are being recognized as important natural enemies of pests, and potential agents for use in biological control. Some adult syrphid flies are important pollinators.
Hoverflies were observed in the entire campus and were more in number in the U2 sub sector.

Robber flies Insects in the Diptera family Asilidae are commonly called robber flies. Adult stages are medium to large (3/8 to 1-1/8 inch) flies often observed on stems of plants, on the ground or flying low. Species vary in appearance and some mimic wasps and bees. Most species are gray to black, hairy-bodied, have a long, narrow, tapering abdomen containing segments that may be banded, patterned or contrasting in color. The heads of adults have a depression between the eyes when viewed from the front. They have long, strong legs for grabbing prey. Adult robber flies attack other flies, beetles, butterflies and moths, various bees, ants, dragon and damselflies, Ichneumon wasps, grasshoppers, and some spiders.
The robber flies were highly dominant in the vegetated subsectors while only being observed in the U1 subsector.

Bee flies (Diptera: Bombyliidae) are a family of flies, that include many species of stout-bodied, yellow haired flies often seen hovering or resting on the ground or on flowers in open, sunny areas. Many have wings marked with darker patterns and they hold their wings outstretched. Adults generally feed on nectar and pollen, thus are pollinators of flowers. Larvae are parasitic on immature stages of other insects including Coleoptera, Diptera, Hymenoptera, Lepidoptera, Neuroptera and Orthoptera.
Beeflies were observed in the entire campus except in the V1 sub sector of the Vegetated sector.

Crane flies Insects in the family Tipulidae are commonly known as crane flies. Crane flies are large tan-colored fragile flies with long legs. Adults and larvae do not feed on mosquitoes. Larval forms of crane flies are grey-brown cylindrical larvae which may bear fleshy lobes on the (posterior) end. Occasionally, the segments towards the end of the body can be greatly expanded. Adult crane flies feed on nectar or they do not feed at all; once they become adults, most crane fly species live only to mate and die.
In the campus the crane flies were more dominant in the vegetated sector and were sporadically sighted in the urban sector.

Long-legged flies (Family Dolichopodidae) This is a large family of flies, and species vary in their appearance and biology. In general, adult flies are medium to small, slender flies with green, blue or copper metallic colored bodies and long legs. Their wings are clear or marked with darker areas towards the wing tips. Wing venation patterns are characteristic for identification to family.
The long legged flies were more in number in the U1 & U2 sub sector while seen sporadically in all the vegetated sub sectors.

Blue Bottle Flies are from the Blow Fly family. They are larger than house flies, growing about half an inch long. Their head and thorax (front and middle sections) are gray, the abdomen (large rear section) is bright metallic blue. They have red eyes and clear wings. Blue Bottle Flies live just about anywhere, including woods, fields, parks, and farms. They seem to prefer shady places. Blue Bottle Flies often enter homes. This fly eats from dead animals or meat, living animals with open wounds, animal poop, or some other decaying matter. Predators of Blue Bottle Flies include spiders, birds, and bats. Larvae and pupae may be eaten by beetles or centipedes.

The blue bottle fly was observed in the entire campus but in greter abundance in the urban sector.

Green bottle fly is a common blow-fly found in most areas of the world, and the most well-known of the numerous green bottle fly species. It is 10-14 mm long, slightly larger than a housefly, and has brilliant, metallic, blue-green or golden coloration with black markings. It has black bristle-like hair and three cross-grooves on the thorax. The wings are clear with light brown veins, and the legs and antennae are black.
In the campus the green bottle fly was not observed in U2 and V2 subsectors

Lauxaniid Flies has two pair of fronto-orbital bristles. They are usually small to medium size, with clean or marked wings. They like to rest in shaded forest or vegetation. Their larvae are usually found on fallen leaves or other rotting plant materials.
The lauxaniid flies were found in the vegetated sector during the study.

Flesh fly -Flies of the Diptera family Sarcophagidae (from the Greek *sarco-* = flesh, *phage* = eating; the same roots as the word "sarcophagus") are commonly known as flesh flies**.** Flesh flies are medium to large sized flies and usually have three dark thoracic stripes and mottled abdomens. Many of the common species have a red tip on the abdomen. Though some species may be smaller than house flies, most flesh flies are about 1/3 to 1/2 inch long. Due to their markings and coloration, sometimes House Flies are confused with Flesh Flies. Flesh flies are larger than house flies. Flesh flies have a checkerboard pattern on top of their abdomen and are gray in color. Most flesh flies breed in carrion, dung, or decaying material, but a few species lay their eggs in the open wounds of mammals; hence their common name. Some flesh fly larvae are internal parasites of other insects. These larvae, commonly known as maggots, live for about 5-10 days, before descending into the soil and maturing into adulthood. At that stage, they live for 5-7 days.
The flesh flies were observed in the entire campus during the study.

Order Lepidoptera (Plate 28 - 33)

This is a large order of insects and one of the best known. It contains some of our most important pests; such as the bollworm, armyworms, cutworms, codling moth, clothes moth and cabbageworm.

Lepidoptera usually have four well developed wings covered with overlapping scales as adults. A few adult Lepidoptera have reduced wings or none at all. Mouthparts of the adults are formed for sucking but some have reduced or non-functional mouthparts.

Butterflies generally fly during the day and can be recognized by the clubbed antennae. Skippers are much like butterflies but have the end of the antennae hooked rather than clubbed. Moths generally fly at night but there are exceptions. Moths have antennae that are linear or feathery but not clubbed.

Immature stages (larvae) are known as caterpillars. Names like cutworms, armyworms, hornworms and many others apply to groups of caterpillars that may be related taxonomically or by similar biology. Their mouthparts are formed for chewing. The well developed head capsule has short antennae. On the front of the face of caterpillars is a groove or suture shaped like an inverted "V." On caterpillars there is a second suture called an adfrontal suture just under the "V." Almost all have crochets (small hooks) on the prolegs even if the prolegs are reduced. These hooks help the caterpillar hold onto the substrate. Caterpillars feed on foliage, stored products, linens. Some are leafminers and a few are borers in herbaceous and woody plants.

Most Lepidoptera feed on leaves of plants in the larval stage. Some caterpillars bore in plant stems, others are leafminers and a few are ever predators. All Lepidoptera have complete metamorphosis. Microlepidoptera are often under 1/4 inch, the largest moths and butterflies are over 3 inches.

Butterflies.

Of all insects the butterflies are the most colourful and conspicuous, with approximately 18,000 species of butterflies the world over (Kehimkar, 2008). Gaonkar (1996) estimated 1501 number of butterfly species in India representing all the five families found across the world. In Mumbai 150 species are reported representing the five families. Like wise, during the present study of the IIT-Bombay campus at Powai a total of 85 species were recorded during the six months covering the three seasons.

Among the five families Nymphalidae was the most dominant one with 29 species of butterflies, followed by Lycaenidae (28 species), Pieridae (18 species), Hesperidae (15 species) and Papilionidae (7 species).

Psyche, Gram blue and common Indian crow were the most common butterflies.

The butterflies of the family **Nymphalidae** (Plate 28& 29) are popularly known as "Brush-footed butterflies". There are over 100 species in Peninsular India. These butterflies are diverse in their body forms and habits and hence generalizations are difficult, except for the pupae of all species are suspended. These butterflies are further classified into several sub families. In the present study, seven sub families were observed.

Angled castor (*Ariadne ariadne*) The angled castor is a weak flier and flies with jerks sailing intermittently and halting to rest close to the ground. It has a wing span of 45 – 60 mm dark ochre coloured butterfly with sparse, wavy dark brown lines on its wings; the forewing has a conspicuous white spot. It is found around human habitation and near disturbed patches of ever green forests and scrub vegetation.
The butterfly was sighted only once in the vegetated sector.

Common Castor (*Ariadne merione*) The common castor is a rusty brown butterfly with wavy black lines on its wings. A white dot is present on the front margin of its fore wings. The hind wings are not as wavy as the angled castor. The caterpillars of the butterfly feed on the Castor plant and the butterfly is mostly seen in close association with the plant. It can also be seen in drier grassy areas where the other larval hosts plants occur.
This butterfly was common in the campus.

Black rajah (*Charaxes solon*) It is an active flier with a wing span of 70 – 80 mm. Upperside blackish brown or black. Both the wings have a transverse yellow band; the band in fore wing broken into 7 or 8 spots and sub-terminal series of smaller yellow spots. It is a strong and actively flying butterfly with wide distribution. It is abundant at low elevations wherever tamarind, its host plant, is distributed. When it settles, it is difficult to locate because of protective colouration. It is attracted to ripe fruits and palm juices. Male found in the vicinity of water.
This butterfly was observed only in the urban sector.

Common Nawab (*Polyura athamas*) Upperside is black. Both wings have a broad, transverse pale sulphur-yellow discal band with greenish tinge. Fore Wing with a large apical yellow spot and a small dot beyond. Hind Wing bluish grey with 2 pointed tails, 2 rows of light and darker terminal yellow spots and a large blue-bordered yellow spot in the tornal angle. Underside discal band bordered with dark brown band and black lines on the inner side. It occurs in jungles or forested regions and open country. The butterfly readily comes to animal dung, urine and dead crab than flowers. Basks usually on tree-tops but often comes down to damp patches. It settles down on low leaves with closed wings. Wingspan 60-75mm.
The Common Nawab was observed in both the Urban and Vegetated sector.

Plain Tiger (*Danaus chrysipus*) This is a tawny medium sized butterfly with a wing span of 70 – 80 mm. The body is black, spotted with white. The apical half of the fore wing is black and marked with a pure white band. The hind wing has three small black spots approximately at the center. The hind wing has a thin, black border that encloses a series of semicircular white spots. The male is smaller than the female. The butterfly is common clearings, disturbed vegetation, gardens near human habitation and near riversides. It is an unpalatable species due to the alkaloids that it stores from the host plants such as *Calotropis gigantea*.
The butterfly was observed through out the campus.

Striped Tiger (*Danaus genutia*) This tawny butterfly with a wing span of 72 – 100 mm has broad and black veins on its wings, giving it a striped appearance. The margins of the wings are black with two series of white spots. It is common in scrub jungles, human habitation as well as dry and moinst deciduous forests. It is a strong flier but never flies fast or very high. It is a common visitor to urban gardens.
It was observed in the entire campus but was more dominant in the vegetated sector.

Common Indian Crow (*Eulopea core*) This is a glossy brown butterfly, paler on the underside and rich chocolate-brown on the upperside, especially when the individual is fresh. It has a wing span of 85 – 95 mm. This species thrives in all habitats, and usually comes to flowers and wet mud.
The butterfly was seen in the entire campus.

Glassy tiger (Parantica aglea) The butterfly with a wingspan 70-85 mm, has a dark brown upperside with extensive transparent, bluish-white streaks and spots. Fore Wing cell streak divided lengthwise into 3 portions and an elongated streak below the cell. Hind Wing with broad discoidal streaks and spots. A weak flier compared to other Tigers, comes out of forests only to visit flowers of Lantana, Crotalaria sp, etc. a known migrant and frequents damp patches occasionally.

The butterfly was observed in both the urban and vegetated sectors.

Blue Tiger (*Tirumala limniace*) One of the commonest butterflies in India, both in plains and in hills except the deserts and higher altitutes. A slow flier with a wing span of 90 – 100 mm flutters the wings majestically in the wooded places and hedges. It can be identified from the other tigers by the black upperside with irregular pale blue streaks and marginal spots. Underside is golden brown. Fore Wing has black basal area While alighting on a flower flutters its wings vigorously and while sipping nectar, keeps the wings spread motionless. Fond of flowers of pink Cocks'comb, Aztec Marigold, Lucerne, Lantana, Heliotrope, Sunnhemp etc.

The butterfly is observed in the entire campus.

Tawny Coster (*Acraea violae*) The tawny red coloured buttelfly with fore wings long but broad and rounded at the apex is common throughout the country in areas of heavy rainfall. It has a wing span of 50 – 65 mm, a slow flier, fluttering unsteadily, close to the ground. Often found basking in the early morning hours. Flowers are the sole source of food for the butterfly hence found close to the undergrowth and herbs. The butterfly exudes a yellowish, bad smelling, oily liquid when disturbed, perhaps for protection.
The butterfly is found in both the urban and vegetated sectors.

Common Leopard (*Phalanta phalantha*) This is a bright tawny butterfly with a wing span of 50 – 60 mm marked with black spots. The underside is pale but glossy and fresh specimens have a bluish or purple sheen. This butterfly is an insect of dry weather occurs at the edges of the jungles, in the plains and gardens. It avoids shady places and drinks from damp patches and on wet roads during hot weather. It feeds from flowers where it settles with its wings half open. It does not stay on a single flower for long and usually walks on to the next one if the flowers are in inflorescence.
Sporadically observed in both the sectors.

Common Baron (*Euthalia aconthea*) The butterfly is dark olive-brown on the upperside. Fore Wings in male are dark brown at the base with 3 U- shaped marginal bands and 2 groups of white spots. Hind Wing has a pinkish tinge at the anterior border, 4 black spots at the base and a submarginal row of black spots. Female is olive brown, similar to male but with larger white markings and more rounded Hind Wing. Underside grayish brown with grey markings at the apex and base, marked as above, black spots along the wing margins and blackish rings at the base. Wingspan 55-80mm. The butterfly relishes fallen rotten fruits instead of flowers for the alcoholic content. It frequently visits wet soil patches and very occasionally bird droppings. Mango is its preferred larval host plant.
The butterfly was observed more in the urban and less in the vegetated sector.

Gaudy Baron (*Euthalia lubentina*) The Butterfly is brightly marked with crimson spots and inhabits deciduous and semi-evergreen forests. It's Wingspan is 55-80mm and is a strong flier. It often settles on tree tops. Both the sexes are dark green with iridescence, having red and black spots on the upper hind wing. It is an avid mudpuddler and is attracted to the fruit and tree sap.
The Gaudy baron was observed only in the urban sector.

Commander (*Moduza procris*) This is one of the vividly coloured forest butterflies with a wing span of 60

– 75 mm. Both the male and female appear similar with a brilliant reddish brown upperside. The underside is predominantly greyish white. It is found along forest roads, edges, and in semi to evergreen forests. It is also found to be close to human settlements. The butterfly is known to drink from wet patches but is also fond of nectar and visits flowers of herbs, shrubs, small trees rarely ascending to large trees.
The commander was observed in both the sectors during the study.

Sailer (*Neptis sp*.) The butterfly with a wing span of 50 – 60 mm flies by flapping the wings repeatedly and then gliding along gracefully. It visits flowers, damp patches and attracted even to human body sweat, but does not participate in large, joint mud puddling. Very bold butterfly and can be even approached very close, often seen basking in the sun. Several species of this butterfly are seen.
In the present study sailers were observed in large numbers in the entire campus. The **common sailer (*Neptis hylas*)** was identified and observed in the Urban sector.

Great Eggfly (*Hypolimnas bolina*) The Great Eggfly is a black-bodied butterfly with a wingspan of about 70–85 mm. The upper side of the wings are jet black, offset with three pairs of white spots & two on the forewing and one on the hind. These white spots are surrounded by purple iridescence. In addition, the upper side of the hind wing bears a series of small white dots. The upper side of the wings of the female is brownish black and does not have any spots like those of the male. The Great Eggfly is a fairly common butterfly found in lightly wooded areas, deciduous forests, thick and moist scrub and the greener parts of human habitation.

The great eggfly was observed in both the sectors.

Danaid Eggfly (*Hypolimnas misippus*) This butterfly is a strong and fast flier with a wing span of 70-85 mm. The male is jetblack above with two glistening white oval spots. A large spot on the hind wing and a small one on the fore wing, in addition there is another small white spot at the tip of the fore wing. The underside is light rusty brown with a golden-yellow tinge. The female appears different from the male, is tawny in colour and mimics the Plain tiger. The Danaid Eggfly is a fairly common butterfly found in lightly wooded areas, deciduous forests, thick and moist scrub and the greener parts of human habitation, it avoids grasslands and ever green forests.

The butterfly was observed in both the sectors but more in the urban sector.

Peacock Pansy (*Junonia almana*) The peacock pansy is bright tawny coloured butterfly with large eyespots and a wing span of 60 – 65 mm. It is the most common butterfly in our country. Found basking during early morning in sunny patches, often surrounded by darker shady areas when it appears like an orange-faced Owl, thus scaring away potential invertebrate predators. Like other pansies, highly territorial in behaviour and often chases away intruders.
Observed in both the sectors during the study.

Grey Pansy (*Junonia atlites*) It is a creamish – grey butterfly with brown lines and a row of lback spots near the wing margin and a wing span of 55 – 65 mm. It is the least common pansy in India, found at low elevations in regions of heavy rainfall. It is found near water bodies, frequently seen in paddy fields, seldom in jungles and never in dry areas.
This was a more common butterfly in the entire campus.

Chocolate Pansy (*Precis iphita*) The upperside is dark olive-brown with indistinct dark brown bands. Basal area of both wings more greenish. Fore wing with 1 or 2 (rarely without) minute ocelli and Hind Wing with an indistinct row of 5 dark brown ocelli. Underside dark brown with wavy lines and less distinct ocelli. Wingspan is 55-80 mm. It is found in woodland and forest areas.

Observed in the entire campus.

Lemon Pansy (*Junonia lemonias*) This is a brown butterfly with numerous eyespots as well as black and

lemon yellow spots and lines on the fore wings and hind wings. It has a wing span of 40 – 60 mm. Very bold butterfly with strong territorial and aggressive behaviour but not as much as the peacock pansy. It flies quickly and strongly but with less fluttering of wings. Generally rests on the ground but not so frequently as the other pansies and visits damp patches more often than the other of the genus.

Observed through out the campus but less in comparison to chocolate and grey pansy.

Blue Oakleaf (*Kallima horsfieldi)* This is a large butterfly with a wing span of 85 – 110 mm The upperside is indigo blueto dark greenish, with oblique discal band pale blue or bluish white and apex probably black. This butterfly preferes evergreen, mixed decidious and moist decidious forests with good rainfall. Flight is rapid but erratic. It is fond of tree sap and overripe fruit. Flies along nullahs, damp patches and clearings. Settles with the wings closed to appear like a dried leaf.
Observed in both the sectors.

Common Palmfly (*Elymnias hypermnestra*) The Upperside is blackish brown with purple gloss. Fore wing with a sub-apical blue or bluish green band and a marginal series of 3 blue spots. Hind wing with a broad chestnut border. The underside is brown or grey or yellowish brown. Outer margin with a narrow, well defined black border. Upperside reddish brown with apex and borders dark brown, having white spots. The wingspan is 60-80 mm. This most common and widely distributed Palmfly is common in jungles and palm plantations. Avoids bright sunlight and rarely comes out into the open. With weak flight, settles for a long time on leaves or trunks of palm trees at some height from the ground. It comes to overripe fruit and animal urine.
The butterfly was observed in the entire campus but was more abundant in the Urban sector.

Common Evening Brown (*Melanitis leda*) This is an inconspicuous brown butterfly with a wing span of 60 – 80 mm. The upper side is dark brown with an eye spot and a white pupil on the fore wings surrounded by orange patches. The underside is variable. These butterflies rests camouflaged among fallen leaves on the forest floor and hence merge with the surrounding. The butterfly is common throughout India, except in the arid northwest region. Usually active at dawn and just before dusk, often entering houses during the nights. Weak flier with jerky flight. Though visits flowers, it is more fond of over ripe fruits, tree sap and toddy, often more abundant around tapped palm trees.
The butterfly was observed in both the sectors and dry season form was also observed.

Common Bushbrown (*Mycalesis perseus*) This is a medium sized (wingspan 38 – 55 mm), brown, inconspicuous butterfly. There is a eyespot on the upperside of each forewing at the outer margin. The underside varies with the seasonal forms. The flight is unstable jerky and is very close to the ground, it moves around shrubs making it difficult to follow it. It is common in Bamboo forests, but also inhabits deciduous, semi to evergreen forests.
The butterfly was observed in both the sectors.

Long branded Bushbrown (*Mycalesis visala)*The butterfly is somewhat similar to the common bushbrown but darker and 45 – 55 mm in wing span. The male has a brown to pale brown band on the underside fore wing.
During the study was observed only in the vegetated area.

Bushbrown During the study several species of Bushbrown were observed in the entire campus, including the dry season forms.

Common Fourring (*Ypthima huebneri*) The butterfly has a wingspan of 30 -40 mm the underside of the forewing has four yellow ringed black eyespots. Upperside is grayish brown. The upper forewing has a large yellow ringed eyespot near the apex. It is found in forested and open areas and visits flowers for nectar.
The butterfly was observed in the entire campus.

The butterflies of family **Lycaenidae** (Plate 29 & 30) are commonly called as blues and are the worlds'

largest family of butterflies. India has 450 species, 28 species were observed during the present study.

Sunbeam (*Curetis sp*.) These tailless forest dwellers are strong fliers. Both the sexes appear very similar with glossy white undersides, but males are red on the uppersides, while females are white with black borders. Males are often seen on damp patches, bird droppings and animal dung.
During the present study the sunbeams could not be identified till the species level, but were observed in both the sectors.

