Chapter – 13: Management of Insect Collections in the Selected Museums in India

Albert Hall Museum, Jaipur

This museum (visited in November 2014) does not have any insect collection (living/ dead), but objects associated with insects are present. There is a Section (in the corridor leading to the ‘Textile Gallery’) on ‘Lacquer Work’. Here, objects used made out of lac derived from the lac insect, have been displayed. Moving a little forward, there is a showcase on the right hand side to the entrance of the ‘Textile Gallery’ displays a sample of a lace decorated with green beetle wings from Trichonopoly. (Plate 13.1)

Bannerghatta National Park, Bengaluru

Inaugurated on 25 November 2006, the “Butterfly Park” constitutes an ideal place for most species of butterflies, because of the presence of natural vegetation and varied habitats. The Butterfly Trail is the 50 metre pathway from the main gate to the domes. This pathway has trees and shrubs of flowering species on both sides, which support the common varieties of butterflies. Right from the time of buying tickets near the entrance, visitors are surrounded by some of the most beautiful butterflies. From here onwards, the plants on either side of the path have interesting signage with literature on different aspects of the butterflies, like their inspirational role, etc.

The Butterfly Trail leads to a huge, transparent dome housing the butterflies. This is the first of the three domes, and is known as The Butterfly Conservatory, offering the visitors a closer watch of butterflies. This dome itself is quite remarkable being 100 ft. in diameter and 10,000² ft. in area. It is a circular enclosure, provided with a polycarbonate roof, inside which the living environment has been carefully designed and controlled, to support about 20 rare species of butterflies. At any time, at least 15 species of butterflies are present in the Butterfly Conservatory, housed in Dome 1, with an adjusted environment that suits the butterflies. The setting inside this dome is entirely tropical, with humid climate. The pond with a bridge and an artificial waterfall with gurgling streams, all contribute towards quite a perfect setting for
butterflies – the nature's most colourful creations. The flora of the conservatory includes plenty of the host plants and shrubs with bright, colourful flowers as well as artificial feed that attract the butterflies. Pests have attacked the flora grown inside the dome in the past and continue to do so even today, but spraying of pesticides is yet to be carried out to prevent any damage to the adult butterflies or their larval forms. The only technique used for managing the pests inside the conservatory is the plucking of the affected leaves and the pruning of the plants. Besides the butterflies, the architectural feature of Dome 1 attracts the visitors. Actually the Butterfly Conservatory had structures resembling the pupae of butterflies in appearance, hanging from the roof. These structures made out of sponge had been hung to absorb the noise and prevent the occurrence of any echoing sounds, though later replaced by small earthen pots like structures. The Park was surveyed twice, in April 2008 and in July 2013.

The Butterfly Conservatory leads into the second dome. A museum with kiosks, life size posters with details on butterflies, dioramas and exhibits constitute Dome 2. The museum exhibits pictures, descriptions and info graphics about the world caterpillars, moths, butterflies, and about the stages in their life cycles like eggs, larvae, cocoons, etc. Such visual aids have been put up on panels and lit up using fluorescent tubes. Informative paintings are drawn on the walls of the museum. Dioramas and animations depicting various facets of the life of butterflies are also present at the museum. Besides graphical content, the museum also has quiz programmes of educational value. Several dry preserved insects (especially butterflies) are present in this museum, displayed in showcases. The arrangement of showcases is much different than that usually witnessed, in the places visited and/ surveyed. Here, the showcases seem to be arranged in panels. In all four panels are present side by side, with four showcases in each, in turn divided into rows of two.

Panel 1 displays specimens from the Orders – Odonata, Orthoptera, Homoptera, Hymenoptera, Phasmida. Mostly Lepidoptera specimens are displayed, around 35 in number. A few of these include Paris peacock (*Papilio paris*), Southern bird wing (India’s largest butterfly), Striped tiger (*Danaus genutia*, Linn.), Atlas moth (*Attacus atlas*, Linn., it is the biggest moth),
Oleander hawk moth (*Daphnis merii*, Linn.). Besides, the Orange tip butterflies (Crimson tip, Yellow tip, White orange tip and Great orange tip), and the Pansies (Lemon, Blue and Yellow), 21 specimens of the Common emigrant, have been displayed on Panel 2. The Mottled emigrant and the Pioneer butterflies are also displayed here. Panel 3 has Crimson rose, Spot swordtail, Tiger butterflies, Common jay, Common mime, Common evening brown, Common baron, Baronet, Common leopard, Tawny coster, Common castor and Sun beam butterflies on display. The grass yellows, Crow butterflies and Spot swordtails have been displayed on Panel 4. The threatened butterflies displayed here include Gaudy baron, Blue mormon, Crimson rose, etc.

There is an Interpretation Centre in Dome 3. After visiting the Domes 1 & 2, if any visitor is still curious about butterflies and moths then they can enter this audio visual room housed there. Here, the interested visitor can watch a 20 minutes film presented in English. This screening gives more in-depth information about these idyllic species.

All the three domes of the Butterfly Park are made out of propylene and supported by high quality aluminium trusses.

The Conservation Laboratory of the Butterfly Park is the place where butterflies are reared, to be displayed on the host plants and in open vegetation. It has three areas. In one area, there used to be (in 2008) four big nets for the purpose of natural breeding of butterflies. In each of these nets, nectar producing flowering plants were grown in pots, so as to attract and feed the adult butterflies. The supply of such plants should be present throughout the year. In case such plants are not able to suffice the requirement of nectar of the adult butterflies, an artificial plant used kept in a pot at the centre, in all the four nets. Each such plant has four, large, differently coloured, artificial flowers. Each of these flowers, has a cotton swab dipped in honey, placed at its’ centre. This is helpful when any butterfly inside any net, is unable to obtain the naturally produced nectar. In each net two to three species of adult butterflies were maintained. Corresponding to the different species of butterflies (adult), specific host plants were also kept inside each net, to facilitate breeding between the adult butterflies. The host plants are smaller than the flowering,
nectar producing plants. After successful breeding, the butterflies lay eggs on the specific host plants. Then these plants used to be transferred from the larger nets to smaller ones. Two small nets were maintained in this area. Inside each of these two nets maximum of four to five specific host plants bearing the larval stages of different species of butterflies were kept. Generally, the first or the second instars are found on the plants maintained inside the small nets. At present (in 2013), there is one Breeding chamber on the left, where mating takes place and the butterflies lay eggs. The Breeding chamber is nothing but one of the four huge nets that used to be present earlier. It has had a shift in position as well. On the right side there is a huge area enclosed using netted material. Inside these on the one side we have small net enclosed areas (similar to the small nets that used to be present earlier). These have the host plans with the eggs laid by the butterflies after mating in the Breeding chamber on the leaves of the plants here for appearance of 1st or 2nd instars larvae. (Plates 13.2 and 13.3)

After the appearance of the second instars, the larvae pertaining to the different species, are transferred from the specific host plants (inside the small nets), into ventilated plastic containers, using brushes. These containers consist of parts of the feeding plants. While transferring the second instars larvae, the first instars stages should not be disturbed at all, as they are very tender and the slightest pressure can cause damage to them. Due to any reason, if the second instars larvae cannot be transferred using brushes, then those parts of the plant bearing the larvae are cut off, and the entire thing is placed in the ventilated plastic containers. Each such cut portion of the feeding plant, has a cotton swab dipped in water, at its’ base. This wet cotton is then covered with aluminium foil, so as to keep them fresh for at least 24 hours, because the feeding plant for the larvae is changed after every 24 hours. The ventilated plastic containers are placed one on top of another on steel racks, in another area of the conservation laboratory. The different stages of butterflies, belonging to the different species are kept here, inside the plastic containers by arranging them in the correct order from their second instars larval stages up to their adult stages, starting from the first rack backwards. Now (in 2013), the work has become more organized, with the employment of local people who have been assigned separate tasks, to speed up the process and for proper
maintenance. This reduces the risk of damage to butterflies and/or their life stages because they are highly sensitive creatures.

