

CHAPTER 6

SIGNIFICANT FINDINGS AND RECOMMENDATIONS

Documentation of the insect diversity of a green city like Vadodara has been done for the first time.

1. From the selected study sites a total of 382 species were recorded.
2. There was not much difference in the biodiversity of Urban and Agricultural sites. From Urban sites 371 species were recorded whereas 323 species were recorded from Agricultural fields.
3. Out of the 17 orders documented, 14 orders have maintained good insect diversity.
4. 62 gardens, large number of Agricultural fields and rich flora of Vadodara is able to sustain such diversity.
5. Fragmented habitats showed maximum biodiversity followed by Community gardens, Agricultural fields and minimum insect population was shown by Residential areas.
6. Generally speaking all the insect species were found in all the habitats only the population varied.
7. Population of soil dwelling insects dependent on decayed vegetation e.g. Diplurans, Collembolans, Embiopterans and Dermapterans was consistent over a period of three year study.
8. Major orders which showed decline were Orthoptera, Hemiptera, Coleoptera and Lepidoptera as they were site and food specific. Urbanization and indiscriminate use of pesticide affected the food plants directly. These were the orders which showed declining trends from the year 2005 to the year 2007.
9. Populations of Diplurans and Collembolans were more in agricultural fields and community gardens as compared to fragmented habitats and residential areas.

10. May flies (Ephemeroptera) were sighted only near the botanical gardens of University campus and Lal baug. No where else they were spotted.
11. Odonates were found in large numbers in all the four habitats.
12. The diversity and population of Dermapterans and Embiopterans were almost the same in Agricultural fields and fragmented habitats. Community gardens and residential areas were not having these orders in good numbers.
13. Phasmid population is hardly sighted like *Megaphasma* sp. May be due to less exploration of forest areas where these insects are found. As such total species of bacunculidae family in India are 6.
14. Population as well as diversity of the species of Orthoptera e.g. *Acridium succintum*, *Poikilocerus pictus* are reducing in the urban areas and increasing in the agricultural fields. For maintaining a balance in their population, grasslands and more shrubs should be grown in the residential areas as well as surrounding agricultural fields
15. Hemipterans were maximally found in those parts of fragmented habitats which had dense vegetation. Periphery of the gardens and cricket ground as well as surrounding area of the pond in Botanical garden had more population of *Lygaeus hospes*, *Petillia calcer*, *Scutellera nobilis*, *Chrysocoris stollii*, etc.
16. Thysanopterans were more in community gardens than in agricultural fields. Thrips were regarded as pest so pesticide usage for pest control reduces their population in agriculture fields.
17. Because of good availability of food for larvae, i.e aphids, jassids, whiteflies in the agricultural fields Neuropterans were spotted more in Agricultural fields and occasionally sighted in the residential areas.
18. Dictyoptera was maximally found in gardens and residential areas but occurs in all the study sites.
19. Coleopterans were seen in all the habitats but in residential areas their population was less.
20. Diptera which is full of vectors was found in all the study sites.
21. University campus, Laxmivilas Palace, Sayaji Baug and Lal Baug has large populations of Lepidoptera and Hymenoptera.

22. Within the order Hemiptera, the aquatic family Belostomatidae e.g. *Sphaerodema annulatum* and *Belostoma indicum* were found to be less in 2007 as compared to 2005. Reason for their decline is human interference in their habitat. Spilling of domestic and industrial waste in the river streams, affects the population of *Bufo melanostictus*, their main food and hence reducing the nos. of *Sphaerodema annulatum* and *Belostoma indicum*. This practice should be resisted and measures should be taken to control pollution in Vishwamitri river flowing inside the main city of Vadodara.
23. The dungrollers *Gymnopleurus cyaneus*, *G. miliaris*, *Onthophagus bonassus*, *O. gazzela*, *Catharsius pithecius* were found in fragmented habitats in 2005. In the year 2007 they were very rarely spotted.
24. Lycaenid butterflies like *Freyeria trochilus*, *Euchrysops cnejus* population were also found to be decreasing in the year 2007. *Freyeria trochilus* feeds on *Heliotropium* which is a weed in the agricultural fields, spraying of weedicides kills this weed. So is the case with *Euchrysops cnejus*, *Catochrysops strabo*, *Lampides boeticus*. Caterpillars feed on pods of pea. Spraying of pesticides kills the larvae reducing the population of these butterflies. Pesticide use should be reduced and alternate food plants of these butterflies like *Butea frondosa*, *Indigofera* sp., *Mimosa* sp. should be cultivated.
25. Insects pests like *Spodoptera litura*, *Plutella xylostella* were sighted only during initial cropping season. Later due to pesticides spray their population declined.
26. Population of aphids which are pests of pigeon pea, spinach, cabbage, cauliflower etc. was more in 2007 as compared to 2006. High multiplication rate of this insect and resistance to indiscriminate use of highly toxic insecticides are the main reasons for their sustenance.
27. For control of aphids, thrips, mealybugs, jassids, noctuid caterpillars in the agricultural fields, use of natural enemies like *Mantis religiosa*, *Hierodula unimaculata*, *Coccinella transversalis*, *Anegleis cardoni*, *Chrysoperla carnia* etc. should be encouraged and implemented.
28. Population of biocontrol agents like praying mantids, around and inside the fields was found to be less.

29. Growing stripes or groups of non crop flowering plants like *Calotropis species* (sometime thought of as weeds), fennel and coriander in the agricultural fields also provide food sources and refuge sites for beneficial insects like *Anagallis cardoni*, *Brumus suturalis* etc. They allow population of these natural enemies to build up and suppress the development of pest aphids within and around the crops.
30. Sandy patches should be maintained near the field margins so that population of predators like *Asclaphus sp.*, *Helicomitus sp.*, and *Brachymneurus abdominalis* can sustain.
31. It was seen that around Padra agricultural fields, nesting sites of *Odynerus* (predates on noctuid caterpillars) and *Apis indica* (pollinator) were being destroyed. Unless they are a threat to the human population nests of bees and wasps should not be disturbed.
32. A list of endangered and rare species along with their pictorial illustrations and map of distribution should be prepared for conservation of biodiversity in general and insect group in particular.

‘Too much of love for any species also results in its decline.’