Apefly (*Spalgis epius*) This is a dainty little butterfly with a wing span of 20 – 30 mm. It has a fast and erratic flight and keeps to the bushes. The butterfly is brown on the upperside the underside is grey with several fine wavy vertical lines.
Sporadically sighted in both the sectors.

Common Hedge Blue (*Actolepis puspa*) This is a small, white butterfly with a pure white face and black eyes. It has a wingspan of 28 -35 mm. There are black lines and spots on the undersides of its wings and a glossy pale blue brilliant colour on the upper surface. It lacks tails on the hind wings. It is a weak flier and keeps close to bushes and streams and where shade is available.
The butterfly was observed in both the sectors.

Common Pierrot (*Castalius rosimon*) It is a small butterfly with white face and black eyes (Wingspan 24 – 34 mm). The underside of its wings is marked with black spots. There is a distinct central region of the hind wing that lacks any markings. On the upperside, the bases of the wings are metallic green. The wing borders are dark brown or black with tiny white spots. The butterfly is common in open forests, grasslands and near human habitation.
The butterfly was observed in both the sectors.

Angled Pierrot (*Caleta caleta*) This is a small black and white butterfly (Wingspan 26 – 32 mm), with broad black markings on white underside. Male upperside is dark brownish black, a broad medial oblique white band across both fore and hind wings. The butterfly flies rapidly, close to the ground visiting low flying bushes. Found along nullahs and shady paths. Visits damp patches
The butterfly was observed in both the sectors.

Forget-me-not (*Catochrysops strabo*) The butterfly is pale grey on the underside with white edged fawn discal bars, the wings are narrow with a wingspan of 25 – 35 mm. These are fast fliers prefers open dry habitats of scrub and dry deciduous forests. Always in sunshine, common along road sidesand degraded areas, but keeps away from cultivation. Visits flowers and wet patches.
This butterfly was exclusive to the vegetated sector.

Lime Blue (*Chilades laius*) It is a light grey, tailless blue butterfly with a wing span of 26 – 30 mm. The underside has numerous dark spots, but the most prominent of these are two that are joined to each other at a right angle forming an 'L' that distinguishes it from the others. It is commonly found around human habitations and riparian forests. It is a modest flier and flutters close to shrubs and small trees.
This butterfly was observed in both the sectors.

Gram Blue (*Euchrysops cnejus*) This is a tailed light grey butterfly marked with thin lines and spots. The pattern of these markings is the key to identification of the species. There is a thin line composed of light brown spots at the outer side of both its wings, in addition to the cell end bars. Near the base of the hind wing are four black dots. It is a very common butterfly in open, drier areas where its larval host plants grow. The gram blue is fond of sunshine and avoids any kind of shade. (Wingspan25 – 33 mm.)
It was the most abundant butterfly in the campus.

Zebra Blue (*Leptotes plinius*) With a wing span of 22-30 mm this species distantly resembles the pierrots. Its wings are translucent and the markings on the undersurfacemay be seen through the upperside when the wings are open. The black and white 'zebra' pattern on the underside of the wings is unique and helps in

identification. This butterfly frequents all open and dry areas to evergreen forests. It is not a very strong flier but can sustain its flight for some time.
This butterfly was observed in both the sectors.

Tiny Grass Blue (*Zizula hylax*) This is the second smallest butterfly in our country with a wing span of 16 - 24mm. The male has pale blue glistening upper surface while the female is brown. Both have dark thin borders on their wings. On the underside of its wings are fine, small dark brown or black spots. The butterfly uses a variety of habitats but prefers moist, yet open and sunny places. It is also found around human habitation.
This butterfly was observed in both the sectors.

Pale Grass Blue (*Pseudozizeeria maha*) It is the largest grass blues of India with a wing span of 26 – 30 mm. The upperside is pale blue and the underside is almost white. The spots are rounded and faint. It flies very closely to the ground in weak flight for shorter distance only.
This butterfly was observed in both the sectors.

Dark Grass Blue (*Zizeeria karsandra*) This is a medium size butterfly with dark blue upperside, the underside is usually brown, occasionally grey. The spots on the wings are rounded and dark. It has a low ground level flight on grassy patches.
This butterfly was observed in both the sectors.

Grass blue During the study there were some grass Blues which could not be identified in the field and were seen spread out in the campus.

Grass Jewel (*Freyeria trochylus*) This is the smallest butterfly found in India with a wingspan of 15-22 mm. The upper and underside of the butterfly is brown. The underside has light brown spots. The margins on the upperside have metallic orange crowned spots. The butterfly has a fluttering close to the ground flight and prefers open drier habitats.
This butterfly was observed in both the sectors.

Pea Blue (*Lampides boeticus*) The butterfly has a wingspan of 24 – 36 mm, and can be readily identified by light to dark reddish lines on the white underside of its wings. There is a distinct white band within the outer margin of the hind wing where these lines are absent. It has a strong flight and visits flowers and damp patches. Common in agricultural and cultivated areas.
This butterfly was observed in both the sectors.

Common Lineblue (*Prosotas nora*) This is a small tailed blue butterfly with a wingspan of 18 – 25 mm. The underside of its wings is pale brown with thin, paired, whitish lines. The upperside of the wings of the male is dark violet with a thin dark border while the female is brown. The butterfly has a fairly strong flight and comes to flowers and tall trees in bloom for nectar. Males are seen in large numbers mudpuddling and on bird and animal droppings.
This butterfly was exclusive to the vegetated sector.

Line Blue There are several species of lineblues in the Peninsular India. Many species have tails or are tailless, while there are some that occur in both forms making it difficult to identify in the field.
During the study several such species were observed in the vegetated sector and a few in the urban sector.

Common Cerulean (*Jamides celeno*) The underside of the wings of this small attractive butterfly is grey-white in the wet season form and pale brown in the dry season form (Wing span 27 – 40 mm). It is marked with long straight lines and their pattern is the key to distinguishing it from the other species. The butterfly prefers partially sunlit places. It flies erratically but not fast stays close to the bushes and avoids sitting on the ground. It avidly feeds on nectar.
The butterfly was more in numbers in the vegetated sectors than the urban sectors.

Dark Cerulean (*Jamides bochus)* The butterfly with a wing span of 25 – 34 mm is smaller than the common cerulean. It is darker brown on the underside and its upperside is a dazzling, deep metallic blue. Its lines are broken into smaller fragments and therefore it resembles the lineblues more. It has a strong and rapid flight around bushes. It is not known to visit flowers but males are seen on damp patches.
This butterfly was observed in both the sectors.

Cerulean During the study the cerulean were observed in the entire campus but it was not possible to identify till the species level due to their flight.

Red Pierrot (*Talicada nyseus*) The butterfly has a wing span of 30 – 36 mm, its flight is slow fluttering one. It is blackish brown on upperside with broad orange red area on the lower half of the Upper hind wing. Underside mainly white with black spots. The buttefly is usually seen in gardens, but prefers moist, sheltered habitats in forests as well as urban gardens where food plants grow.
The butterfly was sighted only once in both the vegetated and urban area.

Rounded Pierrot (*Tarucus nara*) The butterfly has a tailed hind wing and the underside is white with prominent black streak. The black marks elongated into streaks rather than rounded spots. Male is dull violet while the female is dull brown on upper side. It has a wing span of 23 – 28 mm and flies low over grasses and shrubs.
The butterfly was exclusive to the vegetated sector.

Plum Judy (*Abisara echerius*) The butterfly is reddish brown with pale green eyes and a wing span of 40 – 50 mm. Hind wing is prominently toothed, male is purple brown on upper side and the female is brown. The fore wings are never held together but parallel to each other. It is a shade loving butterfly, extremely active in the evenings.
The butterfly was exclusive to the vegetated sector.

Common Silverline (*Spindasis vulcanus*) It is a vividly marked butterfly with a an unmistakable form. Its wings are narrow and pointed and the hind wing has a large lobe with two long tails, the lower one being longer. It has a wing span of 26- 34 mm. The underside of the wings is a light yellow with brilliant red bands. The bands are surrounded by thin black lines on either side and also have central golden lines.
The butterfly was sighted in both the urban and vegetated area.

Peacock Royal (*Tajuria cippus*) The Peacock Royal has a pale grey-white underside and a brilliant, metallic blue upperside. The underside is marked near the outer margin of the wings by a series of thin, black lines. On the hind wing is a pair of long thin, black white tipped tails. The bases of the tails are orange with black spots. The lower tail is longer. It has a wing span of 31 - 45 mm with a swift, strong and smooth flight.
The butterfly was restricted to the vegetated area.

State Flash (*Rapala manea*) This is a strong flier with a wing span of 30 – 33 mm. The underside is brown and marked with a thin, slightly curved darker band that has a whitish margin at its outer edge. The upper surface of the wings is dark slaty blue in male while female is purplish blue. Due to its inconspicuous colors it is difficult to follow its trail in the field.
The butterfly is exclusive to the vegetated area.

The butterflies belonging to the family **Peridae** (Plate 30 & 31) are commonly called as Whites and yellows, because their wings are mainly white or yellow, with black, red, orange or yellow markings. There are 109 species recorded in India of which 18 were observed during the study in the campus.

Common Emigrant (*Catopsilia pomona*) The butterfly has a wing span of 55 - 80 mm. this is one of the most variable buttefly species in India, as far as colouration and size is concerned. The colour of its wings ranges from white with only basal areas of the wings yellow of varying shades to completely lemon yellow. The butterfly is a lively, erratic and powerful flier.
The butterfly was sighted in the entire campus but was abundant in the urban sector.

Mottled Emigrant (*Catopsila pyranthe*) This is a slightly smaller butterfly than the common emigrant with a wing span of 50 – 70 mm. The male is greenish while the female is yellow and both have fine dark grey or brownish striations on the underside of the wings. It has a fairly strong jerky flight and is common to the gardens and roads.
During the study it was observed only in the urban sector.

Emigrant (*Catopsila sp.)* During the study the emigrants were seen in flight through out the campus hence could not be identified up to genus level.

Common Grass Yellow (*Eurema hecabe*) This is one of the most common among Indian Butterflies with a wing span of 40 – 50 mm. It is a bright yellow butterfly with black borders on the upperside of its wings. The butterfly visits flowers and damp patches and is known to migrate in large numbers.
The butterfly was more in numbers in the urban sector while observed only once in the vegetated sector.

Small Grass Yellow (*Eurema brigitta*) This bright yellow butterfly has no distinct markings and has a wing span of 30 – 40 mm. the outer margin of the upper forewing is broadly blackwith inner edge evenly curved. The butterfly prefers degraded habitat and avoids dense forests. It has a fluttering flight at low level among the bushes.
The butterfly was observed in the vegetated area.

Spotless Grass Yellow (*Eurema laeta)* This is a small butterfly with a wing span of 30 – 45 mm. The butterfly is yellow and the dry season form the forewings are pointed, underside is pale yellow overlaid with light brown scales, with a darker oblique line. It prefers forest clearings and paths.
During the study the butterfly was observed in the vegetated area.

Three Spot Grass Yellow (*Eurema blanda*) The butterfly has three unmistakable black spots on the underside forewing. The flight is weak and close to the ground except around the food plants where it can fly to the higher canopy. It has a wing span of 40 – 45 mm.
The butterfly was observed once in the urban sub sector.

Grass Yellow. (*Eurema sp.)* Several species of grass yellow were observed in large numbers through out the campus during the study. However due to the flight conditions they could not be identified till the species level.

Striped Albatross (*Appias libythea*) This is a white butterfly with the wing span 50 – 60 mm. The male looks similar to the common albatross while the female is white and has a broad, black, terminally down curved band at the front margin of the forewings. The butterfly prefers dry deciduous forest and scrub forest. It has a strong flightand males seen in large numbers along damp patches.
This butterfly was observed only in the urban sector.

Pioneer (*Belenois aurota*) The upperside of the buttefly is white with black apical markings and a distinct hockey stick mark at the front margin of the fore wings. The hind wings are unmarked except at the margin. The underside is bright yellow with marginal markings and black bands along the veins. The males are brighter yellow with thinner black bands. The wingspan is 40 – 55 mm and is a strong flier. It prefers open dry areas and thorn forests.
This butterfly was observed in both the sectors.

Common Gull (*Cepora nerissa*) It is predominantly white on the upperside and yellow on the underside. The wing margins and veins are black. The veins are faint on the upperside but prominent on the underside. It has a wing span of 40 – 65 mm, it flies rapidly close to the ground. It prefers open sunny patches and is also found in degraded forests and occasionally visits gardens.
This butterfly was observed in the entire campus.

Common Jezebel (*Delias eucharis*) The upperside of the wings of this buttefly is white, the underside is

bright yellow with black veins and a marginal series of orange red spots which are roughly pentagonal in shape. It has a wing span of 66 – 83 mm and is present in all kinds of habitat. It prefers to be in canopy except when feeding on flowers of shrubs.
This butterfly was observed in both the sectors.

Psyche (*Leptosia nina*) It is a bright white butterfly with a wing span of 35 – 50 mm. The fore wings have an apex with black borders and a black spot. The underside is also white, but dull, overlaid with pale grey scales and marked with faint green striations. The slow flight is characteristic of this butterfly.
This was frequently observed in the entire campus.

Common Wanderer (*Pareronia valeria*) The male is shiny sky blue with black margins and veins. The female is light bluish-white with broader margins and veins. The markings on the underside are similar to those on the upperside, except they are grey brown and not well defined. It inhabits open forests, dense scrubs, woodlands, etc. where light is abundant. It has a wing span of 65 – 80 mm and is a moderate flier.
During the study it was observed in the entire campus and the **spilomela form** was observed in the vegetated sector.

White Orange Tip (*Ixias marianne*) The white orange tip with a wing span of 50 – 55 mm is white on the upperside with broad black borders on the wings and an orange forewing apex. This characteristic confers on it an unmistakable identity and its name. It flies among bushes and small trees, usually within three meters off the ground and feeds on nectar. It is common in deciduous forests, scrub and fallow lands.
This butterfly was observed in both the sectors.

Small Orange Tip (*Colotis etrida*) This is a small butterfly with a wing span of 25 – 45 mm. The upper side of male is white with broad, black edged, orange apical patch. There is sparse black dusting at base of both the wings. It is very fond of flowers, has a feeble fluttering flight close to the ground. Prefers open drier places.
This butterfly was observed in both the sectors.

Great Orange Tip (*Hebomoia glaucippe*) It is one of the largest Pierids (Wing span 80 -100 mm). The upper side is white with apical half of the fore wing having large black edged orange patch. It is common in forested and hilly areas with high rainfall. Absent in degraded habitats. It is very fond of flowers and mud puddling.
This butterfly was observed in both the sectors.

Yellow Orange Tip (*Ixias pyrene*) The male is yellow on the upperside with forewing having a black apical half, enclosing a large orange band. The female is white or yellow on the upperside, the apical band is reduced in size and bearing two black spots. It has a wing span of 50 – 70 mm and has a rapid hurried flight. Prefers mixed deciduous, thorny scrub forest.
This butterfly was observed in both the sectors.

The butterflies belonging to family **Hesperiidae** (Plate 31) are commonly called as Skippers and are often mistaken for moths. There are around 321 species of skippers in India of which around 13 species were observed during the study.

Brown Awl (*Badamia exclamationis*) This is a uniformly brown butterfly that is relatively darker on the upperside and very light on the underside. The forewings have 3-4 semitransparent spots. The butterfly has very long and narrow wings and a fast flight. In fact among the Indian Butterflies it has the longest wings in proportion to their width. (Wing span 50 -55 mm.). It occurs in various habitats but common in thick forest, often settles on leaves with the wings folded over the back.
Found exclusive to the urban sector during the study.

Common Banded Awl (*Hasora chromus*) This is a dark brown butterfly with a big, strong thorax, pointed forewings and a white band at the center of the underside of the hind wings. The wingspan is 45 – 50 mm.,

has rapid skipping flight. It is common in forest and open areas. Visits flowers and open patches, more likely to be seen near streams and rivers.
This butterfly was observed in both the sectors.

Vindhiyan Bob (*Arnetta vindhiana*) This is a dark brown skipper with a wing span 25 – 32 mm. It is endemic to south and central India. It prefers wet grasslands at the edge of moist forests. Comes to flowers, bird droppings and damp patches.
This butterfly was observed in both the sectors.

Rice swift (*Borbo cinnara*) This butterfly has dark brown wings that have semitransparent spots on the forewings and white spots on the underside of the hind wings. The upperside of the hind wings is unmarked. It has a wing span of 30 – 36 mm, has a smooth flight and often takes a winding path. It is known to return to the same spot from where it took off. It prefers open sunny areas and can be found in both forested as well as human habitated areas.
This butterfly was observed in both the sectors.
In addition another **swift** was also observed that was not identified.

Chestnut Bob (*Iambrix salsala*) This is a small butterfly (Wingspan 26 – 30 mm) whose wings are dark brown, overlaid with chestnut scales. The centre of the hind wing is a sliver spot which is enclosed in a thin black ring. It is found in a varity of habitats but more often I the shaded openings and close to the sunlit patches. The flight is not very fast and close to the ground.
This butterfly was observed in both the sectors.

Common Redeye (*Matapa aria*) This butterfly has blood red eyes has no markings on the upper side. The hind wing has grayish fringe tinged with pale yellow. It has a wing span of 40 – 55 mm and a rapid flight. It a commonly a bamboo forest dweller.
This butterfly was observed in both the sectors.

Indian Palm Bob (*Suastus gremius*) The skipper has overlaid grey scales on the underside of the hind wing. Semitransparent white spots on both side of the forewing. The wingspan is 32 – 45 m and has a fast dipping flight. Seen mostly on flowers and bird droppings and damp patches.
This butterfly was observed in both the sectors.

Conjoint Swift (*Pelopidas conjuncta*) This skipper has a slight golden sheen. It has a wing span of 45 – 52 mm, is a strong flier and often seen basking in sunshine on grass blades along forest paths and clearings.
The butterfly was exclusive to the urban sub sector.

Dark Palm Dart (*Telicota ancilla*) This is a black butterfly with orange bands on its fore wings, which are narrow towards the apex. The hind wings are black with pale orange band (Wingspan 34 – 36 mm). The male and female have identical markings. It has a variety of habitats and is a strong swift flier.
This butterfly was observed in both the sectors.

Grass Demon (*Udaspes folus*) This is a black skipper with a big white spot on the hind wing and several smaller white spots on the forewing. The underside of its wings is predominantly white with brown edges and spots. This is a very bold skipper not easily disturbed and keeps to the forest edges or openings. (Wing span 40 -48 mm.)
This butterfly was observed in both the sectors.

Tricoloured Pied Flat (*Coladenia indrani*) The butterfly is deep orange with bright yellow marginal spots. It has a wingspan of 40 -46 mm with a rapid flight. Prefers to remain in shade.
This butterfly was observed in the vegetated sector.

Common small flat (*Sarangesa dasahara*) This butterfly is dull black or brown on the upperside. The underside hind wing has grey brown marked with large diffuse dark spots. It has a fast erratic and jerky

flight close to the ground. Visits bird droppings and flowers and has a wingspan of 26 -35 mm.
This butterfly was observed in both the sectors.

Spotted small flat (*Sarangesa purendra)*It is a blackish brown butterfly on the upperside, mottled on the upperside hind wing with dark patches. Forewing has small semitransparent white spots. It has a wing span of 25 -35 mm and has fast, jerky flight close to the ground. It prefers drier habitats, seen basking in the sun with wings held horizontally.
This butterfly was observed in both the sectors.

The family **Papilionidae (Plate 31)** popularly known as swallowtails are the best known butterflies . They include the largest and most attractive and the most endangered of butterfly species in the world. India has 107 species while in the present study only seven species were observed.

Common Rose (*Atrophaneura aristolochiae*) It is a black butterfly with a crimson body. There is a large white area on the hind wings. A series of deep red or brownish red spots are present on the outer margin of the hind wings. (Wing span 80 110 mm). occurs in open, cultivated and deciduous forest, has a slow straight fluttering flight.
This butterfly was observed in both the sectors.

Common Bluebottle (*Graphium sarpedon*) The upperside of the butterfly is black with a greenish blue central band. The wings are pointed with a span of 80 – 90 mm. The hind wings have a row of submarginal crescent shaped blue spots. Tehunderside of the wings is brown, the blue band is paler, with some red spots. Occurs in semi to evergreen forests. This is a nervous buttefly flying with a fast rapid wingbeats.
This butterfly was exclusive to the vegetated subsector.

Common Jay (*Graphium doson*) The butterfly is black with a pale blue, semitransparent central band that is formed by large spots. There is a marginal series of smaller spots. The underside of the wings is brown with markings similar to the upperside but they are whitish. Inhabits primary as well as secondary forests. It has a swift straight flight with a wing span of 70 -80 mm.
This butterfly was observed in both the sectors.