Nets big or small that are used for the breeding and rearing of butterflies, help to provide the plants (nectar producing and host/larval feeding) as well as the butterflies and their larval stages with security. The nets also help to prevent any attack on the plants and butterflies by any micro or macro living organisms.

Generally, the adult butterflies emerge from their respective pupal forms while still inside the plastic containers, any time between 10 and 12 o'clock in the afternoon. After their emergence, these adults are used by the Butterfly Park for being released inside the "Butterfly Dome", located adjacent to the Conservation Laboratory or inside any of the four big nets where natural breeding of butterflies is facilitated. Depending on the requirements of the park, the proportion of butterflies that are used for either of the purposes may vary within a wide range.

In between the two areas of the Conservation Laboratory used for the natural breeding and rearing of butterflies, there lies a room provided with a computer, several books and equipment required for preparing the butterfly specimens to be displayed at the museum situated adjacent to the 'Conservation Dome'. The two areas used for the natural breeding and rearing of the different butterfly species were large, netted enclosures. The entire set up is being planned to be revamped. A, three bed Research Laboratory, a Breeding Chamber and a replica of the Breeding Chamber are set to come up very soon, instead. Now (as in 2013) a garden was also seen, to promote foraging amongst butterflies. There is a plan to develop a U-shaped garden in the near future to serve the purpose better. Also on the back side (behind Dome 3) there is quite a large area that has been now developed so as to be an appropriate spot for the mud puddling actually of the butterflies. (Plates 13.4 and 13.5)

The nursery, where the host plants used for feeding the larval forms of the different butterfly species, are grown, has remain unchanged. Primarily, 18 such host plants are grown here to serve the purpose. Host plants (for larvae) and nectar producing plants (for adults) are grown in bushes and as trees, both
around the garden as well as inside the 'Conservatory Dome'. Thus, not only the internal environment of the Conservatory Dome, even the landscape around the park has been made butterfly friendly. Nectar producing plants grown at the Butterfly Park are: 1. *Lantana* sp. (yellow, red and white varieties); 2. *Pentas* sp.

**Bengal Natural History Museum, Darjeeling**

Visited in May, 2012, several insect specimens were exhibited in the ‘Insects Section’ of the Museum. From the different showcases, examples of a few specimens include – *Megato xantha bicolour*, *Xylotrupes gideon*, Atlas moth, *Callosomia promethean*, *Salassa thespit* (Lasch), *Opiaeres fullonica* (Linn.), *Callimorpha plagiate* (Wlk.), *Damata longipennis* (Cercus ridx.), *Anomis fulviada* (Wlk.), *Eurois virens* (Bult), Lime butterfly (*Papilio linales*, Linn.), The great orange tip – *Heboinota glaucippe* (Linn.), The common bluebottle – *Zeltide sarpedon*, L., The Ladak tortoise shell – *Vanessa ladakensis*, The Bhutan coma – *Vanessa egae agricula*. A few more examples of insects displayed include – The large silverstrine – *Argymnis child* Gray, Krishna peacock – *Papilio krishna*, Andaman mormon – *Papilio mayo*, *Athyma* sp., The common mime – *Chilasa chilasa* (Linn.), Spectacle swordtail – *Pathysa glycerion*, Gray, The dark blue tiger – *Danais melissa*, The great Nawab – *Eriboea exidamippus*, The Kaiser Hind – *Teinopalpus imperialisi*, Yamfly – *Loxura atymnus*, Common red Apollo – *Parnassius epaphus*, *Lucanus cantori* Hope, *Macrodocus macleayi* Hope & Westwood, *Propomacus* sp., The giraffe beetle – *Apoberus longiceps*, *Saturnia simla*, Robber fly, *Sceliphron madraspatanum*, *Pompilus multipictus*, *Seolia sikkimenses* Btng., *Nephele didyara*, *Oxyambulyx ochraceas* Butler, *Panacra mydon* (Wlk). The Museum does not undertake any fields for insect collection, owing to the enactment of the Wild Life Protection Act, 1972. The insects when collected earlier, used to be killed using potassium cyanide killing jars, in which any insect used to be exposed for 15 minutes. For relaxing the insects, they used to be kept inside triangles made up of tracing paper, this in turn were kept (as many are still present), inside air tight fibre boxes, containing naphthalene balls. Currently, the museum has been in the process of shifting in a new location, under the aegis of the Padmaja Naidu Himalayan Zoological Garden. (Plate 13.6)
Birla Industrial and Technological Museum, Kolkata

This science museum was surveyed during May 2014. On entering the ‘Life Science Gallery’, immediately on the right hand side is displayed an information panel on the ‘Procession of life’. A little forward is displayed the ‘Geological Time Scale’. While the former has the picture of a butterfly, the latter has a picture of an Odonate (Meganeura) in the Palaeozoic era. The next Section is “Evolution – Strides of life”. Here is an L-Shaped diorama alongside the wall (on the right hand side) displaying models of a wasp and a mosquito. (Plate 13.7)

Just beside this, there is a panel (information board) with a table showing the classification of the Class Insecta. Insects have been grouped under the Division Oligoneoptera. In this table the insects include a total of 29 orders. The adjacent panel is on “mosquito and wasp”. Towards the left mosquitoes have been discussed. In the beginning, the general features of a mosquito are listed. Below, there is a write up on the habits and habitat of mosquitoes illustrated with pictures. Just below this is a comparison of the different species of mosquitoes – *Culex*, *Anopheles* and *Aedes* – with respect to their eggs, larvae, pupae and adults, with a picture of each (provided along). Information and illustrations, on the distribution and classification of mosquitoes, follow. Below this, towards the right there is a Section on – “Biological method of mosquito control.” Below this there are pictures and a few lines on each of Bladderwort, *Utricularia* sp.; Guppy (*Gambasia affinis*), Stickle back. Further below, there is a tabular representation on the ‘Diseases transmitted by insects’. A bit on the left is a Section on the ‘food and feeding’, of the mosquitoes. (Plate 13.8)