Tailed Jay (*Graphium agamemnon*) The buttefly is black with bright green spots and streaks on the wings. The hind wing tails are short and stumpy. Common in well wooded regions, it is a restless flier with a wing span of 85 – 100 mm.
This butterfly was observed in both the sectors.

Lime Butterfly (*Papilio demoleus*) This is a medium sized butterfly with black wings that are spotted with various shades of yellow. On the underside it has a beautiful pattern in lemon yellow, red and blue. This occurs several habitats. It has a wing span of 80 – 100 mm with a rapid flight.
This butterfly was exclusive to the urban subsecor.

Common Mormon (*Papilio polytes*) The male is jetblack with a row of white spots along the central region of the hind wing. The margin of the fore wing also has a series of smaller white spots. Once a forest dweller is now also observed around human habitation. Its wing span is 90 -100 mm.
This butterfly was observed through out the campus. Cyrus, stichus and romulus forms were also observed in both the sectors.

Blue Mormon (*Papilio polymnestor*) This butterfly with a wing span of 120 – 150 mm has an unidirectional flight with a lots of ups and downs. It is a very large, black butterfly with glistening pale blue markings. On the underside it is completely black with red spot at the base of its wings and a few pale markings. It is common in the monsoon in the forests.
It was the largest butterfly sighted in the campus.

Arctiidae (Plate32) is a large and diverse family of moths with around 11,000 species found all over the world. This family includes the groups commonly known as tiger moths (or tigers), which usually have bright colours, footmen (which are usually much drabber), lichen moths and wasp moths. Many species have 'hairy' caterpillars which are popularly known as woolly bears or woolly worms.
During the present study three different species were observed

Argina astraea The adult moth is yellow with black spots, and a wingspan of about 4 cms. The larvae are known to feed on Fabaceae plants.
The moth was observed only in the V1 subsector.

Euchromia sp. These moths have a shape and flight (rapid wingbeats so one sees a blurred cone on either side of the body, and a flight path consisting of smooth slowly evolving arcs) that is very much like that of wasps. The species is commonly known as Hand Maiden Moth.
The moth was observed in U2 and V5 sub sectors.

Brunia antica This is a lowland species, possibly most frequent in coastal vegetation, including mangrove.
The moth was observed only in the V5 subsector.

The **Crambidae** (Plate32) are the **grass moth** family of Lepidoptera (butterflies and moths). They are quite variable in appearance, the nominal subfamily Crambinae (grass moths) taking up closely folded postures on grass-stems where they are inconspicuous, while other subfamilies include brightly coloured and patterned insects which rest in wing-spread attitudes.

Six different species of moths belonging to this family were recorded during the study.

Spoladea recurvalis This moth belongs to the family Crambidae. It is found worldwide, but mainly in the tropics. The wingspan is 22-24 mm. Commonly known as Beet webworm moth.
The moth was more common in the urban sector and sporadically sighted in V1, V2 and V5.

Antigastra catalaunalis It is endemic to tropical and subtropical areas, but is also found in other areas due to its migratory nature. Commonly known as Sesame Leaf roller. The wingspan is 19-22 mm.
Sporadically sighted in both the sectors.

Talanga sp. This moth has triangular fore wings with bright markings and is a pest on a number of plants.
During the study was recorded in the V3 sub sector.

Diaphania indica Commonly known as the Cucumber Moth has a tuft of brown hairs on the tip of the abdomen. The tuft on the end of the abdomen of the female is bushier than that of the male.
During the study was recorded in the U1 and V5 sub sectors.

Pygospila tyres This moth has black wings with white spots. The wingspan is about 4 cms.
The moth was observed in theV3 sub sector.

Sameodes cancellalis The adult moth of this species is brown, with white spots partly outlined in black on the forewings, and white bands across the hindwings. The moth has a wingspan of about 2 cms.
The moth was observed in theV3 sub sector.

The **Drepanidae** (Plate32) are a family of moths with a distinctively hook-shaped apex to the forewing, leading to their common name of hook-tips. The larvae of many species are very distinctive, tapering to a point at the tail and usually resting with both head and tail raised. They usually feed on the leaves of trees and shrubs, pupating between leaves spun together with silk.

During the present study the **Hook tip moth** was recorded in the V3 sub sector, the genus and species is yet to be identified.

Most of the Caterpillars in family **Geometridae** (Plate32) only have one or two pair of prolegs. The caterpillars move with curving their bodies into loops. This is why they commonly called Loopers. They are also known as **Inch Worms** because they apparently measuring off one inch at a time as they move. Some of them are called **Twig Caterpillars** because their resting posture looks like a twig. The Geometridae caterpillars are usually hairless and with slender body. They are well camouflaged in green or brown in colour. Most of them feed on leaf and active during the day.

During the present study three moths were observed of which one is yet to be identified, this Geometrid moth was observed in the V3 sub sector.

Hyposidra talaca, They are known as Inch Worms because their caterpillars apparently measuring off one inch at a time as they move. The caterpillars are black in colour with white dots. Their adult moths are brown in colour, with pointed wings.

Chiasmia eleonora This is a grey coloured moth with a white band extending from the hind wing to the fore wing appearing like a the alphabet 'V'. the margins are hairy white.
During the study was recorded in the U1 and V5 sub sectors.

Hyblaeidae (Plate32) are the "teak moths", the two genera with about 18 species make up the **Hyblaeoidea** superfamily. Caterpillar hostplants are well known and almost exclusively the families Bignoniaceae, Verbenaceae and the related mangrove family Avicenniaceae, the mangrove family Rhizophoraceae and a very few other families

Hyblaea puera This moth is commonly known as the **teak defoliator**, is a moth native to southeast Asia. The caterpillar feeds on teak and other species of trees common in the region. It has been recognized as a serious pest of teak for more than a century throughout the world. Being a voracious eater it completely defoliates the leaves.
During the study was recorded in the U3 and V5 sub sectors.

Limacodidae (Plate32) is a family of moths often called **slug moths** because their caterpillars bear a distant resemblance to slugs. They are also called **cup moths** because of the shape of their cocoons. They are mostly tropical, but occur worldwide, with about 1000 described species and probably many more as yet undescribed species.

Nettle caterpillar They are small, hairy moths, with reduced or absent mouthparts and fringed wings. The nettle caterpillar is primarily an agricultural pest but could also cause serious damage to our environment.
The species of the moth was not determined and was observed in U2 and V1 sub sectors.

The **Noctuidae** or **Owlet moths** (Plate 32 & 33) are a family of robustly-built moths that includes more than 35,000 known species out of possibly 100,000 total, in more than 4,200 genera. They constitute the largest family in the Lepidoptera. Most have drab forewings, although some have brightly coloured hindwings. There are usually few differences between the sexes. The overwhelming majority of noctuids fly at night and are almost invariably strongly attracted to light. Many are also attracted to sugar and nectar-rich flowers. Some of the family are preyed upon by bats. However, many Noctuidae species have tiny organs in their ears which responds to bat echolocation calls, sending their wing muscles into spasm and causing the moths to dart erratically. This aids the moths in evading the bats. Several species have larvae (caterpillars) that live in the soil and are agricultural or horticultural pests. The Noctuidae are also remarkable for containing an extraordinary number of species whose caterpillars are able to feed on certain poisonous plants without harm.

During the present study 21 species belonging to this family were recorded.

Tussock moth Adult moths of this family do not feed. They usually have muted colours (browns and

greys), although some are white, and tend to be very hairy. In the larvae of some species, hairs are gathered in dense tufts along the back and this gives them the common name of **tussocks** or **tussock moths**.

The moth was observed in the U3 sub sector.

Asota caricae The adults have yellow fore wings, each with a pale spot near the centre, and some black dots near the base. The hind wings are a deeper yellow, and have a number of black spots. The body is yellow with a black mark on the top of each abdominal segment. The moth is commonly called as Tiger moth

The moth was observed in the urban sector only.

Another species of Tiger moth was also observed but only in the vegetated sector, however the species was not identified.

Episteme adulatrix This moth is commonly called the Day flying moth and belongs to the sub family Agaristinae.

The moth was observed in the V3 sub sector.

Erebus macrops This is commonly known as Owl moth it has a wing span of approximately 12 cm with large eye spots on the fore wing.

The moth was observed in the V2 and V5 sub sector.

Erebus hieroglyphica This is a brown black moth with owl like eyes on the forewings commonly known as the Fruit piercing moth.

The moth was observed in the vegetated sector.

Spirama retorta The Spirama retorta is a dull colored (black and gray) medium-sized nocturnal moth. It is commonly known as Owlet moth.

The moth was observed in the U1, V1, V4 and V5 subsectors.

Anomis flava The adult moth is brown with gold patches on the forewings. Caterpillar is long and green, with yellowish bands between segments. It is missing one pair of prolegs, so it moves like a looper, although not related to the true loopers in Geometridae.

The moth was observed only in the V1 sub sector.

Artena sp.

This moth was observed in the U1 subsector

Ischyja hemiphaea The adult moth of this species has brown forewings. The hind wings are white, with a broad dark brown border. The moths attack fruit, piercing the skin to suck the juice.

The moth was observed in the U3 sub sector.

Mocis undata The adult moth is brown, mottled with sinuous markings. The wingspan is about 3 cms.

The moth was observed in the U1 sub sector.

Rhesala sp. The genus consists of small, dark, dark brown species that are distinguished externally by white marks centrally on the forewings that arise to a mark shaped like and 'X' or an inverted 'V'

The moth was observed in the urban sector and in large numbers in the V5 sub sector.

Chalciope mygdon This moth has triangular wings with a white band.

The moth was seen in V5 sub sector.

Fruit piercing moth

Unidentified fruit piercing moth was observed in the V1 and V3 sub sectors.

Plusiodonta coelonota The adult moth is brown with a darker diagonal mark across each forewing. The moths have a wingspan of about 2.5 cms.
The moth was observed in the U2 sub sector only.

Autoba abrupta The adult moth has pale brown wings with a dark line across each one. The forewings also have a pale mark at the apex. The hindwings also have a black dot at the tornus. The moth has a wing span of about 2 cms.

The moth was observed in the U2 sub sector.

Chrysodeixis eriosoma The **Green Garden Looper** with a wing span of 42 mm has a reddish tinge on the head, thorax, and fore wing; abdomen with the lateral and anal tufts often black in the male. Fore wing with much more gilding on the basal, medial, and outer areas ; the Y mark large, prominent, and golden, the arms often filled in with golden and occasionally joined to the tail.

The moth was observed in the V1 sub sector.

Lymantria sp These are commonly known as Tussock moth The forewing facies is one of repetitive, dark, lunulate or zig-zag fasciation on a paler ground. There is often a strong row of dark marginal flecks or triangles in the spaces on both wings, and the hindwing margin (in males at least) is more frequently angled.
The moth was observed in U1 sub sector.

Gabala sp. The moths are rather delicate in build with elongate forewings and abdomen.
The moth was observed in U2 and V3 sub sector.

Hypena sp. The adult moth has brown patterned forewings. They have a wingspan of about 2 cms.
The moth was observed in the U2 sub sector only.

Nolidae (Plate33) is a family of moths with about 1,400 described species worldwide. They are mostly small with dull colouration, the main distinguishing feature being tufts of raised scales on the forewings (the group is sometimes known as **tuft moths**). The larvae also tend to have muted colours and tufts of short hairs.

Carea sp. The forewing colour is usually dull shades of red, orange or rufous brown, sometimes with a vinous tint.
The moth was observed in the U2 sub sector.

Earias vitella The caterpillars of these moths are commonly called boll worms.
The moth was observed in the V5 sub sector.

In addition an unidentified brown moth was also observed in the U2 and the V5 sub sector belonging to the family Noctuidae.

The **Pterophoridae** (Plate33) family, commonly known as **Plume Moths**, are a well known and easily recognized family. The world fauna is composed of nearly a thousand species in 92 genera. Most species have the wings divided into narrow lobes that resemble feathers or "plumes" because of the long fringe scales along the lobe margins.
The plume moths were observed in the U1 U2 and V5 sub sectors.

The moths of family **Sphingidae** (Plate33) are called Hawk Moths because the can fly very fast, and can also hover in flight. They use this latter ability to sip nectar from flowers using their long *Haustellum* (tongue), when they fly in the evening. They are large moths with long narrow fore wings, and smaller hind wings. When at rest, they hold their wings over the body like a tent.
During the study five species of moths belonging to the Sphingidae were observed.

Theretra silhetensis The adult moths commonly called as Hawk moth of this species have light brown fore wings with a dark stripe from base to apex. The moths have plain brown hind wings. They have a wingspan of about 5 cms.

Neogurelca hyas A crepuscular species with a wing span of 30 – 40 mm, visits flowers. It is a brown color butterfly with the hind wing having a golden hue.
The butterfly was observed in the V4 sub sector.

Clear wing Hawk Moth These large hawk moths are diurnal, that is, active during the day; they are most often seen nectaring at flowers. They hover and dart about, flying both backward and forward just like hummingbirds. The wing on the distal end has clear cells and hence the name.

The moth was observed in the U1 sub sector

Coffee bee Hawk Moth The adult moths soon lose the scales from the wings, leaving them transparent. The moths then resemble Bumble Bees, hence the name 'Bee Hawks' for the moths in this genus *Cephonodes*. The abdomen is yellow with a black band around one abdominal segment, and a dark dorsal mark on the next segment. The wings are generally transparent except that the forewings each have a slightly broader opaque area near the tip. This species has a wingspan of about 4 cms.

The moth was observed in the V4 sub sector

In addition an unidentified hawk moth was also observed in both the Urban and vegetated sector.

The net-like wing pattern in the moths of Family **Thyrididae** (Plate33) and the characteristic resting posture help differentiate these moths from the superficially similar moths in Geometridae.

Striglina sp. The adult moths are orange with indistinct wavy darker lines across every wing. The wingspan is about 3 cms.

The moth was observed in the V3 sub sector.

The **Uraniidae** (Plate33) are a family of moths containing four subfamilies, ninety genera, and roughly seven-hundred species. Some tropical species are known for their bright, butterfly-like colors and are called sunset moths. Such moths are apparently toxic and the bright colors are a warning to predators.

Micronia aculeata This is commonly known as Uranid moth. The species is variable in the cream to grey tone of the ground colour. Occasional specimens have the underside white rather than grey. The forewings,

in the male at least, are apically more acute.

The mothe was observed in U3, V1 and V3 sub sectors.

Order Hymenoptera (Plate 34)

Adult Hymenoptera are winged or wingless insects. Winged members have two pairs of membranous wings with relatively few veins. Mouthparts are formed for chewing or modified like in honey bees for both chewing and sucking. Sawflies and horntails have wide waists but most Hymenoptera like bees, ants, and wasps have the body constricted greatly between the abdomen and thorax. Metamorphosis is complete. They can be microscopic to over 1 inch long. Immature stages have chewing mouthparts and are maggot-like for ants, bees and wasps.

They have a more or less well developed head capsule. Legs are present in some forms like sawflies which resemble caterpillars and even have prolegs (without crochets). Many Hymenoptera are colonial and are fed by members of the colony.

Habits of these insects are varied: some are predaceous; some are parasitic; some cause plant galls; and some feed on plant foliage. Sawfly larvae feed on foliage. Horntail larvae feed in wood like borers. Others, such as bumble bees and honey bees live on plant pollen and nectar. This order includes some of our most harmful, as well as some of our most beneficial insects. The abdomen in the females ends in an ovipositor which may be modified into a stinger or a saw-like organ. Many Hymenoptera have a painful sting and should be avoided if possible.

The Hymenopteran was the most diverse order during the study with 52 different types including 21 unidentified ones.

Cuckoo wasp - The name "cuckoo wasp" is attributed to the fact that this insect, like the cuckoo bird, lays her eggs in the nest of an unsuspecting host. The insect belongs to family Chrysididae. *Chryso* (Greek), gold, referring to golden color of some species. Body metallic blue or green, usually with coarse sculpturing. Most species are external parasites of wasp and bee larvae.
The wasp was sporadically observed in both the Urban and Vegetated sector.

Blue banded Bee: The Blue Banded Bee is an Australian native bee. n size, the Blue Banded Bee can grow from 10 to 12 millimetres. Its appearance includes a golden brown head with bulging eyes that have multiple lenses. They have six sticky legs and a long tongue to help extract nectar from flowers. The bees use a process that involves clinging onto flowers and vibrating powerfully, which causes the food source to shoot out. They only have a limited foraging range of 300m, while females make at least nine foraging flights per day.
The Blue Banded Bee was sighted in the entire campus during the study.

Stingless Bee: Stingless bees, or simply meliponines, are a large group of bees, comprising the tribe Meliponini (sometimes called stingless honey bees) in the family Apidae, and closely related to the common honey bees, carpenter bees, orchid bees and bumblebees. The common name is slightly misleading, as a great many bee species, especially in the family Andrenidae, are also incapable of stinging, as are all male bees. It is further true that meliponines do not lack stingers morphologically; they are simply highly reduced and cannot be used for defense.

Being tropical, stingless bees are not active all year round, although they are less active in cooler weather. Unlike other eusocial bees, they do not sting but will defend by biting if their nest is disturbed. In addition, a few (in the genus *Oxytrigona*) have mandibular secretions that cause painful blisters. Despite their lack of a sting, stingless bees, being eusocial, may have very large colonies made formidable by way of numerous defenders.

The stingless bees were observed in U1 and V1 sector only.

Carpenter Bee: They are so named because they excavate galleries in wood to create nest sites. Carpenter

bees (the genus ***Xylocopa*** in the subfamily **Xylocopinae**) are large, hairy bees distributed worldwide. There are some 500 species of carpenter bee in 31 subgenera. Their name comes from the fact that nearly all species build their nests in burrows in dead wood, bamboo, or structural timbers (except those in the subgenus *Proxylocopa*, which nest in the ground).

Carpenter bees are traditionally considered solitary bees, in several species, the females live alongside their own daughters or sisters, creating a sort of social group. They use wood bits to form partitions between the cells in the nest. A few species bore holes in wood dwellings. Since the tunnels are near the surface, structural damage is generally minor or nonexistent. Only females have a stinger. Female carpenter bees are docile and are reported to sting only if handled.

Carpenter bees can be important pollinators on open-faced flowers, even obligate pollinators on some, though many species are also known to "rob" nectar by slitting the sides of flowers with deep corollas. They do not consume wood. Rather, they feed on pollen and nectar. Carpenter bees are important pollinators of flowers and trees. Carpenter bees typically are just nuisance pests that cause cosmetic rather than structural damage to wood. Nonetheless, considerable wood damage can result from many generations of carpenter bees enlarging existing galleries in wood.

The carpenter bees were observed through out the campus but the nest was recorded only in the V1 and V5 sub sector of the vegetated area.

Honey Bee: Honey bees represent only a small fraction of the approximately 20,000 known species of bees. Some other types of related bees produce and store honey, but only members of the genus *Apis* are true honey bees.

Honey bees are known to communicate through many different chemicals and odours, as is common in insects, but also using specific behaviours that convey information about the quality and type of resources in the environment, and where these resources are located. The details of the signalling being used vary from species to species

All honey bees live in colonies where the worker bees will sting intruders as a form of defense, and alarmed bees will release a pheromone that stimulates the attack response in other bees. The different species of honey bees are distinguished from all other bee species (and virtually all other Hymenoptera) by the possession of small barbs on the stinger, but these barbs are found only in the worker bees. The sting and associated venom sac are also modified so as to pull free of the body once lodged, and the sting apparatus has its own musculature and ganglion which allow it to keep delivering venom once detached. The worker bee dies after the sting is torn out of its body.

Honey bees wer sporadically observed in both the urban and vegetated sectors.

Ground digger Wasp: Ground-digger wasps are very large (slightly larger than a hornet) passive-aggressive wasps that "build" their nests in dry, unfertilized earth. They are typically large and black-bodied with yellow stripes on their back-end. When fully grown, they measure about one and a half inches (or more) in length with about a one and a quarter-inch wide wing span. The digger wasps are solitary wasps; that is, they live independently rather than in colonies and do not depend on other members of a colony to share in the raising of young or the maintaining of a nest.Theground-digger wasp nests are granular mounds of dirt piled up anywhere from two-to-five inches in height. At the base of the mound of granular dirt will be a finger-sized hole with a "path" of dirt leading out from it.
The ground digger wasp was exclusive to the V3 subsector from the vegetated sector.

Hornet: The hornets nests built in unprotected places are covered with a brown envelope (paper) composed of chewed plant fibers. The brown color will help distinguish it from the more common gray nests of aerial nesting yellow jackets. Hornets nests resemble a large, inverted tear-drop shaped ball which typically is attached to a tree, bush or side of a building. Hornet nests may contain thousands of wasps which are extremely aggressive when disturbed. Insect hornets are most commonly are found in hollow trees. The hornet is a relentless hunter that preys on other large insects such as bees, other hornet species, and mantises. The hornets often attack honey bee hives with the goal of obtaining the honey bee larvae.

The hornet wasp was sighted in the U1 and V1 subsector during the study.