On the right hand side of the same panel, wasps have been discussed. Similar aspects of wasps have been put up (as done for mosquitoes), with information, picture and other illustrations. The general features are at the top followed by the special features of wasps, their distribution and classification, and their habitat. Below these, on the left, there are pictures of the interesting types of wasps. Here, the food and feeding habits of wasps have also been discussed. On the extreme right, other aspects of the insect have been put up.
The fifth panel on “Life’s rich tapestry, mentions at an instance that, insects and myriapods (i.e., centipedes and millipedes) together make up 963,000 specimens. Adjacent to this is a habitat case displaying ‘Rainforest Biome’. This small scale diorama only has a cut out model of a butterfly. A board beside this displays the typical food pyramid in a rain forest biome. The second layer from the bottom, correspond to the ‘phytophages’. In this layer labelled diagrams of a butterfly and a dung beetle are seen. (Plate 13.9)

**Bombay Natural History Society, Mumbai**

The Bombay Natural History Society is the only NGO (Non Government Organisation) in India and the largest such NGO in South Asia, that acts as the repository of natural history specimens. The collection is not brought out during the monsoon months to avoid any damage due to high humidity. So, the researcher visited the collections in the month of October 2012. No indiscriminate collections are carried out at the Bombay Natural History Society in Mumbai. Only those taxa or specimens are collected which are there in the collection but have not yet been identified. The Society undertakes project based fields: Taxa Oriented Projects and EIA Studies Projects. At times research scholars sent their collections here, approximately 95% for safeguarding their collection and the remaining for getting their specimens identified. (Plate 13.10)

Techniques used for collection include use of different kinds of traps, like Light Traps using Mercury Light, UV Light, Tungsten Lamp, Fluorescent Light, etc; Pitfall Traps; Yellow Pan Traps. Hand Picking Method is adopted for beetles. Aspirators or Putters that are used consists of a broad and short glass test tube and a rubber cork at the mouth, fitted with two rubber tubes. Different kinds of nets are used like, Sweep Nets and Butterfly Nets. The nets are white in colour but they are painted green to camouflage with the vegetation, so that they are not visible to the insects. These nets have three types of handles – iron, aluminium and telescopic. The handles can be adjusted up to four levels for collecting insects at different heights.
The Bombay Natural History Society has acquired insect collections through gifts and also as confiscations. The confiscated frame has many butterflies but unlabelled. (Plate 13.11)

If the field is for short term, then the insects are tried to be kept alive. In such cases, the insects are killed, relaxed and spread after having brought them to the Society. If the field is for long term, then after the collection has been carried out throughout the day, in the evening the insects are killed. Killing is carried out in a killing jar, which is a glass bottle with a readymade POP (Plaster of Paris) layer. The killing agent used nowadays is ethyl acetate.

Drying of specimen is done using tungsten lamps (table lamps) of 60 Watt. An incubator cum hot air oven is also used for this purpose. In this oven which is also used for activating silica gel, temperature can be set. It can be set to as low as 35°C and as high as 120°C. Insects should be dried at any temperature between 50°C to 70°C, ideally for 3-4 hours daily for 3-4 days; depending on the size of the specimens. After this, papering or layering of specimen is done, (usually in case of moths and butterflies) using butter paper envelopes. These envelopes are then packed in wooden or at times cardboard boxes, to be carried to the Society. Here, the insects are spread and mounted usually on thermocol. Nowadays, pinning boards made up of styrofoam are used. These are adjustable by the presence of screws, hence can be loosened and tightened as required, according to the thickness and the size of the insects.

The Bombay Natural History Society houses only dry preserved insect specimens. For preservation, inside the storage cum display boxes, two kinds of preservatives are used: Naphthalene balls are crushed and packed in paper envelopes which are perforated with pins, avoiding any indirect contact with insect specimens kept in the box to keep off insect pests and remove moisture from the box. Cotton swab dipped in creosote solution is mounted on a pin and placed at a corner in the box, to keep off insects.

Earlier in the field, notebooks were used for documentation, but nowadays, photographs (taken from different angles) are kept alongside labels. Documentation done in the field is first entered into the Insect Day Book.
Register and then into the Actual Register. Many old registers are still in use. The Society is trying to arrange funds from government or corporate sources for digitising the collection. Moreover, there are plans for a website to be accessed by virtual visitors, which would contain information and photograph about each specimen present in the collection. For digitising the collections, volunteers in the form of Post Graduate Students from the Departments of Zoology and Environmental Science are called upon and data of 10,000 specimens had been entered until the day of visit.

As measures of safety, in the collection area of the Society there are several smoke detectors for prevention against fire. In future there are plans to make the entire building fire proof, including the windows, the electrical fittings, etc. The collections’ area does not have any restricted entry at present. But, it was being planned to install two metallic doors in a few years, which would allow entry to only a few selected members of the administration, through thumb impression.

A total of 1,20,000 natural history specimens are there at present. Out of these 55,000 specimens are insects, of which there are 250 type specimens. The collection is from all over the Indian sub-continent (including Andaman and Nicobar Islands) and countries like Afghanistan and Myanmar. Small collections from some countries of the Middle-east are also present here. The cabinets containing the collections are numbered from 01-25. Collections of some of these cabinets are specimens belonging to the genus Leptosis, Bactia, Ixias, etc. (Cabinet 01). Cabinet 02 has specimens from the genus Parenonia, Hestia, Gandaca, Mycalesis, etc. Specimens from the genus Maniola, Euminis, etc., represent Cabinet 03. Specimens belonging to Atilla, Byblia, Ergolis, Melitaca, Symbrenthia, Laringa, etc., and those representing genus Taraka, Azarus, Lycaenopsis, Chaetoprocta, Amblypodia, Charana, Cheritra, Bindahara, etc., are present in Cabinets 04 and 05, respectively. Cabinet 06 have specimens from the genus Baoris, Erymnis, Ampittia, Sancus, Halpe, Padraona, etc. Insects of the genus Oenes, Erites, Elymnias, Sticopthalma, Disophora, etc., are present in Cabinet 07, while 08 represent Apatura, Herona, Dilipia, Penthema, Limenitis, Pathenos, Abrota, etc. Insects belonging to the families Bombycidae, Eupterotidae, Zygaenidae, Limacodidae, Lasiocampidae,
Arctidae, Geometridae, Agaristidae, etc., are present in Cabinet 13. Cabinet no.21 has representations from the orders Orthoptera, Diptera, Dctyoptera, Rhynchota, Hemiptera, Coleoptea, Phasmida, Neuroptera, etc. Mainly specimens of the orders Lepidoptera, Odonata and Dermaptera, are present in Cabinet 22. The insect boxes in the Cabinet numbered 24, has specimens belonging to the orders Lepidoptera, Hymenoptera, Coleoptera and Neuroptera.

Around 250 type specimens are present in the entomological collection of the Bombay Natural History Society. A few examples noted down from such boxes include: *Formicornus andrewesi* (Krek), *F. antiquus*, *Brontispa gleadowi* (Ws.), *Tridona nigra*, *Podagrica strictipennis* (Jac.), *Demonax maculically* (Gah.), *Leptomias bipustulatus* (Pst), *Eodinus zuopicus* (Pst), *Holotrachia puinosella* (Moser), *Orphinus nilgirensis* (Arr.), *Nomia eburni* and *N. phenalura*. Most of these are cotypes. Type specimens are stored in cabinet number 70. Some other type specimens include long horned beetle, tortoise shell beetles, Dobson fly, leaf beetles. Another box has fire flies, leaf beetles, click beetles, ground beetles, water beetles, beside others. Plate (13.12)

**Central Museum, Nagpur**

Visited in October 2012, in the second hall from the entrance (referred to as Gallery No. 3), are specimens belonging to the Class Insecta were seen in the fourth showcase from the left. There were 15 insect boxes on display, arranged in 5 columns, each having 3 rows. A few examples from around 170 specimens on display are, from the top, Box 1 has the rice butterfly, *Melacutis ismene* Cramer., *Charaxes marima*, Westw., *Danais septentrionis*, Butler, etc. Box 3 has the male and female specimens of *Arhopala amantes*, Bastar. Box 4 has *Papilio elytia*, C., *Papilio nomius*, esper., etc. Box 10 has *Stichopthalma camadeva*, Westw., etc. Box 14 has *Telchinia viole*, Fabr., *Byblia ilityia*, Drury., *Papilio aristolochiae*, Fabr., etc. It was not possible to note down the names of most of the insects on display at the Museum, mainly due to problem with the height at which the insects had been displayed. The stages in the “Life Cycle of Silkworm” have been displayed below the insect boxes on leaves, in turn placed on circular discs. The area is covered with sand and has small stones.
Neither any information on the modes of acquisition, killing, preserving, pinning and setting techniques were given, nor any information on the climate control methods or documentation, have been provided at the Museum.

Chhattrapati Shivaji Maharaj Vastu Sangrahalya, Mumbai

Situated very close to the Bombay Natural History Society in Mumbai, this Museum had been visited during the month of October in 2012. For collection of insect specimens, field expeditions used to be carried out earlier. The enactment of different rules pertaining to the protection of wildlife prohibits the museum from undertaking any such field trips to collect any specimens, at present. Now, the museum collects only dead insect specimens, that too from the museum premises.

To kill the insects collected, no separate killing jars are used. Long cylindrical glass bottles serve the purpose when required, as smaller bottles might cause damage to the wings of insects. Earlier the killing agent used were the cyanides, nowadays, if required, chloroform serves the purpose because cyanides are difficult to obtain.

Drying of the specimens is carried out under bulb or by using any slow heating process. Only dry preserved specimens are present in the collection. Be it for the specimens in the reserve or those on display, no preservatives are used. Cleaning is done twice a year, by spraying insecticides, usually Baygon, on the collection; and by spraying termicides, usually Tricel, on the wooden portions of the showcase and the wooden pedestal to prevent attack by the termites.

Insects in reserve are provided with temporary labels which bear the following information: Broad Division of Insects, for example, Moth, Name of the Collector and Date of Collection. These labels are white, rectangular, hard boards. The ink used is not fixed. The insect is fixed on the label using pins.

After temporary labelling, proper identification of the insects is done. Identification of any entomological specimen is done by the entomology experts of the Bombay Natural History Society.
After this, manual documentation of the insects, being added into the collection is carried out. This is done in Accession Registers. The headings under which information is recorded in the Accession Register include the Common Name, Scientific Name, Locality and Date. No accession cards are used for the purpose of documentation.

There were plans to undertake the digitisation of the entomological specimens in the collection of the Museum, in the near future. From January 2013, the Chhatrapati Shivaji Maharaj Vastu Sangrahalaya was supposed to undertake the photo-documentation of its entomological holdings.

In all, i.e., inclusive of reserve and display, there are 4000 insect specimens at the Chhatrapati Shivaji Maharaj Vastu Sangrahalaya. Most of the entomological holdings of the museum have been taken on loan from the Bombay Natural History Society. Most of the collection is in store as reserve collection. Some are inside drawers, on stretching boards. Some insects are in paper envelopes. Earlier an entire gallery was dedicated to “Invertebrates,” but the gallery had to be dismantled on account of some space and maintenance problem. Only a meagre portion of the collection is on display at the Natural History Section of the Museum at present, which includes only a single showcase of butterflies. The Museum had plans to display beetles in a showcase in the near future.

Examples of a few specimens, from amongst the 72 butterflies exhibited at the Museum, include the Swallowtails – Common red Apollo (Parnassius epaphus oberthur), Tailed jay (Graphium agamemnon), Tailed red breast (Papilio bootes), etc. The Nymphalids include Common beak (Libythea lepita), Double-banded blue crow (Euploea sylvester herrissi), Malabar tree nymph (Idea malabarica), Cruiser (Vindula erota Febricius), Staff sergeant (Athyma selenophora), Gaudy baron (Eutholia lubentia), Baronet (Euthelia nais), Autumn leaf (Doleschiallia bisaltide), etc. The blues include Tuffed white royal (Pratapa deva), Spangled plush blue (Flos asoka), etc. The whites and yellows include Dark wanderer (Pareronia ceylonica), Spot puffin (Appias lalage), etc. (Plates 13.13 and 13.14)
The administration of the Chhattrapati Shivaji Maharaj Vastu Sangrahalaya (Mumbai) was still in the stage of planning an open butterfly garden in their sprawling campus, at the time of visit. This plan is aimed at obtaining quality butterflies for the museum’s collection. The museum is keeping such plants as suited to the need of the butterflies. For example, just prior to the visit to the Museum, pulses and cereals were being grown, in the breeding season for the butterflies.

The garden already existing around the museum building includes around two hundred and fifty trees of which 70% are reported to be butterfly food plants. New specific species are being planted to attract the respective species of butterflies, for example, *Lantana* sp., *Aristolachia* sp., *Wadelia* sp., *Celosia argentina*, *Celotropis* sp., *Cycas* sp.

**Coleoptera Section, Zoological Survey of India, Kolkata**

Mode of collection is mainly through field expeditions. Hand picking using forceps, using nets for winged insects, by using sheets (of muslin or white paper on polythene) against light (coloured light should not be used) and using soft camel hair brushes for insects to be preserved in liquid preservatives.

Liquid benzene is the killing agent used. The killing bottle is made by first putting a layer of cotton at the bottom of the bottle and then a piece of circular blotting paper is placed on it. The killing reagent is added to the cotton layer only by using a dropper. The insect to be killed gets choked through immediate action, in a few seconds of being introduced into the bottle.

After this the insect is dried in the sun in the field itself. After all the moisture content of the insect body has been moved, each is individually placed inside tracing paper, rectangular insect envelops. Nowadays, one side of the envelope has a blotting paper stuck to it. This absorbs any extra moisture or liquid oozing out from the body of the insect and provides a surface for writing the label (field documentation). To bring these envelopes to the Section cardboard box or any kind of thick paper board box is sufficient. It is necessary to put some naphthalene or para dichlorobenzene into the boxes, during transport, to keep off fungus and mould.
Once brought to the Section, the insects have to be subjected to relaxation. For this, a pair of Petri-dish and a pair of blotting paper are required. In one Petri dish, is placed a blotting paper, this is soaked with water, on top of this the insect(s) is placed. The specimen(s) is covered with another blotting paper and finally the other Petri-dish. This set up is allowed to stand undisturbed, for one night. This is sufficient to relax the insects.