Mud dauber Wasp: Mud dauber sometimes called "dirt dauber," "dirt dobber," "dirt diver", or "mud wasp" is a name commonly applied to a number of wasps from either the family Sphecidae or Crabronidae. The name of this wasp group comes from the nests that are made by the females, which consist of mud molded into place by the wasp's mandibles. These are solitary wasp species, with nests constructed and provisioned by individual mated females. Eggs of mud daubers are laid singly on hosts in cells in mud nests provisioned with food, sealed and abandoned. Adults of both sexes frequently drink flower nectar, but they stock their nests with spiders, which serve as food for the mud-daubers' offspring. Like connoisseurs, they prefer particular kinds of spiders, and particular sizes of spiders for their larders. Instead of stocking a nest cell with one or two large spiders, mud-daubers cram as many as two dozen small spiders into a nest cell. They appear to know exactly what they are hunting for, and where to find it. mud-daubers generally provision their nests with various kinds of orb weavers, but their diet includes other kinds of spiders, as well. Larvae grow up to 1 inch long and are cream-colored, legless and maggot-like. They pupate in cocoons within the cells and over winter in nests. There can be several generations annually. Mud daubers are rarely aggressive.

The mud dauber wasp was exclusive to the vegetated sub sector 5.

Paper Wasp: Paper wasps are 3/4 to 1 inch (1.9 to 2.5 cm)-long wasps that gather fibers from dead wood and plant stems, which they mix with saliva, and use to construct water-resistant nests made of gray or brown papery material. Paper wasps are also sometimes called **umbrella wasps**, due to the distinctive design of their nests. The nests of most true paper wasps are characterized by having open combs with cells for brood rearing, and a *petiole*, or constricted stalk, that anchors the nest. Paper wasps secrete a chemical which repels ants, which they spread around the base of the anchor to prevent the loss of eggs or brood.

Mouthparts are for chewing. Nests are built from wood fiber collected occasionally from live plant stems, causing some plant damage. This fiber is chewed and formed into a single paper-like comb of hexagonal cells. Mature nests contain up to 200 cells. Paper wasps prey on insects such as caterpillars, flies and beetle larvae which they feed to larvae. They actively forage during the day and all colony members rest on the nest at night.

The wasp was observed through out the campus while the nest was recorded in some of the sub sectors of both the Urban and vegetated sectors.

Potter Wasp: Potter wasps (or **mason wasps**) are a cosmopolitan wasp group presently treated as a subfamily of Vespidae. Potter wasp wings are folded in half, lengthwise, when at rest. Their bodies are smaller (3/8 to 3/4 inch long), black with yellow markings on the abdomen and thorax and also with a narrow "waist." The wasp constructs a nest of clay that appears like a tiny vase attached to a twig or other object, provisioned with insect larvae (stung, paralyzed caterpillars and beetle larvae). Some potter wasp species utilize hollowed twigs, deserted mud wasp nests or cavities such as key holes or holes in brick walls of buildings for nesting sites.

The potter wasps were observed in all the sub sectors except the U2 sub sector, the nest was observed only the V2 subsector.

Saw Fly: These primitive wasps are not flies (Diptera), because they have two pairs of wings. Sawflies are distinguishable from most other Hymenoptera by the broad connection between the abdomen and the thorax, and the caterpillar-like larvae. The common name comes from the appearance of the ovipositor, which looks much like the blade of a saw. Larval stages are caterpillar-like, with a well developed head capsule and three pairs of true legs behind the head and a hairless body. Unlike caterpillars (Lepidoptera larvae), fleshy "false legs" (prolegs) occur on at least the second through sixth abdominal segments and the bottoms of these prolegs lack rows of tiny hooks (crochets) found only on caterpillars. Some sawfly larvae are slug-like, appearing slimy, non-segmented and translucent, greenish to black, while others appear wax-covered in some of their developmental stages. Mouthparts are for chewing. Most sawflies are somewhat

host-specific.
Typical sawfly larvae are herbivorous, the group feeding on a wide range of plants. Individual species, however, are often quite specific in their choice of plants used for food. The larvae of various species exhibit leaf-mining, leaf "rolling", or gall formation. The larvae that do not feed externally on plants are grub-like, without prolegs. Adults of some species are carnivorous, eating other insects, but many also feed on nectar. Large populations can cause economic damage in cultivated areas and forests.
Saw flies wer absent rom the V1 and V3 sub sector during the study.

Spider Wasp: Wasps in the family Pompilidae are commonly called spider wasps. Spider wasps are long-legged, solitary wasps that use a single spider as a host for feeding their larvae. They paralyze the spider with a venomous stinger. Once paralyzed, the spider is dragged to where a nest will be built – some wasps having already made a nest. A single egg is laid on the abdomen of the spider, and the nest – or burrow – is closed. The size of the host can influence whether the wasp will lay an egg that will develop as a male, or a female – larger prey yielding the (larger) females. A complex set of adult behavior can then occur, such as spreading dirt or inspecting the area, leaving the nest site inconspicuous. When the wasp larva hatches it begins to feed on the still-living spider. After consuming the edible parts of the spider, the larva spins a silk cocoon and pupates – usually emerging as an adult the next summer. Some wasp lay the egg on a still-active spider, where it feeds externally on hemolymph. In time, that spider will die, and the mature wasp larva will then pupate.

The spider wasp was exclusive to the V4 subsector during the study.

Ants belong to family Formicidae in the order Hymenoptera. During the present study 19 species of ants were observed in addition to 5 five unidentifed types.

Odour Ant (*Tapinoma melanocephalum*) One of the most common ant found in urban dwellings. They inhabit crevices in buildings, cracks in walls, old bandages, cloth lining of instrument cases and also laptops. They measure 1.5 to 2 mm in length. They have a distinct pale yellowish white gaster. The antennae is 12-jointed and has a long scape that extends much beyond the top of the head. These ants forage in long trails. They also establish temporary nests in soil, plant stems, tufts of grass and cavities within rotting logs and leaf detritus. They are known from both the hemispheres. The presence of this ant indicates human intrusion and disturbance. They are absent from the interiors of undisturbed evergreen forests, but are found in disturbed forest fringes.
The odour ants were found in the entire campus during the study.

White-footed Ghost Ant (*Technomyrmex albipes*) A very common black shiny ant that measures 2.5 to 3mm. They owe their common name to the white coloured tarsus. This ant can be seen in most gardens and vegetated areas, moving in long trails and feeding on nectarines. They also tend homopterans. Their nest are usually within flower pots, or on the ground under stones and below leaf litter and rotten barks. They sometimes also nest within electrical circuit boards and cracks in walls. Their head is longer than broad. The mandibles are brown in colour. There are five gastral segments visible in the dorsal side. A thin silky white pubescence covers the entire body. The gaster is oval. These ants play a significant role in mutualistic ant-plant interactions.
The ant was observed only in the U2 and V5 subsectors.

Yellow Crazy Ant (*Anoplolepis gracilipes*) These ants are 6.5 to 7 mm in length and move in loose trails. Their movements are very fast and appear quite haphazard. The gaster is either pale or dark brown in colour. Nesting sites are in cool and moist places under leaf litter at the base of trees. They are general predators and feed on a variety of insects, caterpillars, and also tend homopterans. Their antennae are 11-jointed and fill-form. Legs are extremely long and slender. These ants are invasive species and have colonized many disturbed forest regions in Western Ghats and wilderness areas all over the world. They have become dominant in forest fringes where human activity is maximum. They also occupy most of the urban habitats. These ants are hence an exclusive indicator of disturbance in the habitat.

The ant was observed in the entire campus except in the V3 sub sector.

Long-necked Sugar Ant (*Camponotus angusticollis*) The presence of a distinct long neck where the pronotum connects with the head, gives these ants their common name. Distinct dimorphism is exhibited by workers. The major workers measure 17 to 21 mm in length while the minors measure 12 to 15 mm. In minors, the head is smaller and elongate. Both forms have a slender and elongate mesosoma, along with exceptionally long slender legs. Gaster is oval and massive. These ants are extremely fast moving solitary foragers and never form trails. They construct terrestrial nests usually in densely vegetated areas. Nests entrances have circular openings that are smoothened on the surface by their salivary secretions. They feed on diverse food items ranging from honey to termites. They are excellent scavengers as they often fed on bird droppings. These ants also tend aphids and treehoppers.
The ant was observed in U1, U2, V2 and V3 sub sectors.

Common Godzilla Ant (*Camponotus compressus*) The body is black and opaque. There is a distinct polymorphism in these ants with at least three easily distinguishable worker castes. The major workers have a disproportionately large head and are 11 to 126 mm in length, while the minor workers measure 6 to 8 mm, and have a smaller head. Eyes are placed frontally and not laterally. They have a massive gaster. Their long legs have tibiae that are shaped like a prism. They occupy a variety of habitats such as evergreen forests, shoals, deciduous forests and plantations. They are also present in most garden and parks, are common visitors to lavatories to feed on urea. Their nests are usually underground galleries located at the base of trees. These ants are general predators and tend homopterans for honeydew. They forage either solitarily or in small groups by tandem running.
The ant was present in the entire campus except in the V2 sub sector.

Giant Honey Ant (*Camponotus irritans*) These are ground dwelling ants. They construct nests in soil, and occasionally in cracks and crevices of concrete structures. They are general predators and scavengers. Major workers measure 8 to 10 mm in length and the minors' measure 6 to 7 mm. Head and gaster in the major workers are dark reddish brown and shinning. Minor workers are proportionately short in length and have a honey yellow coloured head and mesosoma.
The ant was exclusive to the V3 subsector.

Weaver Ant (*Oecophylla smaragdina*) These are orange coloured arboreal ants, famous for their habit of spraying formic acid in addition to which, they also deliver a painful bite. Their colour varies in different habitats, from bright red to yellowish orange. They have distict long legs, with a sharp tarsal claws on each leg. They use these claws to hold on to leaves (and also to human skin!). These ants have a very slender appearance. Their mandibles are long and triangular and their first tooth is curved to equip them for a predatory life. They feed heavily on spiders, centipedes, beetles and of course other ants. Their arboreal nests are constructed by binding leaves with silk produced from their own larva. They are found all across India, but are especially abundant in deciduous and evergreen forests. They are distinctly absent from monocultures and drier regions.
The ant was observed only in the vegetated sector except the V2 sub sector.

Black Crazy Ant (*Paratrechina longicornis*) These are tiny dull coppery brown ants, which appear black, found commonly scurrying around pavements and kitchens. They measure around 3.5 mm in length. Their 12-jointed antennae have a remarkably long and slender by which they can be easily identified. They are regularly found scavenging on dead animals and feeding on sugary products. They usually move in trails, but also forage solitarily. They nest in cracks and crevices in buildings, and underneath leaf litter in gardens. Their body is covered with fairly abundant hairs. The ant is not armed with spines or teeth. The gaster is oval and huge. This is an introduced species and is an indicator of disturbance.
The ant was observed in the entire campus and was the most dominant one.

Pagoda Nests The ants of the genus *Crematogaster* and a few species of *Polyrachis* build arboreal carton nests called the Pagoda nests. The ants chew leaves and regurgitate them along with a mixture of abdominal and salivary secretions. They also use leaves and twigs to construct these nests.
During the present study the pagoda nests were observed U1, U2, V1, V3 and V5 sub sectors. In V5 Sub

sectors the nest were in large numbers. The species identification was not possible.

Glossy Slender Ant (*Crematogaster ransonneti*) These ants (4 to 4.5 mm in length) have an extremely broad cordate gaster, with the entire body dark chestnut brown in colour. The body is however, consistently smooth, shining, very polished and is completely devoid of hairs. Their head is nearly square, being broader than long. Eyes are placed about the middle of the head. They make their nests in hollow crevices of trees and can be seen foraging on the ground below the nesting trees. Only ants of the genus Crematogaster raise their gaster high up in the air when they sense intrusion to release alarm pheromones. The gaster is also raised when ants are hurriedly returning to the nest, while carting food.
The ant was observed only in the U2 subsector.

Common Broad Acrobat Ant (*Crematogaster subnuda)* A very common ant widely distributed throughout India. This is a bright chestnut red coloured ant (3 to 3.5 mm in length) with the gaster dark, nearly black in colour. Head is smooth the antennae are 12-segmented and the last three apical segments thicken to form a distinct club. As in other species of Crematogaster, the cordate gaster is raised high up vertically in the air while foraging and raised further higher when the detect intrusion. In the open scrublands these ants construct carton nests but otherwise nest at branch intersections.
The ant was observed in the entire campus.

Pharaoh Ant (*Monomorium pharaonis*) These are reddish yellow ants, with the posterior part of the gaster black in colour. The entire body is smooth and shining. Major workers are slightly larger (3 mm) than the minor workers (2 mm). Compared to the majors, the head and mesosoma in the minor workers are slightly pale in colour. Node of the petiole is slightly thick, not pointed, but is rounded at the top. Postpetiole is slightly broader than the petiole. These ants are commonly seen in most backyards, gardens and parks. Nests are constructed in soil below leaf litter.
The pharaoh ants were observed in the Urban sector and the V1, V2 & V4 sub sectors.

Common Red Fire Ant (*Solenopsis geminate*) Derives its common name from the burning sensation one feels when these ants bite. They are found everywhere from parks to fields and in our homes, but absent from pristine evergreen forests. They can be identified by their characteristic nest construction, wherein a diffused layer of soil particles are raised above the ground, with several nest entrances for one colony. They also construct nests in door crevices, and in foundations of buildings. Very often, a large number of ants that have a large head and sharp mandibles, can be seen patrolling the nests. These are the major workers (often called as soldiers) that measure about 7 mm in length.
The ant was observed in the entire campus except for the V2 and V3 sub sectors.

Miniscule House Ant (*Tetramorium smithi*) These common ground dwelling ants, measuring 2.5 mm in length, are found in Southern and Western India. The head, alitrunk and petiole are brownish red, the latter two being slightly brighter. They can easily be identified by their 11-segmented antennae. The gaster is brown, smooth and shining. Head without the mandibles is longer than broad. Eyes are large, round and placed closer to the middle of the head. The antennae and legs are short. The petiole and the gaster are smooth and shining. The hairs are sparse on the body.
The ant was observed in the entire urban sector and in the V3, V4 and V5 sub sector.

Slender Jawed Sail Ant (*Leptogenys chinensis*) These ants forage solitarily. They are one of the common predatory terrestrial ants of Peninsular India, often nesting in gardens and vegetated areas. Body is black, smooth, shining and elongated (10 mm in length). The head is oval with large eyes. They move extremely fast mostly in short trails. They feed on termites, spiders and hunt centipedes. Antennae and legs are distinctly long. They have sparse erect pale hairs all over the body with more dense hairs at the tip of the gaster. Under bright lighting, a blue metallic luster on the ant's body can be seen.
The ant was exclusive to the V1 sub sector.

Polished Leaf-border Ant (*Tetraponera allaborans*) Found dwelling on trees, these are black and extremely shining ants (5 to 6 mm in length). Their mandibles and antennae are reddish yellow. The legs

are reddish brown, while the femur is brownish black in co lour. These ants are both territorial and aggressive. They are exceptional predators and feed on a variety of insects. They make use of their sharp sting to kill them. They do not forage in trails but hunt in small groups and bring their prey to the nest. They often nest in twigs of *Delonix sp* and *Vitex altissima* trees. They have a distinct rectangular head. Hairs are very sparse on the body. Eyes are large and oval.
The ant was observed in only the U1 and V5 sub sectors

Harvester ant (*Pheidole sp*.) The name harvester ant comes from the ants' habit of cutting little pieces of grass. They use these grass clippings to build large nest mounds. Harvester ants usually live in dry environments. They like to build their nests in exposed areas. Some nests are quite large. They may be 4.6 m deep and may be home to up to 10,000 harvester ants. Inside the nest are several separate storage areas called granaries. The granaries hold seeds that the ants have collected and are saving for future meals. The main sources of food for harvester ants are the seeds of different types of grasses. They also eat the bodies of insects and spiders. Worker ants collect seeds by traveling over well-developed trails that can extend 50-60 km from the nest. Harvester ants have a strong sting, which they use to defend the colony. When disturbed, the ants come rushing out of the nest. They pinch intruders with their mandibles and then sting them with small stingers on their abdomens.
The ant was exclusive to the V3 sub sector.

Arboreal Bicolored Ant (*Tetraponera rufonigra*) These are arboreal ants that are very aggressive and extremely territorial. Most often they are found foraging on trees. They nest in the dead wood of trees and wooden beams and posts. Can be easily identified by their very distinct body colour, size and shape. These are large ants and measure 10.5 to 13 mm in length. The colour may vary from light orange red to orange yellow to dark brick red. Head is rectangular being longer than wide. Legs are moderately long and stout. They give a painful sting at the slightest of disturbance.
The ant was observed in the entire campus.

Order Megaloptera (Plate 35)

The order's name comes from Ancient Greek - from *mega-* "large" + *pteryx* "wing" -, in reference to the large, clumsy wings of these insects. Megaloptera are relatively unknown insects across much of their range, due to the adults' short lives, the aquatic larvae's tolerance to pollution which is often rather high and the generally crepuscular or nocturnal habits.

The life cycle of Megaloptera occupies 1–5 years, with the larvae passing through 10–12 instars. The adults are short-lived and take little, if any, food. During the day they are usually found resting on vegetation on the margins of larval habitats. Megalopteran larvae are generalist predators and, at least in captivity, scavengers. Some species fly in bright sunlight, others when the light intensity is low. Less than 300 species of Megaloptera have been described world-wide.

Dobsonflies: Dobsonflies, also known as "the king bug" because of their intimidating mandibles. The dobsonflies overlap their wings. Male dobsonflies have long sickle shaped jaws that are used to hold the female during mating. Females have shorter jaws but can bite more effectively. Dobsonflies spend most of their life in the larval stage, during which they are called hellgrammites. Hellgrammites live under rocks at the bottoms of lakes, streams and rivers, and prey on other insect larvae with the short sharp pincers on their heads, with which they can also inflict painful bites on humans. These vicious, primeval creatures reach to 2" to 3" in length, with gills all along the sides of their segmented bodies that allow them to breathe underwater.

The Dobsonfly was exclusive to the V3 subsector of the vegetated area of the campus.

Order Neuroptera (Plate 35)

Neuroptera are rather fragile insects with two pairs of many-veined wings of about the same size. Antennae are long and threadlike or shorter and some are even clubbed. Chewing mouthparts occur in adults. Most Neuroptera hold their wings roof-like over the abdomen. Immature stages are predaceous generally with

chewing mouthparts. Some immatures have mouthparts modified for grasping and sucking. Many immature Neuroptera have extensions on the sides of their bodies.

Of the three types of Neuropterans recorded only Owlfly was exclusive to the vegetated sector.

Antlion: Immature antlions are called "doodlebugs," and they make pits in sandy areas and are known to capture ants that fall into the pits. Depending on species and where it lives, the larvae will either hide under leaves or pieces of wood, in cracks of rocks, or dig pits in sandy areas. Antlion larvae are unusual among the insects as they lack an anus. All the metabolic waste that is generated during the larval stage is stored and is eventually emitted as meconium by the newly eclosed adult.

Strictly speaking, the term "antlion" applies to the larval form of the members of this family, but while several languages have their own terms for the adult, there is no widely used word for them in English. Very rarely, the adults are called "antlion lacewings".

The antlions were observed throughout the campus except the U2 area.

Lacewings: These are small insects with a slender, iridescent bodyand long antennae. The wings are large, membranous and similar in shape, with connecting longitudinal and transverse veins, forming a lace like network. They are 1/4 inch to over 3 inches long. Lacewings and their immature forms, known as aphid lions, are the most common insects in this order, and both feed on aphids, hence beneficial to man. Adult lacewings can be found throughout the year. They are considered beneficial, because they feed on other insects.

During the study, except for the V3 sub sector the lacewings were observed through out the campus.

Owlfly are dragonfly-like insects with large bulging eyes and long knobbed antennae. They are not true flies, but rather Neuropterans in the family Ascalaphidae, and as such are not closely related to the true flies at all; to the dragonflies and damselflies, they are even more distantly related. Adults in this family are from medium to large size. They have the very long and clubbed antenna. When rest, their abdomen is extended above the stem that they are sitting on while their wings hanging downwards. Adult owlflies are aerial predators feeding on other insects. When disturbed, some owlflies will release a strong, musk-like, chemical to deter an enemy. The abdomen in a few species is held up, projecting into the air, to look like a broken twig. Usually they are active during the day.

Owlflies are readily distinguished from dragonflies because the latter have short bristle-like antennae. The closely related ant-lions, family Myrmeleontidae, have short, clubbed antennae, smaller eyes, and very different wing venation.
The owlfly was only observed at the V3 subsector.

Order Coleoptera (Plate 35)

Coleoptera usually have two pairs of wings. The front pair of wings, called elytra, are thick and form a hard shell over the abdomen of the most beetles. Elytra meet in a straight line down the middle of the back. Some have short elytra and may be confused with earwigs but the caudal appendages on beetles are segmented rather a single piece like in earwigs. The hind wings are membranous and are folded under the front wings when at rest. Mouthparts are formed for chewing in adult beetles and immatures but some are modified considerable for piercing or pollen feeding. Weevils may have a snout which can be long and slender giving them the appearance of a sucking mouth but mandibles are at the end.

Immatures can have six legs or be legless almost maggot-like, and generally are called grubs. They come in many sizes and shapes and include the wireworms, white grubs and many others. Some are more worm-like. They generally short antennae, and a distant head capsule. Prolegs are never present but there may be extensions or hooks on the end of the abdomen.

Coleoptera is the largest order of insects, including about 1/4 of all known insects with about 280,000 different species in the world. They are microscopic to over 2 inches long. Food habits are varied. Some feed on living plants; some are predaceous; some are scavengers; and others bore in wood. This order includes some of the best known and most important of our insect enemies. Most of the members are

terrestrial, but some are aquatic. Perhaps the most famous members of this group are lady beetles, June beetles and the cotton boll weevil.

During the present study 18 types of coleopteran were observed including six unidentified ones.

Dung Beetles Males and female beetles are between ½ and 1 inch long and overall metallic blue-green and copper. The front of the head is flattened and golden bronze. The male has a long, curved horn extending from the front of the head (clypeus) while the slightly larger female has a tubercle. The front legs are modified for digging. There are a number of dung beetles or "tumblebugs" in the subfamily Scarabaeinae that are important in recycling animal feces. The dung beetles, play an important role in nature: reducing fecal material in nature and thereby reducing the habitat for filth-breeding flies; considered beneficial and medically harmless.

The dung beetles were observed only in the U2 and V2 sub sectors.

Lady beetles in the family **Coccinellidae** are also called "ladybugs" or "lady bird beetles." Adult beetle is orange with 6 small dark spots on each wing cover. The segment behind the head (pronotum) is black with a white margin and two convergent white dashes (appearing like \/ with the head at the top). The larva is soft-bodied, gray and orange markings, and covered with rows of raised black spots. They are generally considered useful insects as many species feed on aphids or scale insects, which are pests in gardens, agricultural fields, orchards, and similar places.

The lady bird beetles were observed throughout the Urban subsector, and only in the V1 and V4 sub sector of the vegetated sector.

Blister beetles (family Meloidae**)** vary by species in shape, size (3/8 to 1 inch long) and color (solid gray to black or with paler wing margins, metallic, yellowish striped or spotted). Most are long, cylindrical narrow-bodied beetles that have heads that are wider than the first thoracic segment (pronotum). The wing (elytra) covers are usually soft and pliable. Blister beetle species feed on flowers and foliage of a wide variety of crops. Immature stages feed on grasshopper eggs, live in solitary bee hives or are predaceous, depending on species. Adults can be found on flowers or infested crops. Care should be taken to not handle them. Adults usually occur in loose groups or swarms that feed on leaves of certain plants, especially legumes. Their bodies contain a toxin (cantharadin) that can cause blisters to form on the skin. Animals, particularly horses, ingesting beetle contaminated feed become extremely ill and may die. Handling blister beetles can cause blisters on the skin as a reaction to cantharadin. Larval stages feed on grasshopper eggs or are predaceous and are thus considered to be beneficial, although a few species feed in nests of solitary bees.

The blister beetles during the study were observed during the monsoon in the vegetated sub sector and the U3 sub sector close to the vegetated sector.

Tortoise beetles Adults are broadly oval to round and nearly convex in shape with some sculpturing of the surface and the edges broadly expanded. They are green-gold with purple mottling and about 1/4-inch long. As is characteristic of the family, the larvae and adults may be found on the same host plant. There are multiple generations per year.

The tortoise beetle during the study were observed through out he vegetated sector and in the U2 subsector near the vegetated patch.

Diving beetles The adult beetles have streamlined, oval or football shaped flattened bodies that are usually 1/8 to 1 inch (3 to 25 mm) long. Most species are brown to black but some have distinctive patterns of spots, lines or mottling on the wing covers (elytra). They have elongate hairlike (filiform) antennae. Larvae are not frequently seen and have a long thorax and long legs. The head bears conspicuous large sickle-shaped mandibles without teeth. Predaceous diving beetles are easily confused with water scavenger beetles

(Coleoptera: Hydrophilidae). The latter surface for air head first and have a ridge or keel on the underside that runs down the thorax and extends into a point. Beneficial insect; predaceous on other insects; immature stages (larvae) sometimes called "water tigers"; capable of biting, but generally medically harmless. When numerous in fish hatcheries, they may reduce numbers of fry.

During the study the diving beetles were observed near the water pools in the V1 and V4 sub sector.

Weevil is any beetle from the Curculionoidea superfamily. They are usually small, less than 6 mm (ï¿½ inch), and herbivorous. Due to the shape of their heads, weevils are commonly known as snout beetles. There are over 60,000 species in several families, mostly in the family Curculionidae (the true weevils). Some other beetles, although not closely related, bear the name "weevil", such as the biscuit weevil (Stegobium paniceum), which belongs to the family Anobiidae. Many weevils are damaging to crops. The grain or wheat weevil (Sitophilus granarius) damages stored grain. The boll weevil (Anthonomus grandis) attacks cotton crops. It lays its eggs inside unripe cotton bolls, and the young weevils eat their way out. Weevils are often found in dry foods including nuts and seeds, cereal and grain products. In the domestic setting, they are most likely to be observed when opening a bag of flour although they will happily infest most types of grain including oats, barley and breakfast cereals. If ingested, E. coli infection and other various diseases can be contracted from weevils, depending on their diet.

The weevil during the study was observed through out the campus except in the U3 sub sector.

Giraffe weevil - This species is black with red elytra. Its name is derived from an extended neck that looks much like that of the common giraffe. The giraffe weevil can grow up to 80mm (3 inches) and is among the longest of the weevils. Only the male has a long "neck" and measures up to 0.98 inches (25 millimeters) in length. They live in forests. The adults feed on the leaves of a small tree, called the giraffe beetle tree. Adults rest on leaves in open areas and along roadsides. Females lay their eggs on leaves. The leaves are then rolled up into a protective tube that serves as a food source for the larvae.

The weevil was exclusive to the V3 subsector.

Jewel beetles belong to family Buprestidae and are also known as or metallic wood-boring beetles because of their glossy iridescent colors. The family is among the largest of the beetles. The larvae bore through roots, logs, stems, and leaves of various types of plants, ranging from trees to grasses. The wood boring types generally favor dying or dead branches on otherwise-healthy trees, while a few types attack green wood; some of these are serious pests capable of killing trees and causing major economic damage.
The Jewel beetles were observed only in the V2 and V4 sub sectors.

The **longhorn beetles** (Cerambycidae; also known as long-horned beetles or, more archaically, longicorns) are a cosmopolitan family of beetles, typically characterized by extremely long antennae, which are often as long as or longer than the beetle's body. The family is large, with over 20,000 species described. Several are serious pests, with the larvae boring into wood, where they can cause extensive damage to either living trees or untreated lumber.
Long horned beetles were sighted in both the urban and vegetated subsectors.

Pumpkin beetles This attractive insect belonging to family Chrysomelidae lives its entire immature life underground emerging as the adult beetle to feed on leafy vegetables like pumpkins. Both the larvae and adults of leaf beetles eat plant material. Some are serious commercial pests. The larvae feed on the roots. The Pumpkin Beetle is of concern to gardeners as it feeds on the leaves and flowers of cucumbers, melons and of course pumpkins.
The beetle was observed in the vegetated areas of the U2 sub sector and the V1 subsector.

Scarab beetles belong to family Scarabeidae are often called scarabs. Several members of this family have shells which act as left-handed circular polarisers; this was the first-discovered example of circular polarization in nature. Many scarabs are scavengers that recycle dung, carrion, or decaying plant material.
The scarabs were observed only in the U2 and V4 sub sectors.

Class Arachnida (Plate 36)
Spiders
Family - Araneidae

This family comprises of small to large spider. The lateral eyes of both eye rows are located close together on the sides of the head. The legs are hairy. The abdomen is large but variable in shape. The six short spinnerets form a compact cluster. These are the spiders which build the popular cartwheel web, comprising of spokes and spirals. The webs vary greatly in size and structural design and often differ with species. The spiders of Araneidae have poor vision and rely on changes in tension of the treads of their webs to locate their prey. The trapped prey is wrapped in sheets of silk and can be consumed immediately or stored for future meal.
Seven types of spiders were observed during the study.

Signature Spider This spider weaves a web marked with distinctive zig-zag bands of white silk. It is known as the Signature Spider because of this. The spider holds its legs together in pairs, making it look like a creature with four legs instead of eight.
Two types of signature spiders were observed in the campus one ***Argipore anasuja*** was exclusive to the V4 sub sector while the other was observed in the entire campus.

Debri Spider Orb weavers in the ***Cyclosa*** genus have a unique cone-shaped abdomen. These spiders maintain a line of debris in their webs (consisting of dead prey and shed-skin) and camouflage themselves among the debris when threatened.
The Debri spider was observed in the entire campus.

Spiny orb-weavers is a common name for ***Gasteracantha***, a genus of spiders. They are commonly called so, due to the prominent spines on their abdomen. These spiders can reach sizes of up to 30mm in diameter (measured from spike to spike)
The spider was observed only in the V4 and V5 sub sectors.

Dome Spider builds a dome shaped web that looks like a large inverted saucer with tangle of web above and below. The spider sits above the dome. The dome may be 50 cm in diameter. The body of the spider is black and white with rusty red stripes down the back. The head is grey and the legs are grey with black bands.
The spider was observed in fairly large numbers except for V2 sub sector.

Garden Orb Weavers are stout, reddish-brown or grey spiders with triangular abdomen. The Garden Orb Weavers build large, strong, vertical orb webs. The web is usually built in the evenings and taken down again at dawn. The spider rests head-down in the centre of the web during darkness, waiting for prey. During the day, the spider rests under nearby branch or in nearby foliage with its legs drawn under the body.
The spider was not observed in the V2 and V3 subsectors during the study.

The **orb-weaver spiders** are the builders of spiral wheel-shaped webs often found in gardens, fields and forests. Their common name is taken from the round shape of this typical web.
The spider was observed in U2, V1, V2, V4 and V5 sub sectors during the study.

Family - Clubionidae

This is a large family comprising of two clawed, spiny legged hunting spiders also called as **Sac Spiders**. The males and female are similar but can be differentiated by smaller size of the male. These spiders are common in foliage and on ground and often make tubular retreats by rolling up leaves or under stone in litter.
The sac spider was observed in the U2 sub sector only.

Family - Gnaphosidae

The members of Gnaphosidae have a long, slightly flattened abdomen and drab brown or black colouration. The legs are spiny. The eight homogenous eyes are arranged in two rows. The oval posterior median eyes in most species gives this Family it common name Oval eyed Spiders. These nocturnal hunters

are found under stones and logs as well as in houses.

Ground spiders' are reddish, brown, gray, striped, black spiders, and include nearly 2,000 described species in over 100 genera, distributed worldwide. This makes the family the seventh largest known.
The spider was observed in U1, U2, V1, V3 and V4 sub sectors.

Family - Hersilidae

These drab coloured flat and fast moving spiders are very cryptic in colouration and hard to spot even at close quarters. The posterior spinnerets are usually longer than the abdomen, giving these spiders, their common name **two tailed spider**. They do not build web but hunt actively. The bark of tree is it most favoured habitat.
The spider was observed only in the U2 sub sector.

Family - Lycosidae

The spiders are medium sized, drab looking spiders. They specialize in hunting their prey like wolves and hence the common name **Wolf Spider**. Most of these are Nocturnal ambush hunters. Some members of this family dig tunnels in the ground while some build funnel shaped webs which expand into sheet. They use a variety of habitats such as grass, stones etc. Some species are known to skid over water as well as hide below it.

Wolf Spiders are robust and agile hunters, and have good eyesight. They live mostly solitary lives and hunt alone. Some are opportunistic wanderer hunters, pouncing upon prey as they find it or chasing it over short distances. Others lie in wait for passing prey, often from or near the mouth of a burrow. Wolf spiders carry their egg sacs by attaching them to their spinnerets
The spider was observed in U1, V1, V3 and V5 sub sectors.

Funnel Web spiders Although Spiders of Family Lycosidae are generally roving hunters, members of one unusual Wolf Spider subfamily are actually sedentary web builders. Funnel-Web Wolf Spiders build horizontal, funnel-shaped sheet webs that are used for both hunting and shelter. Although they spend much of their time lurking in their funnel-shaped lairs, Funnel-Web Wolf Spiders are still fairly easy to spot out in the main part of their webs.
The spiders were observed in the entire campus except in U2 and V3 sub sectors.

Family - Oxyopidae

This Family of spiders is also called Lynx Spiders and usually seen among plants. These hunting spiders make no webs. They can be easily identified by long, narrow conical abdomen and raised head. The body is strongly spined.

Green Lynx spider *Peucetia viridana* in general is larger and green in colour. The green abdomen often has a pattern of longitudinal stripes. The long spiny legs are basically pale green in colour with femora reddish below and covered with dense black spots. It is distributed in tropics and subtropics.
The spider was observed in the V3 sub sector.

The Lynx spider *Oxyopes sp*. Carapace is round from front with hexagonally arranged eyes. A thin black straight line starts from each of the anterior median eyes, down the vertical face, and continues on down the centre of the long, pale chelicerae at the tip. The abdomen is long and thins. The legs are extremely spiny. There are black vertical bands along the side of the abdomen.
The spider was observed in the entire campus.

Family - Pisauaridae

These medium sized active hunters are also called as **Nursery Web Spiders**. These specialize in hunting on ground as well as on water. They often run on the surface of water and dive if pursued. They possess sharp vision.
The spider was observed in V3 sub sector.

Family - Salticidae

The spiders of Salticidae are characterized by four forward directed eyes on a massive square carapace. These spiders show variety in colouration and ornamentation. They have well developed vision and can differentiate colors. These spiders are also known as Jumping Spider due to their ability to jump large distances. Some of the Salticids are excellent ant mimics. These are diurnal hunters and usually retreat into their silken nests during rainy or cloudy days. They are active hunters and do not rely on web to catch food.
Three types of spiders were observed in the campus belonging to this family.

Mopsus Spider *Telamonia dimidiata* This is a common spider in the leaves of garden plants. Female is pale yellowish coloured with two reddish brown longitudinal bands on the abdomen, whereas male is characterised by a median white band on the abdomen bordered by black lateral bands and cephalothorax has white median central spots and lateral white bands. It makes its nest among leaves.
The spider was observed in the U3 and V4 sub sector.

Jumping Spider Unlike web-weaving spiders which ensnare flying insects in their nets or crab spiders which ambush their prey, jumping spiders actively hunt for food. Jumping spiders are known for their curiosity. If approached by a human hand, instead of scuttling away to safety as most spiders do, the jumping spider will usually leap and turn to face the hand.
The spider was observed in the entire campus.

Some Jumping Spiders mimic ants. They mimic in body shape and colour patterns. The **Ant-mimic Spiders** walk like an ant too. The spiders hide among ants without being detected. They wave their front legs just like the ant's antenna.
The spider was observed in U1 and V1 sub sectors

Family - Scytodidae

The spiders of this family are also called **Spitting spiders** because of their ability to spit out two streams of sticky fluid at their prey. This fluid is housed in the large glue glands present in the dome shaped carapace of the spider. These spiders often oscillate while spitting thus creating a zigzag stream which helps in effectively pinning down the prey. These spiders are often seen in houses.
This spider was observed in U2, V1, V2 and V4 sub sector.

Family - Sparassidae

These large spiders also called as **Huntsman spiders** are characteristic by straight or procurved posterior eye row. They possess flattened bodies with legs pointing outward. They live amongst vegetation and on tree trunks and are active hunters. They do not build webs.
The Huntsman spiders were observed in V1 and V4 sub sector.

Family - Tetragnathidae

These spiders have long slim cylindrical abdomen and long thin legs. The large chelicerae especially in the males gives this family its common name the Long jawed spiders. These are orb weavers of different kind, making web at an angle between vertical and horizontal. The large jaws of the males are used to clasp the females during mating.

The **Venusta Orchard Spider**, whose Latin name *venusta* means beautiful, is a small (7mm) orbweaver. The Venusta Orchard Spider (*Leucauge venusta*) spider has bright green and silvery-white markings on its body. Some specimens have yellow, orange, or reddish markings. Males are half the size of females. They carry their egg-shaped abdomens high. The legs are very long. This spider lives in open, light areas, on one foot-wide orb webs built on trees and shrubs.
The spider was absent in the U3 sub sector only.

Long-jawed orb weavers are fairly easy to identify by their huge, powerful jaws, or chelicerae, and long, slender abdomen. These spiders have eight eyes and these eyes are in 2 rows. They have 3 claws on each tarsus.
The spider was not observed in U2 and V2 sub sectors.

Family - Thomisidae

The members of Thomisidae are small to medium sized spiders that get their crab like appearance due arrangement of their legs. They are usually pale but occasional brightly coloured specimens are seen. They prefer to wait near plant blossoms to ambush the nectar seeking insects. They are extremely camouflaged for the same.

Crab spiders catch their prey by ambush. They lie in wait on flowers, often aided by camouflage, for nectar-feeding insects. the insects may be much larger than the spider but they are soon paralysed with a venomous bite.
The spider was not observed in the U2 and V2 sub sectors.

Family - Uloboridae

These are unique among the spiders as they lack venom glands. They have eight dark eyes which are arranged in two recurved rows. They are also called as Safe Spiders and build their webs on horizontal plane with a zig zag band of silk called stabilimentum laid across it. They are mostly solitary but members of some genera build communal webs. The spiders of this family are commonly called as Hackled Orb Weavers
The spider was observed in the U1 and V5 sub sector only.

Order - Opiliones

Harvesterman: It is third largest group of Arachnids after spiders and mites. They have a characteristic fused one-piece looking bodies and extremely thin, long legs. Some species do possess short thick legs. A Harvesterman is able to shed legs when required. In fact the last segments of legs in many species have many joints, thus providing flexibility. The female lays eggs in cracks in ground, rotten wood, moss or humus through ovipositor. Though Harvesterman is mostly carnivore feeding on aphids, spiders it occasionally feeds on vegetable matter. They often congregate in large, tangled masses.
It was observed in V2 and V5 Sub sector in the campus.

Amphibians (Plate 37)

Order – Salientia

The order includes frogs and toads, comprising about 2,600 species. According to their anatomy and reproductive habits, they are classified into 12 to 17 families in five or six groups. All have loose skins, no tail in the adult, and pass through an aquatic larval stage. They usually have no ribs and their skeleton and hindlegs are adapted for swimming and leaping.
During the study four frogs and two toads were observed of which one toad and frog remained unidentified.

Common Indian Toad (*Bufo melanostictus*) The Common Indian Toad belongs to the family of true toads, *Bufonidae*. Distinguishing characteristics of the family include lack of teeth, wartiness, and a pair of parotoid glands behind the eyes that secrete toxins. These are the largest among the Indian toads, reaching a snout to vent length of up to 150 mm. The toad exist in diverse climatic conditions and mostly feeds on insects.
During the study the toad was observed only in the V4 sub sector.

Indian Pond Frog (*Euphlyctis hexadactylus*) A medium to large sized olive green frog belonging to family Ranidae. It is commonly seen in ponds and tanks with dense growth of aquatic plants. The frog has white undersides and the toes are fully webbed. The snout to vent length is around 130 mm. The females are larger than the males. It feeds on insects, larvae and snails.
During the study the frog was observed in the V1 sub sector.

Indian Bull frog (*Hoplobatrachus tigerinus*) Indian Bullfrogs are large frogs and they grow up to 160 mm in length. They are coloured yellowish/olive green and they have dark irregular markings. Their snout is pointed and they have long hind limbs. Their toes are nearly entirely webbed. The Indian Bullfrog is solitary and is is usually nocturnal. When they are frightened they jump over the surface of the water in much the same way as they would over land. The diet of an Indian Bullfrog consists of insects, small mammals and small birds.
During the study the frog was observed in the V1 sub sector.

Common Indian Tree frog (*Polypedates maculatus*) This is a slender medium sized frog belongs to family Rhacophoridae. The adults are 50 mm in snout to vent length. The frog is brownish, yellowish, grayish or whitish above with darker spots. The hind of the thighs have yellow spots with a brown network. The frog is capable of chainging its colour to some extent to merge with the surroundings. It is found in diverse habitats and can even visit homes.
The foam-nest is semiglobular in shape with a flat bottom attached to the substrate. Fresh foam is white, becoming dirty white or brown. Trees overhanging water tanks and pools are used as spawning sites. Size of foam-nest: 65-92 mm in diameter
During the study the frog was observed in the U2 sub sector, while the egges nest was observed in the V1 sub sector.

Reptiles (Plate 37)

The reptile form one among the four classes of terrestrial or land dwelling vertebrates or animals with backbone. They have evolved from amphibians and they have given rise to the birds and mammals. As a group, the reptiles can be separated from the amphibians by their dry scaly skin and breeding habits that is lying of eggs on land, from the birds by the absence of feathers, and from the mammals by the absence of fur or hairs. 16 species of reptiles belonging to 2 orders were recorded during the present study of IIT-Bombay campus.