Following the relaxation process, the insects are to be stretched, set and pinned. The mounting is done on rectangular blocks of thermocol, or inside small boxes provided with lining, such that pins can go into it. For pinning, the special entomological pins are only used. Very small insects are pinned using pins of size 00 or 0. Larger insects might require No. 4 pins. 1 and 2 are used for the medium sized ones. With the size of the insect the pin size (no.) increases. The insects that are too small to be pinned are mounted on white triangular cards (card mounted).

The mounted insects are then kept inside the ‘Dry Chamber.’ The chamber has two doors a wooden door with a glass door inside; each opening on a different side. It has three shelves, the last one has liquid benzene (tied in a piece of muslin), a mixture of camphor and carbolic acid (in the ratio 3:1 to prevent fungus/ mould growth) and naphthalene powder/ solid; the shelves above are for the mounted insect. The shelves are not made up of solid wood or glass but, of fine mesh so that the vapours of all the chemicals kept in the last shelf of the chamber, spreads onto all sides of the chamber. The insects are kept in this chamber, for three days, approximately. The heat source from below is a bulb of 40 watts. (Plates 13.15)

After having been dried completely, the insects are stored permanently in the insect (storage) boxes. Wooden boxes with glass tops are provided with naphthalene and camphor/ carbolic acid mixture. The naphthalene balls are powdered and poured into the grooves, present on all sides of the box with the help of piece of paper and a wooden spatula. The preservative mixture is prepared by taking 3 parts of camphor and 1 part of carbolic acid, and keeping the mixture in the sun until it gets the characteristic colour, indicating that it is at
its best and ready to use. This mixture is soaked in a tuft of cotton wrapped around the head of a number 5 entomological pin. The pin is inserted at a corner, inside the insect storage box.

Normally, three labels are attached to each insect in the collection of their Section. These are, a) The locality label, providing with the name of the country, the state, the district, the locality, GPS (Global Positioning System) data (if any), date of collection, name of the collector, host (if any). It is usually not possible to write all such information on a single label, so extra label(s) might be used. The information regarding the host may or may not be provided on the locality label; b) The species name label gives the name of the species and the name of the person(s) to have determined it (denoted as ‘Det. by’); c) The registration number label, gives the unique number assigned to each specimen which is a part of the ZSI (Zoological Survey of India) collection.

Documentation in the Coleoptera Section follows both manual procedures and digitized means. Manual documentation includes entering all available information pertaining to the individual holdings in to the register. Two types of registers exist, the one used for regular entry for an insect entering into the collection and has to be identified, known as register for ‘NAME COLLECTION’, the other being for the type specimens, deposited at the CEL (Central Entomological Laboratory), and known as the ‘TYPE REGISTER’. The Name Collection register, records information on two adjacent pages, under the following consecutive heads: Reg. No, Zoological Name, Locality, etc., on one page. Collector/ Donor, Date of Collection, No. of Example, Determined by/ Family/ Taxa (has been added), Date of Entry and Remarks; on the adjacent page. The Type Register, records information under: Type – category, No. of exs. Z.S.I Reg. No/ H4A, Name of Species and Family; on one page. Locality data, Name of collector, Date of collection, Host, if any, State of preservation and Remarks (Condition of type, etc) – on the adjacent page. Be it any register, information about the gender of the insect is either given in the ‘Remarks’ column, or indicated with the appropriate sign in the ‘Name of Species’ column. At times a separate column is provided to record the gender of the insect collected. All the entries in such registers are made using the Rotring pen, usually, if unavailable, any waterproof black ink is used.
Up to May 2014, the Coleoptera Section has recorded 35,530 identified specimens and a total of 2,68,360 unidentified specimens (data given by the officer-in-charge of the Section).

Besides dry collections, the Section also has a pretty good number of wet collections as well. In fact, there is a separate room for storing the insects preserved wet. Here there are nine almirahs (steel body, with glass panes/doors framed in steel) and a two shelved open rack as the storage unit. Insects preserved wet are directly collected in vials having 70% alcohol. This same liquid is used as the preservative for permanent storage of such insects. To keep the insects soft, a little volume of ethyl acetate is added to the 70% alcohol used as the preservative. Earlier, glass bottles with different kind of glass lids were used. At present a slightly different kind of glass bottle, provided with plastic caps are being used, for bulk storage. Thus, individual vials are packed inside the glass jars (bottles), by lining along the wall of it stuffing cotton in the middle, to allow the vials stand upright and not run into each other. After such arrangement, 70% alcohol is poured into the bottle, up to the brim, to preserve all its content. The individual vials and the jar/bottle storing it, are provided with labels written on white pieces of paper in black, either using the Rotring Pen or in pencil. (Plate 13.16)

RFD i.e. a ‘Result Framed Document’ is also prepared in this Section, as part of digitized documentation. A more elaborate made of documentation, the field names in RFD at the Coleoptera Section are same and/similar to the ones used by the Isoptera Section of Zoological Survey of India, Kolkata. Moreover, there are details on the stages of insects, mode of preservation (wet/dry), etc., in the RFD of this Section.

Identification is done according to the key. Insects are first segregated and arranged, family wise. This is followed by identification.

Slides are usually not prepared with the intention to create a collection. The main job to be accomplished at the Section is identification of the collections brought in and/obtained. Usually, identification of the specimen(s) is done by
observing the external features (external anatomy). If such features are insufficient and there is difficulty in identifying the insect, then slide preparation becomes the last option. It is usually the genitalia of which a slide mount is prepared, to aid in the identification process. The method for preparing a slide, as followed by the Coleoptera Section, includes boiling the genitalia in 10% caustic potash (KOH) solution. This step is executed to remove all the fat bodies, present in association with the genitalia. Then the genitalia (now devoid of any fat content), is washed with water a few times. After drying, the genitalia are finally mounted on ‘DPX’. Unless hyaline, staining is not carried out. If staining done at all, clove oil is used. Not only genitalia, at times some parts of some of the insects are desired to be studied in detail, for instance, the mouth parts or the wings, etc. Slide mounts of the particular part(s), are then prepared. The slides are stored in the drawers of the slide cabinet.

**Digha Science Centre and National Science Camp, New Digha**

The Digha Science Centre had been visited during October 2010. The Life Science Gallery of this Science Centre has displays pertaining to insects in two instances only. On the left hand side from the entrance (into this gallery) there is a panel on “India – the land of biodiversity.” On the top left hand corner of this panel, there is a picture labelled, “A common tiger butterfly”. This panel tells the visitors that India is very rich in flora and fauna and is home to innumerable insects, including colourful butterflies.

Opposite to this, there is a model showing the human DNA. It is displayed on a pedestal, which in turn is divided into sections. Each has write-ups and corresponding pictures of organisms (lower and higher forms of animals), who share their DNA with human beings. One such section shows a fruit fly. It informs that this fly (*Drosophila melanogaster*) shares 50% of its DNA with human. (Plate 13.17)

**Entomology Division, Forest Research Institute, Dehradun**

Collection of insects is a continuous process at the Forest Research Institute. Officials undertake field trips as and when required. Actually, whenever damage by any insect of any tree in the forest regions under the jurisdiction of the Institute is reported, a team is sent out for collecting the insect pests. This is
done to ensure that the forests are protected from future destruction by those insects.