Order - Squamata

Order - Squamata of Reptilia containing lizards (sub order Lacertilia) and snakes (sub order Ophidia). Lizards are fairly typical reptiles, normally with limbs. It is thought that the snakes have evolved from a group of lizards that took to living underground, losing their limbs and sense of hearing in the process. Snakes have no normal eyelids but there is a transparent third eyelid which covers the eye permanently. The bones of the skull are modified and some are only loosely attached to each other so that the jaw can open

widely to swallow prey. The fangs are large teeth connected to poison glands. Associated with the long, narrow body, only the right lung develops in snakes: the left remains merely as a tiny sac.

Family – Agamidae

Agamids can be separated from all their oriental lizards by the nature of their teeth. These are divided into incisors, canines and molars. Eyes and ears are well developed. Eyes are with eyelids. During breeding season, the male is brilliantly coloured in many species. 3 representatives of this family were recorded during present study. Out of which one was not be identified.

Forest Calotes (*Calotes rouxii)* Widely distributed in forests of peninsula, especially in the Western Ghats. During breeding season, the head and a narrow strip along the mid-back of the male turn bright brick red, contrasting vividly with the black on the rest of the body. It is an arboreal species.

Garden Calotes *(Calotes versicolor)* Hindi: Girgit; Marathi: Sarda. A medium sized arboreal lizard with oval head and laterally compressed body. Brown or sand grey above, uniform or with a pattern of spots and bars on the back and sides. Occupies all biotopes from dry desert to thick forests. It is the commonest agamid lizard of India. It is an arboreal, diurnal lizard of gardens, hedges, scrubland, and forest. Prefers shrub and undergrowth.

Brahminy Skink (*Mabuya carinata)* It belongs to family – Scincidae. In present study, this is the only specie which was recorded in IIT campus. It is shiny brown, olive or Bronze above, darker spots often present. A light band from behind the eye to the base of the trail is present. Upper lip is white and lower parts are white or yellow. Actively searches through the ground litter for prey. This is the commonest and best known of Indian skinks. In forest this is more often heard than seen as it creeps through the litter on the ground, occasionally 'surfing' to survey the surroundings.

Common Indian Monitor (*Varanus benghalensis)* It belongs to family – Varanidae. Members of this family show uniformity of structure not seen in other groups of lizards. They have long, flattened body, long tail, long neck and extremely elongated, slender, forked tongue, similar to that of snakes. Eyes with well developed eyelids. Teeth recurved. Limbs are well developed and the digits armed with strong claws. The Common Monitor is widely distributed and lives in all biotopes from evergreen forest to the fringes of desert. It is a diurnal lizard, though more active in the mornings and evenings. It is a carnivore and eats any animal it can overcome. The juveniles are said to be completely insectivore.
It is the only sps of this family found in U3 area that was recorded in the campus.

Brook's Gecko It belongs to Gekkonidae family. Geckos lack eyelids and the eye is covered by a transparent shield. 5 geckos were sighted during present study. Out of which 4 are un identified. Brook's gecko can live in variety of habitats, on trees, rocks, under stones and buildings. It is Commonest of the Indian geckos occurring throughout the Indian sub region and breeds during hot weather.

Vine snake (*Ahaetulla nasuta)* Hindi: Harshara; Marathi: Harantol. It belongs to family *Colubridae*. Three species of belonging to this family were recorded during the study. Vine snakes are with green colour, horizontal pupil and the pointed snout are distinctive. A long, very slender snake. Tongue pale pinkish with white tip. An elegant snake with a wonderful turn of speed over foliage, the slender light body is capable of obtaining support from the minutest twig and twining stem.

Russell's viper (*Daboia russelii)* It belongs to family Viperidae. Only one spp was recorded. Russell's viper is widely distributed but prefers open country. Normally sluggish and does not strike readily unless irritated, when it bites with great malice. The main food is murid rodents. The young are often cannibalistic.

Rat snake (*Ptyas mucosus)* It belongs to family Colubridae. Dorsally olivaceous brown, sometimes as dark as or a light mustard yellow. Scales on posterior part are irregularly margined with black forming a reticulate pattern with a tendency to form crossbars. A common snake throughout India. Diurnal in habit. Takes readily to water and swims vigorously with the head well above water. It is eclectic in diet, devouring

almost anything that chance brings within its reach but show marked preference for frogs and toads.

Chekered keelback (*Xerochrophis piscator)* Hindi: Dhoria; Marathi: Divad. It belongs to family Colubridae. It has strongly keeled scales and five rows of black spots on a yellowish or olivaceous background. It is the commonest fresh water snake; frequents water and is very common in tanks, fields, pools and rivers. Extremely active snake, capable of jumping clear off the ground and will do so repeatedly if pursued. It swims nimbly and with vigor, and is a versatile diver. It feeds mainly on frogs. Fish are frequently taken and also tadpoles.

Order - Crocodilia.

It comprises of alligators and crocodiles. An order of Reptilia, with internal openings of the nose far back in the mouth owing to the presence of a long bony far back in the mouth owing to the presence of a long bony false palate (as in mammals).

Marsh crocodile (*Crocodylus palustris)*Hindi; Marathi: Muggar. It belongs to family Crocodylidae. Single species of crocodile is present in IIT-Bombay campus. Its back is armoured with 16 to 17 transverse and 6 longitudinal series of bony plates embedded in the skin. Ventrally skin lacks armour. Olive above, white or yellowish white below. Toes are webbed. The best known and most widely distributed among the three species of Indian crocodiles. The Muggar is an excellent swimmer, the tail being the exclusive propellant. The senses of sight, hearing and smell are well developed and the animal remains very alert while basking on lad. Usually they are silent but hisses loudly when threatened, fading the enemy with snapping jaws and lashing tail.

Class Aves - (Birds).
Order - Anseriformes (Plate 38)

The order includes the ducks, geese and the allied forms. Anseriform taxa are distributed worldwide, except for the Antarctic region. Anseriform birds inhabit aquatic environments including lakes, ponds, streams, rivers, swamps and marshes. Some taxa are found in marine environments outside of the breeding season. Anseriform birds are medium to large birds (30-180 cm; 230 g -22.5 kg). The plumage varies from gray or brown to black and white. Screamers are noted for head and neck ornaments, while anatids may have brightly colored speculums (patch of color on secondaries) in green, bronze, or blue. Some anseriform birds associate with other bird species during the breeding season.

Anseriform birds are herbivorous and feed primarily on leaves, stems, flowers, roots, seeds of aquatic vegetation. They may also forage for insects, plankton, mollusks, crustaceans, and small fish.

Most anseriform taxa are considered seasonally monogamous, although multiple partner copulations within a breeding season may occur. Duration of pair bond may last for several years or more in some species. Pair bond formation involves complex courtship displays often entailing body posturing and vocalizations. Most anatids copulate on the water while anhimids copulate on land.

In the IIT- Bombay Campus this Order was represented by single Family Anatidae comprising of five Genera and five Species excluding the Domestic Goose.

Spot billed Duck (*Anas poecilorhyncha)*: A large scaly patterned light and dark brown coloured duck with bright orange-red legs. It can be easily identified by dark, yellow tipped bill, which has two orange-red spots at its base. It is chiefly an herbivore feeding on surface aquatic plant matter. It is a Breeding Resident around Mumbai and in the campus was observed in the lake near to the U2 sub sector.

Lesser Whistling Teal (*Dendrocygna javanica)*: A small brown and maroon-chestnut coloured duck. It feeds chiefly on vegetable matter but is also known to feed on small fish, snails etc. It is a Breeding Resident around Mumbai and in the campus was observed in the lake near to the U2and V1 sub sectors.

Ruddy Shelduck (*Tadorna ferruginea)*: A large orange-brown duck with pale brown neck and black tail. Often a faint black collar is observed at the base of the neck. It can be identified by white, black and glistening green wings. Omnivore feeding on plant matter as well as molluscs, crustaceans, fish, reptiles and aquatic insects. It is a Winter Visitor to Mumbai and in the campus was observed in the lake near to the U2 sub sector.

Cotton Pygmy Goose (*Nettapus coromandelianus)*: It is the smallest of the wild ducks. It is easily identified by its predominantly white plumage and short, deep at base goose-like beak. Omnivore feeding mainly on vegetable matter as well as insects, crustaceans etc. It is a Breeding Resident around Mumbai and in the campus was observed in the lake near to the V1 sub sector.

Domestic Goose: These domesticated birds were observed only in the U1 sub sector.

Order - Apodiformes (Plate 38)

This order includes Swifts and Humming Birds, of which Humming birds are restricted to the New Worlds. In India the order is represented by Swifts and Tree swifts. Birds belonging to the Apodiformes order are small to very small, with short legs, tiny feet and a short humerus. In addition, they have long primaries and short secondaries as adaptations for their characteristic flying method. Their eggs are white, elongated and rounded at both ends.

As their name ("footless" in Latin) suggests, their legs are small and have limited function aside from perching. The feet are covered with bare skin rather than the scales (scutes) that other birds have. Another characteristic is long wings with short, stout humerus bones. The evolution of these wing characteristics has provided the hummingbird with ideal wings for hovering.

Apodiformes are represented by single Family Apodiadae comprising of two Genera and two Species.

Asian Palm Swift (*Cypsiurus balasiensis*): Small, slender sooty-grey bird with narrow deeply forked tail.

The long slender bow-like wings are identifying characteristic. They are very gregarious and are often seen flying over palms. These insectivores are specialized to feed on the wings and dipterous insects form major part of their diet. It is a Breeding Resident around Mumbai. This swift was observed in the entire campus except for V2 sub sector.

House Swift (*Apus affinis*): It is a small smoky-black bird with white throat. It can be easily identified by a small square tail and long narrow wing. A common gregarious bird around human settlements. This insectivore flies almost incessantly feeding on flies and midges in the air. It is a Breeding Resident around Mumbai and in the campus was sighted only in the V3 sub sector.

Order – Charadriformes (Plate 38)

Charadriiformes is a diverse order of small to medium-large birds. It includes about 350 species and has members in all parts of the world. Most Charadriiformes live near water and eat invertebrates or other small animals; however, some are pelagic (sea birds), some occupy deserts and a few are found in thick forest.
In IIT- Bombay Campus Charadiformes are represented by five Families comprising of six Genera and six Species.

Red wattled Lapwing (*Vanellus indicus*): A medium sized bird which is brown-bronze above and white below with black breast, head and neck. It can be identified by the characteristic crimson wattle in front of each eye. It is an alert bird known to create frantic "Did-he-do-it" calls. The diet chiefly consists of insects, grubs, molluscs etc. It is a Breeding Resident around Mumbai and in the campus was observed in the lake near to the U2 and V1 sub sectors.

Bronze winged Jacana (*Metapidius indicus*): A leggy swamp bird with glossy black head, neck and breast. It can be easily identified by its greenish bronze back and wings and chestnut-red tail stub. Commonly seen walking around in floating vegetation in ponds and tank with its elongated spider like toes. This omnivore feeds on seeds and roots of aquatic vegetation as well as insects and molluscs. It is a Breeding Resident around Mumbai and in the campus was observed in the lake near U2 and V1 sub sectors.

Pheasant tailed Jacana (*Hydrophasianus chirurgus*): This brown and white swamp bird is easily identified by its pheasant like down curved tail during breeding season. It has elongated spider like toes. It is an omnivore feeding on aquatic plant matter as well as insects and molluscs. It is a Breeding Resident around Mumbai and in the campus was observed in the lake near U2 and V1 sub sectors.

Whiskered Tern (*Chlidonias hybridus*): A small bird white above and grey below with almost square slightly forked tail. It has a characteristic red bill. It develops a black cap on head during breeding season. The diet comprises of small fishes, tadpoles, crabs and insects. It is a Winter Visitor to Mumbai. The tern was observed near the V1 sub sector in the lake.

Black winged Stilt (*Himantopus himantopus*): This slender black and white wader is at home to freshwater, marine or brackish wetlands. It is distinguished by a slender black bill and thin, enormously long red legs. Its diet includes worm, molluscs, aquatic insects etc. It is a Breeding Resident around Mumbai. The stilt was observed near the U2 sub sector in the lake.

Common Sandpiper (*Actitis hypoleucos*): A small bird which is grayish olive-brown above and white below with pale dusky breast and few streaks in front of neck. It feeds on insects, worms, molluscs etc. It is a Winter visitor to Mumbai but is known to stay in wintering grounds throughout year. In the campus it was observed in the U2 sub sector near the lake.

Order - Ciconiiformes (Plate 38)

This order includes storks, heron, egrets and their relatives.
In IIT- Bombay Campus Ciconiiformes are represented by two Families comprising of seven Genera and eight Species.

Grey Heron (*Ardea cinerea*): A large bird ashy grey above and grayish white below and white crown. It has a peculiar long, white, slender S-shaped neck and large black occipital crest. It feeds on frogs, reptiles and fish. It is a Winter Visitor to Mumbai and in the campus was observed only in U1 and U2 sub sectors.

Purple Heron (*Ardea purpurea*): A large Heron which is bluish grey above and black, chestnut below. It has a distinct rufous head and neck. It feeds on fish, frogs, snakes etc. It is a Breeding Resident around Mumbai. The purple heron was sighted only in U2 and V1 sub sectors along the lake.

Indian Pond Heron (*Ardeola grayii*): It is a small earthy brown marsh bird with white wings, tail and rump. Its diet includes frogs, fish, crabs and insects. It is a Breeding Resident around Mumbai. The Pond heron was sighted in the entire campus except for V3 sub sector.

Cattle Egret (*Bubulcus ibis*): In non breeding form it is pure white with a yellow beak. The breading plumage is distinct orange plumage on head, neck and back. Usually associated with cattle seen feeding on insects like grasshoppers, cicadas, blue bottle flies as well as frogs, lizards, fish. It is known to feed on Banyan fruits. It is a Breeding Resident around Mumbai and was one of the common birds in the campus.

Greater Egret (*Casmerodius albus*): A snow white bird with large black, bare legs. The beak is black-yellow or yellow. It can be easily identified by the black gape extends right beyond the eye. It feeds on fish, frogs etc. It is a Breeding Resident around Mumbai and in the campus was sighted near the lake from U2 and V1 sub sectors.

Median Egret (*Mesophoyx intermedia*): A large snow white bird with long neck. The black gape line does not extend beyond eye. It feeds on fish, frogs etc. It is a Breeding Resident around Mumbai and sighted in U2 and V1 sub sectors along the lake..

Black Crowned Night Heron (*Nycticorax nycticorax*): A small heron which is grey above and white below, with black back. The crown, nape and a long crest black. The diet comprises of crabs, frogs, aquatic insects etc. It is a Breeding Resident around Mumbai and was sighted in U3 and V1 sub sectors .

Glossy Ibis (*Plegadis falcinellus*): The breeding adults have glistening black above and chestnut below. The downward curving beak is an important identifying characteristic. It feeds on molluscs, crustaceans, insects etc. It is a Breeding Resident around Mumbai and sighted in U1, U2 and V1 sub sectors

Order – Columbiformes (Plate 39)

The bird order includes the very widespread and successful doves and pigeons, around 313 species are found worldwide. Columbiformes contains plump land birds with small heads and short legs with reticulate scales. Feet not webbed, toes short. They have short bills with a down-curved culmen and a fleshy cere. Their dense plumage is easily detached. Food consists primarily of fruits, seeds and grain. Some are exclusively frugivorous. Unlike most other birds, however, they are capable of drinking by sucking up water, without needing to tilt the head back. Like many birds, all Columbiformes are monogamous.
Columbiformes are represented by single Family Columbidae comprising of two Genera and three Species.

Blue Rock Pigeon (*Columbia livia*): A common grey city bird with glistening metallic green, purple and magenta sheen on neck and breast. It has two dark bars on wings and a band across end of tail. This grainivore feeds on cereals, pulses, groundnut etc. It is a Breeding Resident around Mumbai and a common bird of the campus.

Spotted Dove (*Streptopelia chinensis*): It has pinkish brown and grey underparts with white spots. The black and white checkered markings on hindneck are important feature for identification. It is a grainivore feeding on cereals, pulses etc. It is a Breeding Resident around Mumbai and observed in both the sectors though it was not common.

Eurasian Collared Dove (*Streptopelia decaocto*): It is a pale grey and brown dove with a prominent but

narrow half collar or ring on the hindneck. Its diet consists mostly of grains especially pulses and cereals. It is a Breeding Resident around Mumbai. This dove was sighted only in the V1 sub sector.

Order – Coraciiformes (Plate 39)

The name Coraciiformes means "Raven-like", which is a misnomer (ravens are songbirds). Specifically, it comes from the Latin language "Corax", meaning "Raven" and Latin "Forma", meaning "form", which is the standard ending for animal orders. The group comprises of usually colourful near passerine birds including the kingfishers, the Hoopoe, the bee-eaters, the rollers, and the hornbills. They generally have three forward-pointing toes (and toes 3 & 4 fused at their base), though in many kingfishers one of these is missing.
Order Coraciiformes is represented by five Families comprising of six Genera and seven Species.

Small Blue Kingfisher (*Alcedo atthis*): A small blue green kingfisher with rust coloured underparts. It has a short stumpy tail and straight, long, pointed beak. Often seen sitting on over hanging branches scanning water. It feeds on small fish, tadpoles and aquatic insects. It is a Breeding Resident around Mumbai and observed in both the secors.

White throated Kingfisher (*Halcyon smyrnensis*): It has a brilliant turquoise blue body with deep chocolate brown head, neck and underparts. The conspicuous white throat patch and heavy, long pointed red bill are important features for identification. It is a Breeding Resident around Mumbai and was observed inboth the secors except the V2 and V3 sub sectors..

Indian Grey Hornbill (*Ocyceros birostris*): A large grey bird with an enormous black and white curved bill. A peculiar protuberance on the bill called as casque on the head and long tail are its identification characteristics. It is a Breeding Resident around Mumbai and was sighted in the U2, V3 and V5sub sectors.

Indian Roller (*Coracias benghalensis*): A medium sized blue bird with rufous brown breast and pale abdomen and under tail. It has big head and heavy black beak. This insectivore is a blessing to agriculture as it feeds on all types of insects especially pests. It is a Breeding Resident around Mumbai was sighted only in the V2 sub sector.

Small Green Bee-eater (*Merops orientalis*): This small green bird with tinge of reddish brown on head and neck and slender, long, slightly curved beak. Around neck is conspicuous black marking. The median tail feather is prolonged into blunt pins. It is an insectivore feeding chiefly on the dipteran and hymenopteran member. It is a Breeding Resident around Mumbai and sighted in both the sectors.

Blue tailed Bee eater (*Merops philippinus*): A small green bird with deep chestnut breast and throat. The tail and rump are distinctly blue. It is an insectivore feeding chiefly on the dipteran and hymenopteran member. It is a Winter Visitor to Mumbai and observed only in the V1 sub sector.

Hoopoe (*Upupa epops*): A brown bird with black and white markings on back, wings and tail and a conspicuous fan-shaped crest. The beak is long, slender and gently curved. Its diet comprise of insects, grubs and pupae. It is a Winter Visitor to Mumbai was sighted in the U3 sub sector of the campus.

Cuculiformes (Plate 39)

The bird order traditionally included three families viz. Musophagidae - turacos and allies, Cuculidae - cuckoos, coucals and anis, Opisthocomidae – Hoatzin
Cuculiformes are represented by single Family Cuculidae comprising of three Genera and three Species.

Greater Coucal (*Centropus sinensis*): This member of Cuckoo family is often mistaken to be crow due to its thick broad black beak and glossy black body. It can be easily identified by chestnut wing, long broad tail and a red eye. It consumes a variety of organisms like caterpillars, insects, lizards, young mice as well as birds' eggs. It is a Breeding Resident around Mumbai and a common bird in the campus.

Pied Crested Cuckoo (*Clamator jacobinus*): A black and white cuckoo with prominent crest. It is said to be harbinger of Southwest Monsoon. This Omnivore feeds insects, caterpillars and at times berries. A Monsoon Visitor to Mumbai.

Asian Koel (*Eudynamys scolopacea*): This common bird shows a distinct sexual dimorphism. The males are jet black while the females are brown, profusely spotted and barred with white. It is a known nest parasite of other birds. It is an omnivore feeding chiefly on fruits and berries as well as caterpillars and insects. It is a Breeding Resident around Mumbai.

Order – Falconiformes (Plate 39)

These include the diurnal birds of prey. Order Falconiformes is composed strictly of carnivores, and as such their bodies are designed strictly for killing. They typically have a sharply hooked beak with a cere (soft mass) on the proximodorsal surface, housing the nostrils. Their wings are long and fairly broad, suitable for soaring flight. Falconiformes have strong legs and feet with raptorial claws and an opposable hind claw. Almost all Falconiformes are carnivorous, hunting by sight during the day or at twilight. They are exceptionally long-lived, and most have low reproductive rates.
In IIT- Bombay Campus Falconiformes are represented by three Families comprising of six Genera and six Species.

Shikra (*Accipiter badius*): It is a medium built hawk with ashy blue grey above and white below. The breast and abdomen region cross barred with rusty brown. It is an ambush hunter feeding on lizards, mice, squirrels, birds etc. It is a Breeding Resident around Mumbai and sighted in U1 and V3 sub sectors only.

Eurasian Marsh Harrier (*Circus aeruginosus*): The male Marsh Harrier is a dark brown bird with pale rufous head, neck and breast with silver grey tail and wings. The female are dark brown with buff cap on head and leading edge of wing at shoulder. It feeds on frogs, fish, small birds, mammals and occasionally carrion. It is a Winter Visitor to Mumbai. The bird was observed close to the lake near U2 sub sector.

Brahminy Kite (*Hiliastur indus*): This raptor can be easily distinguished by rusty red body and white head, neck and breast down to abdomen. It has a rounded off tail. It feeds on offal, fish, frogs, land crabs, small snakes, bats as well as winged termites. It is a Breeding Resident around Mumbai and observed in V2 sub sector in the campus.

Black Kite (*Milvis migrans*): This large brown bird is the most commonly seen raptor and commensal with man. It can be easily distinguished from other similar bird by its forked tail. It is chiefly a Scavenger feeding on garbage and offal. It is an opportunist taking on any easy picking such as earthworms, lizards, winged termites, mice as well as disabled or young birds. It is a Breeding Resident around Mumbai, was a common bird in th e campus.

Common Kestrel (*Falco tinnunculus*): It is a small slender falcon with brick red above, brown spear-spotted light buff below and a grey head. It has ponted black wings typical to falcons. It has a variable diet which includes field mice, lizards and large insects like locusts. It is a Breeding Resident around Mumbai and observed only in the V5 sub sector.

Osprey (*Pandion haliaetus*): It is a dark brown hawk with brown and white head and white underparts. It has a broad brown band across the upper breast. It is a piscivore and often referred to as Fish hawk. It is a Winter Visitor to Mumbai, was observed near the lake in U2 sub sector.

Order – Galliformes (Plate 39)

Galliformes (meaning chicken-like) is a large and diverse group comprising about 70 genera and more than 250 species. Gallinaceous birds are chicken-like in appearance, with small to large bodies and blunt-wings. Plumage coloration ranges from cryptic to dark to brightly colorful. Some gallinaceous birds have elaborate head and neck ornamentation including wattles and casques. Some are primarily arboreal and others are terrestrial. Social groups may range from solitary dwellers to mated pairs to gregarious flocks. Mating systems range from monogamy to polygyny to polygynandry. Megapodes, also known as mound

builders, bury their eggs, which are incubated by heat from decaying vegetation, sun-warmed sand, or geothermal sources. Cracids may play an important role in the forest ecosystem as seed predators and dispersers. Some phasianoid galliforms have been domesticated and are kept as ornamentals or are bred and raised for human consumption. As a group, Galliformes has a nearly worldwide distribution. Galliform taxa inhabit a diversity of habits including primary forests, deserts, scrub forests, cultivated lands, bamboo thickets and alpine meadows.
Herbivorous to slightly omnivorous galliforms, comprising the majority of the group, are typically stoutly built and have short thick bills primarily adapted for foraging on the ground for rootlets or the consumption of other plant material such as heather shoots. The young birds will also take insects.
Galliformes are represented by single Family Phasianidae comprising of single Genus and Species viz. **Indian Peafowl (*Pavo cristatus)*.** This large member of chicken family is well known for the long tail of the adult cock. It is the National Bird of India. There is a distinct sexual dimorphism with brilliantly blue coloured male and a drab mottled brown female. The female shows slight metallic green sheen on lower neck. It is an Omnivore feeding on grains, vegetable shoots, insects, lizards, snakes etc. It is a Breeding Resident around Mumbai. The Peafowl was observed in U1, U2 and V3 sub sectors.

Order – Gruiformes (Plate 39)

The diverse order contains a considerable number of living and extinct bird families with, on first sight, little in common. Gruiform means "crane-like." Traditionally, a number of wading and terrestrial bird families that did not seem to belong to any other order were classified together as Gruiformes. These include, the very large cranes, or the relatively small and secretive water-loving crakes and rails, as well as a variety of very small families, some of them containing very few species, such as the Heliornithidae, the limpkin, or the trumpeters. On first sight, the Gruiformes seem to have little in common with one another because they are morphologically diverse. Other birds have been placed in this order more out of necessity to place them somewhere; this has caused the expanded Gruiformes to to lack distinctive apomorphies. A notable feature in several gruiform lineages is that flighlessness evolves far more easily than in most other birds. About one-third of the extinct families were at least partially flightless, and numerous living and extinct flightless rails are known.
Gruiformes are represented by single Family Rallidae comprising of four Genera and four Species.

White breasted Waterhen (*Amaurornis phoenicurus*): It is a long legged grey bird with prominent white face and breast. It is a shy silent bird keeping to reeds and vegetation of marshy ground. It is an Omnivore feeding on insects, worms, mollusks, grains and shoots of marsh plants. It is a Breeding Resident around Mumbai. The waterhen was observed near the lake from U2 and V1 sub sectors.

Common Coot (*Fulica atra*): It is slaty black almost tailless duck-like waterbird with lobbed toes. The ivory white pointed beak and frontal shield on forehead are its identifying characteristics. It is an Omnivore feeding on grass and shoots of aquatic plants as well as insects, molluscs etc. It is a Breeding Resident around Mumbai, was observed near V1 sub sector in the lake.

Purple Swamphen (*Porphyrio porphyrio*): It is a large purplish blue rail with long red legs and toes. The red frontal shield and red short heavy bill are its diagnostic features. It feeds on shoots and vegetable matter as well as insects and molluscs. It is a Breeding Resident around Mumbai and observed in U2 and V1 sub sectors in the lake .

Common Moorhen (*Gallinula chloropus*): It is slaty grey brown marsh bird with white edges on closed wings. The bright red frontal shield on forehead and red base of greenish bill are diagnostic characteristics. This Omnivore feeds on grass and shoots of aquatic plants as well as insects, molluscs etc. It is a Breeding Resident around Mumbai, was observed in the V1 sub sector.

Order – Passeriformes (Plate 39 - 41)

The birds of the order includes more than half of all bird species. Sometimes known as **perching birds** or, less accurately, as songbirds, the passerines form one of the most diverse terrestrial vertebrate orders: it is roughly twice as diverse as the largest of the mammal orders, the Rodentia.

The names "passerines" and "Passeriformes" are derived from *Passer domesticus*, the house sparrow – and ultimately from the Latin term *passer* for true sparrows and similar small birds. Many passerines are songbirds and have complex muscles to control their syrinx; many gape in the nest as infants to beg for food. The foot of a passerine has three toes directed forward and one toe directed backwards, called anisodactyl arrangement. The toes have no webbing or joining. The hind toe joins the leg at the same level as the front toes. In other orders of birds the toe arrangement is different.

Most passerines lay colored eggs, in contrast with non-passerines, whose eggs are white except in some ground-nesting groups where camouflage is necessary, and some parasitic cuckoos.

Order Passeriformes is represented by 16 Families and seven Sub families comprising of 35 Genera and 48 Species.

Large Cuckooshrike (*Coracina macei*): A grey bird with broad dark eye streak and wheatish from breast down. The wings and tail are black. It is an Omnivore feeding on large insects as well as berries and fruits especially of banyan, pipal and other wild figs. It is a Breeding Resident around Mumbai, was observed in the V5 sub sector.

Barheaded Cuckooshrike (*Coracina melanoptera*): It is an ashy bird with black head, wings and tail and whitish underparts in case of mail; while the female has grey head and underparts are barred black and white. It is an Omnivore feeding chiefly on insects but also enjoys berries of *Lantana* and other plants. It is a Breeding Resident around Mumbai, was observed in the V5 sub sector.

Jungle Crow (*Corvus macrorhynchos*): It is a jet black crow with a glossy sheen on body. It has a heavy bill and deep hoarse caw. It is a scavenger feeding on carrion, offal as well as eggs and chicks of other birds and young of small mammals. It is a Breeding Resident around Mumbai, was common to the campus .

House Crow (*Corvus splendens*): It has smaller size and grey body and neck with black wings. The beak is slender. It is common around human habitation. This scavenger has no particular food choice feeding on carrion, offal, kitchen scraps, insects, fruits, eggs or fledgling birds. It is a Breeding Resident around Mumbai, was common to the campus.

Thick billed Flowerpecker (*Dicaeum agile*): A faintly brown streaked bird ashy olive brown above and buff white below. It has thick bluish bill. This Frugivore is partial to *Dendrophthe* and *Viscum* berries but also eats other fruits like pipal figs, *Lantana* berries. The bird was sighted in the V1 sub sector.

Ashy Drongo (*Dicrurus leucophaeus*): It is a glossy slim slate black drongo with a deeply forked tail. The crimson eyes are its identifying character. It has an excellent repertoire including ability to mimic other birds. It is chiefly a forest bird feeding mainly on insects. It is a Winter Visitor to Mumbai. The drongo was observed in the U1, V1 and V3 sub sectors.

Black Drongo (*Dicrurus macrocerus*): It is a slim, agile glossy bird with long, deeply forked tail. A white rictal spot near beak distinguishes it from Ashy Drongo. It has variety of harsh calls and is known to mimic birds of prey. It is a Breeding Resident around Mumbai. Sighted in the entire campus except V4 sub sector.

Red Avadavat (*Amandava amandava*): The breeding males are red with white spots. The non breeding males and females have red bill, red rump and white spots on wings. It is a Grainivore feeding chiefly on seeds of grasses. It is a Breeding Resident around Mumbai, was observed in V1 sub sector.

Scaly breasted Munia (*Lonchura punctulata*): The adult males are chocolate brown upperparts and white speckled with black underparts. It is a Grainivore feeding chiefly on seeds of grasses. It is a Breeding Resident around Mumbai, was common in the urban sector and also sighted in the V1 and V3sub sectors.

Dusky Crag Martin (*Hirundo concolor*): A small sooty brown bird with short square tail and swallow like wings. This insectivore feeds mainly on midges and other tiny winged insects in air. It is a Breeding Resident around Mumbai and singhted in the V3 and V4 sub sectors of the campus.

Red rumped Swallow (*Hirundo daurica*): A small bird with glossy deep blue upperparts and dark brown streaked fulvous white underparts. The chestnut half collar on hind neck and deeply forked tail and a red rump are its identifying characteristic. This Insectivore feeds on flies and midges on the wing. It is a Breeding Resident around Mumbai, was sighted in U3 and V3 sub sectors.

Common Iora (*Aegithina tiphia*): A tiny black and yellow bird with two white wing bars. It has a sweet long drawn musical whistles and short chirrups. It feeds on insects their eggs and larvae. It is a Breeding Resident around Mumbai, was observed in both the sectors.

Long tailed Shrike (*Lanius schach*): It has a bright rufous lower back and rump while underparts are washed rufous. The head is grey with black forehead and black band through the eyes. It has a stout hooked beak. It feeds on a variety of diet which includes large insects like grasshopper, lizards, young mice etc. It has a peculiar habit of impaling its prey on thorns and hence also known as Butcher Bird. It is a Breeding Resident around Mumbai. Except in V2 and V5 was sighted in the entire campus.

White Wagtail (*Motacilla alba*): It is a black and white bird. The chin, throat and underparts are white. It gets its name due to continuous wagging of tail as it moves. It is an Insectivore and a Winter Visitor to Mumbai, was sighted only in the U2 sub sector.

Grey Wagtail (*Motacilla cinerea*): It is a slim grey and yellow with a long tail. It is an Insectivore and a Winter Visitor to Mumbai and was observed only in the V5 sub sector.

Citrine Wagtail (*Motacilla citreola*): It is a bright yellow and black coloured Wagtail. It can be differentiated by yellow broad supercilium and forehead. An insectivore feeding chiefly on midges and flies. It is a Winter Visitor to Mumba, was observed in U1, U2 and V1 sub sectors.

Black Naped Monarch (*Hypothymis azurea*): A bright blue of flycatcher with a partial fan tail and whitish abdomen. It shows a velvety black patch on nape and black gorget across foreneck. It is an Insectivore feeding on flies, midges as well as larger insects like cicadas. It is a Breeding Resident around Mumbai, was observed in the U1 sub sector.

Asian Paradise Flycatcher (*Terpsiphone paradise*): This handsome bird show very distinct sexual dimorphism. The adult male is white with metallic black crest on head and two long narrow ribbon-like tail feathers. The females and juvenile males are chestnut above and greyish white below. This Insectivore feeds on flies, gnats and other dipterous insects. It is a Breeding Resident around Mumbai, was sighted in U1, V1 and V5 sub sectors.

Tickell's Blue Flycatcher (*Cyornis tickelliae*): It is a small blue bird with bright azure forehead, eyebrows and shoulder patches. The throat and breast are rusty, fading to white on abdomen. It feed on flies, gnats and other dipterous insects. It is a Breeding Resident around Mumbai, was sighted in V1 sub sector.

Red throated Flycatcher (*Ficedula parva*): It is a small plain brown flycatcher with partly cocked black and white tail. The adult males have chin, throat and breast bright orange-red while the females and juvenile males have ashy fulvous breast and white underparts. It feeds on flying insects and is a Breeding Resident around Mumbai, was observed in U2, U3 and V4 sub sectors.

White browed Fantail Flycatcher (*Rhipidura aureola*): A dark sooty brown flycatcher with broad white forehead and underparts. The white supercilium extends to the nape. An insectivore feeding chiefly on dipteran and hemipteran insects. It is a Breeding Resident around Mumbai, was sighted in the Urban and V3 sub sectors.

Blyth's Reed Warbler (*Acrocephalus concinens*): A small warbler with dark olive brown upperpart, and buff underpart with white throat. It feeds on grasshopper and other insects. It is a Winter Visitor to Mumbai, was sighted in the U2 and V1 sub secotrs.

Booted Warbler (*Hippolais caligata*): It has pale olive brown upperparts and buff underparts. It feed on insects. It is a Winter Visitor to Mumbai, was sighted in U1, U2 and V1 sub sectors.

Common Tailorbird (*Orthotomus atrogularis*): A small olive-green bird with whitish underparts and a rust coloured crown. It gets its name from the way it makes its nest by stitching together leaves. It is an Omnivore feeding on tiny insects, their eggs and grubs as well as nectar from various flowers. It is a Breeding Resident around Mumbai, was sighted in the entire campus.

Greenish Warbler (*Phylloscopus trochiloides*): It is dull greenish above and sullied yellowish white below. It has a well marked yellow supercilium and dark eye streak. The cheeks are mottled olive and yellowish. It feeds on insects including the caterpillars. It is a Winter Visitor to Mumbai, was sighted only in the V1 sub sector.

Plain Prinia (*Prinia inornata*): A small warbler with ashy slate upperparts and fulvous white underparts. It sports a long black and white tipped tail and a pointed beak. Its diet includes insects. It is a Breeding Resident around Mumbai, was sighted only in the V1 sub sector.

Ashy Prinia (*Prinia socialis*): A small brown warbler with rufous brown upperparts and fulvous white underparts. It has long unmarked tail and a pointed beak. Its diet includes insects. It is a Breeding Resident around Mumbai, was fairly common in the entire campus.

Yellow-eyed Babbler (*Chrysomma sinense*): This small babbler with cinnamon and chestnut upperparts and white underparts. It gets it name from the conspicuous orange-yellow ring round eye. It is an Omnivore feeding on spiders and insects as well as berries and flower nectar. It is a Breeding Resident around Mumbai, was sighted in the U2 sub sector.

Spotted Babbler (*Pellorneum ruficeps*): A small olive brown babbler with a reddish brown cap. The whitish underparts are heavily streaked or spotted with brown on breast. It feeds on insects. It is a Breeding Resident around Mumbai, was observed inV5 sub sector only.

Jungle Babbler (*Turdoides striatus*): An earthy brown and untidy looking bird with a long tail. It is usually associated in groups of six or more giving it its common name "Sat Bhai". It is an Omnivore feeding on spiders and insects as well as wild figs, berries, grains and flower nectar. It is a Breeding Resident around Mumbai, was sighted in both the sectors.

Oriental Magpie Robin (*Copsychus saularis*): It is a small black and white bird with a cocked tail. In females the black is replaced by grey. It is a common garden bird. This Omnivore feeds on insects and flower nectar, but is known to take on smaller reptiles. It is a Breeding Resident around Mumbai, was common to the campus.

Common Stonechat (*Saxicola leucora*): The male Stonechat can be distinguished from drab female due to its black head, orange brown breast and white collar like patches on sides of neck, shoulders and above root of tail. Its diet comprises of insects. It is a Winter Visitor to Mumbai, was sighted in V1 sub sector.

Indian Robin (*Saxicoloides fulicata*): A black bird with a white patch on wings and rusty red patch under the root of tail as against ashy brown female which lacks wing patch. It feeds on insects and their eggs, spider etc. It is a Breeding Resident around Mumbai, was sighted in the V sub sector.

Orange headed Thrush (*Zoothera citrine*): It has bluish grey upperparts while the head, neck and underparts are orange chestnut. The vent and the under tail-coverts are white. It is an omnivore feeding on insects, worms especially earthworms as well as berries and fruits. It is a passage migrant to Mumbai, was sighted in the V5 sub sector.

Crimson Sunbird (*Aethopyga siparaja*): It is also known as yellow rumped sunbird. The male has glistening purple, green and crimson body. The pointed metallic green tail and a characteristic yellow rump

are its identifying characters. The females are drabber with dusky olive green above and dull ashy green below. It feeds on the nectar from the flowers. It is a Resident around Mumbai, was seen in U1 sub sector.

Purple Sunbird (*Nectarinia asiatica*): It is a common garden bird. The breeding male is metallic dark blue and purple with bright yellow and scarlet pectoral tufts. The non breeding male and females are brown to olive brown above and pale dull yellow below. It feeds nectar from flowers. It is a Breeding Resident around Mumbai, was sighted in U1 and V3 sub sectors.

Purple rumped Sunbird (*Nectarinia zeylonica*): A common garden bird with metallic crimson, green and purple upperparts and breast and yellow underparts. The females and non breeding males are drabber. It feeds nectar from flowers. It is a Breeding Resident around Mumbai, seen in both the sectors.

Eurasian Golden Oriole (*Oriolus oriolus*): It is a bright golden yellow bird with black in wings and tail and a conspicuous black streak through eye. The females are duller and greener. It is an Omnivore feeding on insects as wells as fruits, berries and figs of banyan and peepal. It is a Breeding Resident around Mumbai, was sighted in both the sectors but more in the urban sector.

House Sparrow (*Passer domesticus*): It is one of the most familiar birds in India and stays closer to human settlements. There is distinct sexual dimorphism. The male has rufous chestnut back with black streak. The sides of neck, upper back and behind back are chestnut with dark brown tail and white shoulder patch on rufous wing. The adults show a distinct grey crown, black lores and around eye. The females are ashy grey-brown above, streaked with blackish and rufous and fulvous white below. It is an omnivore feeding on grains, fruit buds, flower nectar, insects as well as kitchen scraps. It is a Breeding Resident around Mumbai. The bird was common to the campus except V2 and V4 sub sectors.

Indian Pitta (*Pitta brachyuran*): It is a gaudy bird with green, blue, fulvous, black and white with crimson breast and under tail. It keeps to the ground in undergrowth and scrub jungle. It is an Insectivore feeding on insects and grubs. It is a passage migrant to Mumbai, was observed in V5 sub sector.

Red-vented Bulbul (*Pycnonotus cafer*): It is a smoke brown bird with partially crested head with scale like markings on breast and back. The conspicuous red patch on the vent below the root of tail is the distinctive character. It is an Omnivore feeding on insects, fruits, berries, peas, vegetables as well as flower nectar. It is a Breeding Resident around Mumbai, Was seen in the entire campus except U1 sub sector.

Red-whiskered Bulbul (*Pycnonotus jocosus*): It is another common bird with brown upperparts and white underparts with a blackish marking around neck. The black erect pointed crest and crimson whisker like markings with a crimson vent are its distinguishing characteristic. It is an Omnivore feeding on Omnivore feeding on insects, fruits, berries, peas, as well as flower nectar. It is a Breeding Resident around Mumbai, was sighted in both the sectors .

White cheeked bulbul (*Pycnonotus leucotis*): It is an earth brown bird with black head, white cheek and sulphur yellow vent. It is an Omnivore feeding on Omnivore feeding on insects, fruits, berries as well as flower nectar. It is a Breeding Resident around Mumbai, was sighted in V5 sub sector.

White browed Bulbul (*Pycnonotus luteolus*): It is a sober brownish olive green bird with pal underparts. It is devoid of crest and has a conspicuous white forehead and eyebrows. It feeds on insects, flower nectar, figs of banyan and peepal and berries of *Lantana* and *Zizyphus*. It is a Breeding Resident around Mumbai, was seen in V2 and V4 sub sectors.