Other than the adults, the other stages of the different insects belonging to various orders that are collected are sent to the “Insectary.” This is the place, where the insect pests collected in their developing stages (but not as adults) are kept for their future development and final emergence. Besides this, the breeding of insects is also carried out here. Special type of containers, are present in the Insectary, in which the respective stages are kept, for example: the breeding cages, the rearing cages, etc. All the containers have been assigned particular numbers with specific prefixes as R.R.D and B.C.R. The adult emerges from its' pupal stage generally in the morning, into the bottles attached to the cages. The number of days required for the metamorphic changes of each insect is also known in this manner. The Insectary is well equipped with all necessary chemicals and apparatus as required, for example: Desiccators, etc. (Plate 13.18)

The adult insects, those that have been collected from the field, as well as those that have emerged from their developmental stages at the Insectary, both before being killed, are sent to the Systematic Laboratory. Here, these insects are identified, then naming of the insects specimens follow, in accordance with the Linnaeus Classification System and the Binomial Nomenclature.

After being collected and identified, the adult insects are killed using ethyl acetate. Then the insects are subjected to relaxation, setting and pinning, following the standard techniques corresponding to their respective orders and following the precautionary measures.

The Entomology division houses nine orders of insects. These are Lepidoptera, Coleoptera, Hymenoptera, Diptera, Orthoptera, Thysanoptera, Collembola, Hemiptera (earlier Rhynchota) and Odonata. All species available in the collection are pests. Some of the collection has been displayed in the Entomology Museum of the Entomology Division. The huge hall constituting the Museum houses a total of 3000 exhibits, including insects and the different
plant parts infected by them. A few examples of the mode of arrangement and the exhibits displayed at the Museum include

(Showcase No.5) *Calophyllum* to *Caseria*,

<table>
<thead>
<tr>
<th>Side</th>
<th>Row</th>
<th>Name of the Specimen</th>
<th>Plant No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Top</td>
<td>Infested Trees –</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. <em>Calophyllum tomentosum</em></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. <em>Calophyllum apetalum</em></td>
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</tr>
<tr>
<td></td>
<td>Example : Damage done to wood by –</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Xyleborus</em> sp. Scolytidae</td>
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<td></td>
</tr>
<tr>
<td>Right Top</td>
<td>Infested Trees –</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. <em>Careya arborea</em> 2. <em>Carvia callosa</em></td>
<td>1</td>
<td></td>
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<tr>
<td>Right Bottom</td>
<td>Example : Damage to stem by -</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Zeuzera multistrigata</em> Moore, Cossidae</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

(Showcase No.7) *Cinnamomun* to *Dysoxylum*

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<thead>
<tr>
<th>Side</th>
<th>Row</th>
<th>Name of the Specimen</th>
<th>Plant No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Top</td>
<td>Infested trees –</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. <em>Cinnamomun impressionervium</em></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. <em>C. camphora</em></td>
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<td></td>
<td>Example : Damage done to wood by –</td>
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<tr>
<td></td>
<td><em>Termitidae</em></td>
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</tbody>
</table>
(Showcase No. 25) *Pongamia* to *Pterocarpus*

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<tr>
<th>Side</th>
<th>Row</th>
<th>Name of the Specimen</th>
<th>Plant No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Top</td>
<td></td>
<td>Infested tree –</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Pongamia pinnata</em></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Example: Damage done to wood by –</td>
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<tr>
<td></td>
<td></td>
<td><em>Lyctus a ricanus</em>, L. Lyctidae</td>
<td></td>
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<tr>
<td>Left Bottom</td>
<td></td>
<td>Infested tree –</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. <em>Premma</em> sp.</td>
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<tr>
<td></td>
<td></td>
<td>2. <em>Psidium guajava</em></td>
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<td></td>
<td></td>
<td>3. <em>Populus generosa</em></td>
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<td></td>
<td></td>
<td>Example: Damage done to wood by –</td>
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<tr>
<td></td>
<td></td>
<td><em>Glenea pulchera</em>, Auris, Lamilidae</td>
<td></td>
</tr>
<tr>
<td>Right Top</td>
<td></td>
<td>Infested tree –</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. <em>Prosopis chilensis</em></td>
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<tr>
<td></td>
<td></td>
<td>Example: Damage done to wood by –</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Cossidae</em>, Lepidoptera</td>
<td></td>
</tr>
<tr>
<td>Right Bottom</td>
<td></td>
<td>Examples: Damage done to wood by –</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td><em>Pterospermum acerifolium</em> willd</td>
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<td></td>
<td></td>
<td>Damage done to wood by –</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Zeuzeracoffeae nietn</em>. Cossidae</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Infested tree- <em>Pterocarpus marsupium</em></td>
<td></td>
</tr>
</tbody>
</table>

(Plate 13.19)

The National Forest Insect Reference Collection (NFIRC) is a repository for insects, housing around three lakhs insect specimens. Some of the insects at the repository are up to 150 years old. At the NFIRC, the insects are dry preserved and stored pinned in regular display boxes. Display boxes with insects of the different orders are again stored in separate cupboards. The NFIRC follows proper methods for preserving the entomological holdings. Every display case has space for providing with preservatives like, creosote and/or carbon disulphide/ naphthalene balls. Moreover, the NFIRC is subjected to fumigation once in every six months. In 2011, i.e., in the year the
survey was done, fumigation had taken place from the 15th of April to the 15th of June. For fumigation, the mixture used consists of one (1) part of crushed naphthalene balls, two (2) parts of creosote solution and one (1) part of carbon disulphide solution, i.e., in a ratio of 1:2:1 is used. The fumigation using this mixture is carried out manually here. The NFIRC is an airtight region, as all the openings (doors and windows) remain closed throughout the year. This helps in the maintenance of proper relative humidity (RH) of the hall housing this huge reserve collection. For making the hall more airtight, a double door system is also present. The windows and doors being provide with glass panes, allowing the natural light into this reserve collection area. (Plates 13.20)

Documentation of all its’ holdings are evident at the Entomology Division of the Forest Research Institute (the Insectary, the NFIRC or the Entomology Museum). Each insect specimen at the National Forest Insect Reference Collection, has a card attached to it with information against the following headings: Holotype/ Paratype, Locality, Host (Plant), Male/ Female, R.R.D. No./ B.C.R. No., Genus, Species, Author, Date of Collection. Documentation is not only done using cards, but Accession Registers are also maintained here. For accessioning the NFIRC follows the system followed at the British Museum of Natural History, London. At the Insectary the rearing and breeding cages are numbered, i.e., R.R.D. No. and B.C.R. No., are provided. Moreover, cards are also used for documentation purpose. Forms have been designed with heads so as to collect appropriate information, against the insect stages being obtained and reared in the Insectary. Use of good digital camera is being done to photograph the insect specimens in the collection, to enable photographic documentation. Moreover, with the development of software, efforts are being made to digitise the collections of the Entomology Division of the Forest Research Institute in Dehradun.

Gass Forest Museum, Coimbatore

Major portion of the collection exhibited here, had been collected by Mr. H. A. Gass, during his tenure as the conservator of forests. The Gass Forest Museum, visited during November 2012, is housed in a huge two-storied rectangular hall. An adequately sized room present at the end of this huge hall, on moving left from the entrance, houses the entomological holdings of the
Museum. Although, the collection comprises different orders of insects, the room has a label just at the entrance that reads ‘Butterflies & Moths.’ This may be due to the presence of a greater percentage of specimens from the Order Lepidoptera. That the insects are of great importance and even has influence on the survival of the human race is evident from the words of the great Albert Einstein, mentioned on a piece of paper, pasted on the door leading to the display of insect collections, at the Museum. (Plate 13.21)

Exactly opposite the door, there is a window, exhibit cases begin from the wall adjacent to this window. The display at the Museum, the height at which the insects were displayed at times either too high or too low; also the pins used for the specimen labels intervened with the viewing of each insect. The traditional pattern of display is being followed here, i.e., the insects are exhibited in simple wooden showcases provided with glass tops. The wall from which the exhibition begins has 7 showcases. The top tier had 4 showcases. Showcase 1 displayed ‘Coleopterous Borers of Felled and Converted Timbers.’ Showcase 3 exhibits the ‘Pests of Bamboo.’ Insects from the Coleoptera are displayed in Showcases 2 and 4. The showcase just below Showcase 1 is unlabelled (has no main heading), wet preserved stages of an insect are visible. ‘Feeding patterns of Teak Defoliators’ has been put up in the adjoining showcase; followed by the display of ‘Fruit pests and stored product pests’.

Next there is a window. The wall adjacent to this has 10 showcases. The first showcase on the top left displays the ‘Pests of Eucalyptus.’ Showcases two – five beside this, display the insects from the Order Coleoptera. Families Elateridae and Cerambycidae are exhibited in Showcase 2. There are specimens from the families Curculionidae and Cerambycidae (Showcase 3). Buprestidae and Cetoniinae are also represented (Showcase 4). Scarabids constitute Showcase 5. The second tier of showcases on this wall exhibits a ‘phasmida leach,’ on the extreme right. The first and the third showcases have put up the ‘Coleopterous borers of Living Standing Trees’, from the family Cerambycidae. The second and the fourth showcases, respectively display the ‘Coleopterous Borers of Felled and Converted Timbers.’ (Plate 13.22)
The pillar connecting to the next wall has an interesting display. The single showcase here, displays insects from varied orders, i.e., Lepidoptera, Coleoptera, Hymenoptera, Hemiptera, Odonata, Diptera, Orthoptera and Dictyoptera. On the adjacent wall there are 8 showcases, all exhibited insects belonging to Order Lepidoptera. The first showcases in both the tiers, represent family Papilionidae. The second showcases (top and bottom), both represented the family Nymphalidae. The families Cossidae and Eupterotidae are represented in the upper tier. Its counterpart in the lower tier represents family Noctuidae, as does the showcase, beside this one. The last showcase in the tier above has 16 members of the family Danaidae. An example is *Euploea core*.

Again there is a window. There is a showcase with dried insects on the sill of this window. Divided into four columns, dry preserved entomological specimens from the Orders Coleoptera, Lepidoptera & Orthoptera, Hemiptera & Homoptera and Homoptera (again), are displayed in the respective columns (left to right). The wall adjoining the window has eight showcases, with 4 in each row. Just beside this arrangement are 4 showcases, with two in each row. The two on top have specimens from the families Hesperiidae and Satyridae. An example from each of these, include *Tagiadas* sp. and *Mycalesis Junonia*, respectively. The total numbers of specimens are 50 and 20 respectively. The showcases below have 20 and 38 specimens, respectively. The first showcase in the lower tier represent family Nymphalidae, an example is *Lymenitis procris*. The showcase beside depicts family Geometridae, an example being *Hyperthra lutea*.

Again there is a window. The adjacent wall has 4 showcases, having two in each row. Families Nymphalidae, Notodontidae, Pieridae and Arctidae, respectively (all of the Order Lepidoptera) are represented in these showcases. Showcase 1 on top has 24 specimens and the next one has 30 specimens. Examples from these include *Junonia almora* and *Pydna* sp., respectively. 18 and 51 specimens respectively, make up the showcases below. *Parenenia pingasa* and *Spilosoma tadanum*, respectively are examples from such showcases. Yet another window intercepts the exhibition. Next to this there are four showcases all exhibits are, insects pertaining to Lepidoptera. The two
showcases on the top display Orders Danaidae and Lycaenidae, having 16 and 59 specimens, respectively. *Telchina viola* and *Magissa Malaya* are examples from the two showcases. The showcase on the left exhibits family Lycaenidae, it has 54 specimens an example being *Zizaeria gaika*. The showcase beside has only 13 specimens of the family Amanthiidae, an example being *Abisara* sp.

Although a bit monotonous, the wall just next has 28 showcases, divided into two rows, with 14 in each row. All these showcases exhibit Lepidoptera specimens. Families Pyralidae, Noctuidae, Sphingidae, Pieridae, Noctuidae, Hesperiidae, Noctuidae, Saturniidae, Nymphalidae, Psychidae/ Syntomidae/ Thyridae, Satyridae, Noctuidae, Papilionidae and Nymphalidae; are depicted in the showcases constituting the top row. Around 430 insects are present in these showcases. The families of butterflies and moths, displayed in the showcases of the lower tier include Eupterotidae, Saturnidae, Hypsidae, Papilionidae, Noctuidae, Geometridae, Lymantridae, Sphingidae (in two consecutive showcases), Lycaenidae, Lasiocampidae/ Limacodidae, Papilionidae, Pieridae and Lymantridae. Over 350 dry preserved insects occupy these exhibit cases. (Plate 13.23)

Mainly dry preserved insects are present in the collection. The insects are prepared by first drying in an oven, and then pinning. The collections are not subjected to fumigation. Naphthalene powder is the only preservative used for the collections. The naphthalene is changed only after the earlier powder has fully evaporated.

**Government Museum, Chennai**

The Government Museum, Chennai is the second oldest museum in India. Located in the ‘Main Building;’ the Zoological Galleries of the Government Museum, Chennai extends over 11 halls, adjoining the Sculpture Galleries of the Archaeology Section. Galleries and portions included in the Zoology Section are General Zoology Gallery; Skeletal Exhibits; Flight in Animals Gallery; Foreign Animals Gallery; Reptile Gallery; Bird Gallery; Mammal Gallery; Amphibians; Mammals (dioramas); Birds (annexure); Coral Gallery; Invertebrate Gallery; Fish Gallery. Besides the exhibited specimens, the
Zoology Section possesses a large reserve collection, of over a thousand specimens, stored in jars and several hundreds of dry specimens, preserved in boxes and cabinets. Specimens on display as well as those in reserve have been properly and systematically arranged, catalogued, labelled, preserved and clearly explained. Although, the scope of the collection is mainly limited to South Indian fauna, the Museum has also acquired some specimens from some foreign countries. Invertebrates are on display in the first floor galleries. Amongst the notable exhibits in the ‘Invertebrate Gallery’ are several insects. The entomology holdings, i.e., the insect collections of the Government Museum, Chennai, are not solely represented in the galleries, but they form a major part of the Museum reserve collection as well. Grasshoppers and butterflies are the most represented in the entomological collection of this Museum.