Common Myna (*Acridotheres tristis*): It is a dark brown bird with yellow bill. Legs and bare skin around eye. It shows conspicuous white patches in wings called 'mirrors.' It has Omnivorous diet which includes fruits, insects as well as kitchen scraps. It is a Breeding Resident around Mumbai, was common to the campus and seen in all sectors.

Asian Pied Starling (*Sturnus contra*): It is a black and white bird deep orange- yellow bill. It shows orange orbital skin. It lacks the conspicuous white mirror in wings as in Myna. Its diet includes fruits, insects, kitchen scarps as well as offal. It is a Winter Visitor to Mumbai, was seen in U2 and V3 sub sectors.

Chestnut Tailed Starling (*Sturnus erythropygius*): It is a small bird with silvery grey upperparts and rusty brown underparts. It has blackish wing quills but lacks the conspicuous white mirror in wings as in Myna. Its diet includes insects, flower nectar, figs of banyan and peepal and berries of *Lantana* and *Zizyphus*. It is a Winter Visitor to Mumbai, was sighted in U2 sub sector only.

Brahminy Starling (*Sturnus pagodarum*): This is a small bird with grey upperparts and reddish fawn underparts. It has a glossy black crown and along crest and black wing quills. It is largely Omivorous feeding on berries, wild figs and insects. It is a Breeding Resident around Mumbai, was observed in U1 sub sector only.

Order – Pelecaniformes (Plate 41)

Pelecaniformes are an order of medium-sized and large waterbirds found worldwide. They are distinguished from other birds by the possession of feet with all four toes webbed (totipalmate). They all have a bare throat patch (gular patch). The nostrils have evolved into dysfunctional slits and unlike other birds, they breathe through their mouths. There are some 50-60 living species. Pelecaniformes comprises of six families (Phaethontidae (tropicbirds), Sulidae (boobies and gannets), Phalacrocoracidae (cormorants and shags), Anhingidae (anhingas), Pelecanidae (pelicans) and Fregatidae (frigatebirds)). Some are primarily aerial, some are underwater swimmers, some are surface swimmers, and some plunge from great heights into the water. Pelecaniform birds are distributed worldwide, primarily in coastal and marine zones. Many pelecaniforms breed in mixed colonies with other pelecaniforms, gulls, terns, or penguins but individual birds are monogamous. Pelecaniform birds feed primarily on fish and squid. They may also prey on mollusks, crustaceans, amphibians, reptiles, and invertebrates.
Pelecaniformes are represented by two Families comprising of two Genera and two Species.

Oriental Darter (*Anhinga melanogaster*): A black water bird with velvety brown narrow head and slender, long neck and pointed dagger-like beak. It has silvery grey streaks on back. It is a Piscivore and is a Breeding Resident around Mumbai, was seen in the lake close ot U1 and V1 sub sectors.

Small Cormorant (*Phalacrocorax niger*): It is a glistening black duck like bird with a long stiff tail and a white patch on throat. It has a slender compresses beak which is sharply hooked at the tip. It is Piscivore and catches fish by chasing them under water. It is a Breeding Resident around Mumbai, was seen in the lake close ot U1 and V1 sub sectors.

Order – Piciformes (Plate 41)

Piciformes are insectivorous, although the barbets and toucans mostly eat fruit and the honeyguides are quite unique among birds in being able to digest beeswax (though insects make up the bulk of their diet). Nearly all Piciformes have parrot-like zygodactyl feet (two toes forward and two back), an arrangement that has obvious advantages for birds that spend much of their time on tree trunks. All nest in cavities and have altricial young.
Piciformes are represented by two Families comprising of two Genera and two Species.

Coppersmith Barbet (*Megalaima haemacephala*): A common garden bird also called as Crimson breasted Barbet. It has grass green body wit streaked yellowish underparts. The throat is yellow with crimson breast and forehead. It has short distinctly triangular tail. It is Frugivore feeding on fruits and berries but is partial towards banyan and peepal figs. It is a Breeding Resident around Mumbai, was common to the campus.

Rufous Woodpecker (*Dendrocopos hyperythrus*): A chestnut rufous woodpecker with cross barred body and black on wings. He male possesses a crimson patch of feather under the eye. It is an Insectivore feeding on eggs, larvae, pupae and adults of arboreal *Chromatogaster* ants. It is known to nest in the arboreal nest of these ants. It is a Breeding Resident around Mumbai, was seen in U1, V1 and V5 sub sectors only.

Order – Podicipediformes (Plate 41)

Podicipediformes comprises one family (Podicipedidae), six genera, and 22 species. Grebes are distributed almost worldwide (absent from the Arctic, Antarctic, some oceanic islands). Grebes inhabit freshwater ponds and lakes, and slow flowing rivers (up to 3000m altitude).

Grebes are stocky to narrow-bodied, diving waterbirds. Sexes are similar with females often smaller in body and bill size. Grebes are excellent divers and powerful underwater swimmers (foot propelled). Grebes prey on fish, aquatic insects, crustaceans, mollusks and small vertebrates.

Little Grebe (*Tachybaptus ruficollis*): It is a small, drab, plump bird with silky white underparts. In its breeding plumage the neck and head are brown and chestnut and the upper plumage is slightly paler. It has a short pointed bill but no tail. It feeds on aquatic insects, larvae, tadpoles, frogs, crustaceans etc. It is a Breeding Resident around Mumbai, was seen in the lake near V1 sub sector.

Order – Psittaciformes (Plate 41)

The order comprising of Parrots & Parakeets has about 350 species, contained within two families, Psittacidae and Cacatuidae (cockatoos). Some authorities regard lorikeets as a separate third family.
The upper mandible of the curved bill is hinged at the joining to the skull which gives it more flexibility than in other birds. The arrangement of lower jaw mandible fitting up under the top one is distinctive. This, and in most species a thick muscular tongue allow parrots to manipulate food items easily in their mouths. The exceptions are a few nectar feeding parrots which have longer, thinner tongue adapted for collecting nectar and pollen from flowers. Most species feed on fruit and seeds but a few will feed on insects as well.
Order Pelecaniformes are represented by single Family comprising of single Genus and three Species.

Plum headed Parakeet (*Psittacula cyanocephala*): It is a smaller Parakeet with bluish red head and maroon shoulder patches. The female lack these shoulder patches and posses grey head with bright yellow collar round neck. It is a Frugivore feeding chiefly on fruits. A breeding Resident around Mumbai, was seen in V5 sub sector.

Alexandrine Parakeet (*Psittacula eupatria*): It is a large sized green bird with conspicuous maroon patches on shoulder. It has a short massive deeply hooked red bill. The males possess a rose-pink and black collar which is absent in females. It is a Frugivore feeding chiefly on fruits. It is a Breeding Resident around Mumbai, was common in the urban sector and also sighted in the V3 sub sector

Rose Ring Parakeet (*Psittacula krameri*): It is a medium sized green bird with short massive deeply hooked red bill. The males possess a rose-pink and black collar which is absent in females. It is a Frugivore feeding chiefly on fruits. It is a Breeding Resident around Mumbai, was common to the campus.

Order –Strigiformes (Plate 41)

This is an order of birds of prey, comprising 200 extant species. Most are solitary, and nocturnal, with some exceptions (e.g. the Burrowing Owl). Owls mostly hunt small mammals, insects, and other birds, though a few species specialize in hunting fish. They are found in all regions of the Earth except Antarctica, most of Greenland, and some remote islands. The living owls are divided into two families, the typical owls, Strigidae, and the barn-owls, Tytonidae.
A diverse order, owls range in size from sparrow- to eagle-sized. They are known for many characteristics, including their well-developed talons, soft plumage, and notoriously silent flight. Most species are active hunters at night, and as such they have several important adaptations for this lifestyle. Their forward-facing eyes are large, elongated, and have slightly thickened corneas. The number of light-sensitive elements (rods) in their retinas is high, especially compared to other birds. This allows them a heightened sense of vision in dim light, but contrary to popular belief, they cannot see in total darkness.

Spotted Owlet (*Athene brama*): It is a small grayish brown owl with white spot. It has a typically large head with staring yellow eyes that are directed forward. It had a mixed diet comprising of beetle and other insects, scorpions, young birds, mice and lizards. It is a Breeding Resident around Mumbai, was only seen in the U1 sub sector.

Mammals (Plate 42)

Order: Artiodactyla

These are even toed hoofed mammals. Another key distinguishing feature is the shape of the astragalus, a bone in the ankle joint, which has a double-pulley structure. This gives the foot greater flexibility.

Domestic Cattle (*Bos indicus)*
It belongs to family Bovidae. It is a ruminant and has a four chambered stomach. It has true horns that do not shed and grow continuously. Cows have cloven hooves. They are reared for milk, meat and hide. It was observed in all areas except V4.

Order – Carnivora

Modified fourth upper premolar and first lower molar (carnassial pair). The name "Carnivora" is sometimes taken to mean that members of this group are all carnivorous or that all carnivorous mammals are members of this group. This is not so. Members of Carnivora have diverse food habits, although many are primarily carnivorous, and carnivory is widely distributed in mammals, being found in many other orders including bats, marsupial mammals, primates, and dolphins and whales.

Domestic Dog It belongs to family Canidae. They have blunt, nearly straight and non-retractile claws. Dogs have five toes on the forefeet and four on the hind. It was observed in all areas except V5

Order – Primates

Evolutionary trends in primates- digital dexterity, nails, pads, thumb opposable. relatively large cerebral cortex, exchange of optical for olfactory centers, shortened muzzle, eyes forward for stereo vision, slow reproductive rate, long life span. They show omnivory/herbivory, complex mating and social systems, other more complex behaviors such as tool use, learning. It is one of the earliest of the modern orders to appear. Cretaceous origins probably developed from the insectivores. Known from all continents except Antarctica/Australia

Rhesus Macaque (*Macaca mulatto)*Hindi: Bandar; Marathi: Lal Makad. It belongs to family Cercopithecidae. The most wide spread monkey of North India. It is fed by humans at temples. Being intelligent they gather at such spots for food and demand it with impunity. In urban and rural areas they often raid homes for eatables. The group size may vary from 5 to 50. The group was observed in U1.

Hanuman Langur (*Semnopithecus entellus)* Hindi; Marathi: Hanuman Langur. It belongs to family Cercopithecidae. The most widespread langur in India. It has silvery grey body and black face. Considered as sacred by Hindus. The Hanuman langur is known for its unique association in the forest with the Cheetals or Spotted Deer, each warning the other of the approach of predators. It was observed in U1.

Domestic Cat It belongs to family Felidae of order Carnivora. Cats conserve energy by sleeping more than most animals, especially as they grow older. The daily duration of sleep varies, usually 12–16 hours, with 13–14 being the average. The temperament of a cat can vary depending on the breed and socialization. Cats with oriental body types tend to be thinner and more active, while cats that have a cobby body type tend to be heavier and less active. It was observed in U1, U2, U3 and V3

Indian Grey Mongoose (*Herpestes edwardsii).* It belongs to family Herpestidae (Carnivora). It has Tawny grey fur and individual hairs have ten alternate dark and light bands. Its legs are darker than the body, its tail is as long as its head and body put together. Very bold and inquisitive, this mongoose often lives near human habitation. It was observed in U2, V1 and V3

Ruddy Mongoose (*Herpestes smithii).* A large forest mongoose of peninsular India, It has reddish-brown infusion, particularly on the head, neck, and shoulders. Its legs are also reddish, especially the hind ones. The tail is short with black tip that is carried pointed upwards, a unique behavioural trait. It was observed in V2.

Order – Logomorpha

The order of mammals including rabbits, hares, and pikas; differentiated from rodents by two pairs of upper incisors covered by enamel, vertical or transverse jaw motion, three upper and two lower premolars, fused tibia and fibula, and a spiral valve in the cecum.

Indian Hare (*Lepus nigricollis)* Hindi: Khargosh; Marathi: Ran Sasa. It is reddish brown with black hair mixed throughout. It is a very territorial hare; it defends upto 10 hectares of land against rival males. It prefers open scrub, short grassy patches, and overgrazed forest land. It was observed in V2.

Order – Rodentia

It is characterised by two continuously growing incisors in the upper and lower jaws which must be kept short by gnawing. Common rodents include mice, rats, squirrels, chipmunks, gophers, porcupines, beavers, hamsters, gerbils, guinea pigs, degus, chinchillas, prairie dogs, and groundhogs.

Bandicoot Rat (Bandicota), House rat, Rat. They are mostly small with long tails and short limbs. All of them are terrestrial but some live in trees and caves. They can be diurnal or nocturnal and while most of them are graminivorous (grain-eaters) and feed on vegetable matter, some feed on invertebrates and small vertebrates. Three species of rats were sighted during present study. They are – Bandicoot rat – it was found in U1 only; House rat – found in U2 only; one sps of unidentified rat was seen in U2, U3 and V4 areas.

Order – Chiroptera

Chiroptera comes from two Greek words *cheir* "hand" and *pteron* "wing." The forelimbs of bats are developed as wings, making them the only mammals naturally capable of flight (opposed to other mammals, such as flying squirrels, gliding possums and colugos, that glide only for a distance). Bats do not flap arms like birds, instead they flap spread out hands where their fingers are very long and covered with a thin membrane.

Indian flying fox *Pteropus giganteus* Hindi: Chamgadhar; Marathi: Vatvaghul. They are often seen roosting in hundres on large trees. It is chestnut-brown with with large black years and huge black wings that it often folds over its tan or orange belly. Major sighting of this sps was in U1 then in V1 and V4. One more spp of unidentified bat was observed in V4.

Three striped palm squirrel *Funambulus palmarum* Hindi: Gilahari; Marathi: Khaar. It belongs to order Rodentia and family Sciuridae. It is a small, common squirrel of peninsular India, grayish brown with pale underparts. It has three pale parallel lines on its back from head to tail. Legs are short, and its bushy, black-and-white peppered tail has a bold, reddish brown mid-ventral line running through it.
This mammal was common in the campus.

Order – Insectivora

Order Insectivora comprises of a wide variety of mammals, from the pygmy shrew to the spiny hedgehog. Insectivores are named after their tendency to eat insects, but they also eat other invertebrates such as worms and even some vertebrates. Insectivores vary greatly in appearance, are small and rodent-like in appearance. They typically have a long snout, some are covered in a mouse-like fur with a hairy, smooth tail, others are covered in spines and lacks tail entirely.

Shrew It belongs to family Soridae, are small, mouse-like mammals with long pointed snouts, small eyes, and inconspicuous ears. They are mainly nocturnal sometimes can be seen during day. Their world is sub-leaf stratum, logs, or crevices, where they build their nests. Some species are adapted for semi-aquatic environment and forage under water.
It was found in U3 sub sector in the campus.

Civet It belongs to family Viverridae of order Carnivora. These have modified skin gland that is functional in true civets. They differ from cat by having five toes on the hind feet and an elongated face. Their ears are larger than mongooses. Most of them are nocturnal and are omnivores.
The indirect evidences of civet were recorded in U1 and V4 sub sectors.

Species Account
Less observed Fauna

Other Fauna (Plate 42)

Hammer headed flatworm: *Bipalium* is a genus of large predatory land flatworms, terrestrial planarians. They are often loosely called "hammerhead worms" or "arrowhead worms" because of the distinctive shape of their head region. They require high humidity and are found in dark, cool, moist areas under objects such as rocks, logs, in debris, or under shrubs, and on the soil surface following heavy rains. Land planarians devour earthworms, slugs, insect larvae, and are cannibalistic.
They were observed only in V1 Sub sector of the Campus

Centipedes: Centipedes are arthropods whose bodies are made up of a chain of many flattened segments, each except the one behind the head and last two bearing a single pair of appendages (legs). The appendages of the first body segment have been modified to form large, poisonous fangs that are used to capture prey. They are generally found in leaf litter in woods and forests or in rotting timber. Centipedes are primarily nocturnal, or below ground hunters and are shy of the light. The centipedes are one of the largest terrestrial invertebrate predators and often they contribute a significant proportion to invertebrate predatory biomass in terrestrial ecosystems.
They were observed throughout the IIT- Bombay Campus.

Earthworm: Earthworm is the common name for the largest members of Oligochaeta. These invertebrates range in color from brown to red, and most have a soft body. Earthworms don't have eyes, but they do have light-sensitive cells scattered in their outer skin. These cells don't enable earthworms to see images, or forms, but they do give their skin the capacity to detect light and changes in light intensity. The worm's skin cells are also sensitive to touch and chemicals Earthworms are very important animals that aerate the soil with their burrowing action and enrich the soil with their waste products. There are over 3,000 species of earthworms around the world.
It was observed in U2, V1 and V2 Sub sectors in IIT- Bombay Campus.

Millipede: belong to Class **Diplopoda**, are arthropods that have two pairs of legs per segment as two single segments fused together as one. Most millipedes have very elongated cylindrical bodies. Millipedes live on land in moist microhabitats like under rocks, in rotting logs, in leaf debris, or occasionally in burrows. Most millipedes eat dead and decaying plant material, but a few are also carnivores. Millipedes also occasionally eat moist, living plants. They are often nocturnal. When they are in danger, millipedes curl up in a spiral, protecting their soft undersides. They can also spray a bad-smelling liquid that repels many predators.
They were observed in U1, U2, V1, V2, V3 and V4 Sub sectors of the Campus.

Slug: These are a group of gastropods with a minute shell.
They were observed only in V4 or Along Pipeline Sub sector of IIT- Bombay Campus.

Snail: Land snails are gastropods which literally mean stomach-foot as they locomote by gliding on a muscular structure on the bottom of the abdomen, called the foot. They have a single shell, usually coiled, that is a combination shield and humidor. Snails have two pairs of tentacles on the head. Land snails have a light-sensitive eyespot located on each of the larger tentacles; water-dwelling snail eyespots are at the base of the tentacles. The smaller pair of tentacles is used for the sense of smell and the sense of touch. Most snails eat living and decaying plants, but some are scavengers and some are predators. They eat using a radula, a rough tongue-like organ that has thousands of tiny denticles (tooth-like protrusions). They were observed in U2, U3 and V3 Sub sectors of the Campus.

Giant African Snail: The East African land snail or giant African land snail is a species of large, air-breathing land snail. *Achatina fulica* has a narrow, conical shell, which is twice as long as it is wide. The shell is generally reddish-brown in colour with weak yellowish vertical markings but colouration varies with environmental conditions and diet.. Adults of the species may exceed 20cm in shell length. *A. fulica* remains active at a temperature range of 9°C to 29°C, and survives temperatures of 2°C by hibernation and 30°C by aestivation. *Achatina fulica* is considered one of the worst snail pests in the tropics and subtropics. It consumes large volumes of native plants, modifies habitats and out-competes native snails. This species

has been nominated as among 100 of the "World's Worst" invaders by the Invasive Species Specialist Group (ISSG).
They were observed only in U1 Sub sector of IIT- Bombay Campus.

Wood Louse: is a crustacean with a rigid, segmented, long exoskeleton and fourteen jointed limbs. They are usually found in damp, dark places, such as under rocks and logs. They are usually nocturnal and are detritivores, feeding mostly on dead plant matter. Woodlice then recycle the nutrients back into the soil.

They were observed only in U2 Sub sector of the Campus.

Land Crabs: These are crabs adapted for terrestrial existence. Similar to all other crabs, land crabs possess a series of gills. In addition, the part of the carapace covering the gills is inflated and equipped with blood vessels. These organs extract oxygen from the air, analogous to the vertebrate lungs. Land crabs are tropical omnivores who sometimes cause considerable damage to crops.
They were observed in U1, U2 and V1 Sub sectors of the Campus.

Tilapia fish: Mozambique Tilapia has spread worldwide through introductions for aquaculture. The wild populations of *Oreochromis mossambicus* are a result of intentional release or escapes from fish farms. It is omnivorous and feeds on almost anything, from algae to insects. Mozambique tilapia (*Oreochromis mossambicus*) may be a possible threat to native species through competition for food and nest space. Juveniles have been documented to feed on other fish. It can tolerate a wide range of water temperatures from 4°C to 40°C, low oxygen levels, poor water quality and pollution. The Mozambique tilapia is a mouth brooder. Males construct nests in areas of sparse to moderately dense vegetation. It has been nominated by the Invasive Species Specialist Group (ISSG) as among "100 of the World's worst" invasive alien species.
It was observed only in V1 subsector.

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Annexure

1. Diversity of ant fauna (Family:Formicidae) in IIT-Bombay campus.
   - Kaustubh Bhagat, Gauri Gurav and Goldin Quadros.

2. Study of Odonata during Monsoon in IIT-Bombay Campus, Mumbai.
   - Aniruddha H. Dhamorikar, Gauri Gurav and Goldin Quadros.

3. Study of Insect diversity on the Asteraceae plants of IIT-Bombay campus.
   - Alok Chorghe, Gauri Gurav and Goldin Quadros.

4. Study of biodiversity of insects on *Leea indica* in IIT-Bombay campus.
   - Kashmira Khot, Gauri Gurav and Goldin Quadros.