In this Museum, the management of insect collections involves the following stages – Collecting; Killing; Relaxing; Pinning and Setting; Display; Storage; Temporary Storage; Reserve.

When surveyed during April in the year 2008, the Government Museum, Chennai already had an extensive collection of insects, so at present unnecessary collections pertaining to the same orders of insects are not being carried out. Collections if at all carried out are done only locally, i.e., within the campus of the Museum. No extensive field collections are undertaken for this purpose. At times, collections are even made by the participants of the training camps organized by the Museum. The methods and tools applied by the Museum, in collecting the insects of the different orders differ. Hymenopterans like bees and wasps; and Lepidopterans like butterflies are usually trapped using insect nets with very fine mesh, from flowers. Coleopterans like ground beetles are caught using a pair of forceps, from under stones and decaying logs of wood. Sugar traps are also used to trap the Coleopterans. Nocturnal Coleopterans may be either trapped under the ‘Light Trap’, or torch lights may be used to search them. Moths, some beetles and other nocturnal insects are obtained by painting patches of sugar on the tree trunks, and looking for them with a lantern after dark. Moths may also be caught by hanging up a sheet of white cloth or white paper dipped in oil, with a lantern behind it. They are
attracted by light, and may be picked off with glass-bottomed tin boxes as they settle on the sheet. Not only moths, but even the Coleopteran ground beetle may be collected using the ‘Meat Trap’. In this a piece of meat is placed in a bottle and this is buried in the ground at night, so that the mouth is just on a level with the ground. Being invisible to them, the insects are unaware of the trap, but are drawn to it by the smell of the meat and ultimately fall into the bottle. These are then collected the next morning.

After collecting the specimens, they are generally transferred into a kilner jar, in order to kill them. The killing agent used by the Museum in the kilner jar, is potassium cyanide. Most insects like Hymenopterans, Lepidopterans, Orthopterans, etc., are easily killed by introducing them into the potassium cyanide bottle. Insects die in a few seconds of being dropped in this bottle. Insects, especially those belonging to the orders, Hymenoptera and Lepidoptera should never be left in the KCN bottle longer than necessary, as cyanide changes the colour of these insects – green becoming yellow and yellow in turn becomes red. Precautions necessary for the other insect order are also taken into account by the Museum personnel.

Another way of preparing a killing bottle or a kilner jar is, to place a wad of cotton wool or cotton balls, soaked in chloroform at the bottom of the wide mouthed bottle or jar with an air-tight lid, and a false bottom is made with a circular piece of wire gauze over the cotton. The insects are dropped on the wire gauze and the lid closed tightly, and they die in a few seconds. Government Museum, Chennai employs this method to kill the beetles collected.

The Museum kills grasshoppers, Coleopterans and other non-hairy insects simply by throwing them into boiling water, out of which they should be taken out as soon as possible and placed immediately on blotting paper, to drain off the water. To avoid the deformation of the specimens, butterflies are not killed in this Museum, by pinching the thorax.

From the kilner jar, the killed entomological specimens are transferred into the relaxing jar, at the Museum (Chennai). A relaxing jar may be prepared by
putting a few crystals of para-dichlorobenzene and then placing two circular pieces of blotting paper on the chemical. The relaxing jar may also be prepared by spreading a layer of moist sand about 1.5 inches in thickness, at the bottom of a wide-mouthed bottle, and the two circular pieces of blotting paper or newspaper are laid over the sand, to absorb extra moisture, if any. To prevent moulds forming inside the bottle, a few drops of Lysol solution may be poured into the bottle. The insects to be relaxed are dropped into the relaxing bottle and the lid closed. Insects should be left inside the bottle for (6-7) hours, so that their limbs and wings that have stiffened due to the killing procedure, become soft and sufficiently pliant, and do not have any danger of being detached from the body of the insect.

Then the insects are taken out of the relaxing jar and placed on the mounting board. The mounting board consists of two cork sheets, which can be adjusted according to the size, of the body of the insect. Entomological pins are used for pinning the insects on the mounting board. The method of pinning, adopted by the Government Museum, Chennai, varies with the different types of insects, and is according to the standardized norms, followed by most museums, with a few customizations.

In case of butterflies, the narrow strips of paper used to secure the wings in position over the cork sheets, is passed in criss-cross fashion over the wings. The setting board with the butterflies pinned on them, are placed in a dry cage or box, with some naphthalene and left for about (5-10) days. During this period they dry and stiffen in the desired position. Moths and fleshy grasshoppers are preserved in much the same way as butterflies. But in case of bulky-bodied moths, it is necessary to slit open the underside of the abdomen, remove the viscera and stuff the abdominal cavity with some cotton-wool soaked in 4% formalin. Then these are adjusted and set on the grooved cork setting boards.

Grasshoppers and crickets are pinned in the usual manner. Coleopterans like beetles and bugs with wings closed over their backs are pinned over plain cork boards or pith blocks. The pith blocks or cork sheets with the pinned insects are then put away to dry in a box for about (1-2) weeks. When dried, and set in position, the insects may be released from the setting boards. Hymenopterans
like bees and wasps are pinned with their wings spread out. Homopteran bugs are pinned through the large middle segment of the thorax (meso-thorax). Dipterans like flies and mosquitoes are pinned on the small blocks of pith or circular cardboard discs. Small insects are mounted by being gummed on small strips of cardboard near one end of which is passed a long pin for handling the carded specimen.

At the Government Museum, Chennai, generally, after the insects have been killed, they are subjected to sufficient relaxation, and then the insects are temporarily stored until being subjected to pinning. Beetles and bugs are stored, by being wrapped in pieces of tissue paper and the two ends of the paper twisted in opposite direction. Butterflies and moths are temporarily stored in triangular shaped paper (soft, oblong, white paper is used) envelopes, with their wings folded together over their backs, so as to prevent any damage to the wings. The envelopes with the insects inside are then packed in tins or cardboard boxes into which some naphthalene powder has been sprinkled.

Earlier index cards were used to carry out the indexing of the specimens in the collection, at the Government Museum, Chennai; but at present, digitization of the zoological collections of the Museum has been undertaken. For the different types of collections exhibited in the different galleries of the Museum, separate wooden boxes have been allotted. Each box has index cards pertaining to the different kinds of collections like, Zoology, Botany, Geology, Archaeology, etc. In the box pertaining to the Zoological collections, the holdings belonging to the different phyla are kept together. Index cards corresponding to each phylum are separated from one another using rectangular cards made of metal alloys. The name of each phylum is inscribed on the respective metallic cards. Within “Phylum Arthropoda,” there are different classes like Insecta, Arachnida, etc; index cards pertaining to the specimens belonging to these different classes are tied up together, to form a single bundle. A hole is present at the bottom of each index card to enable their tying up in bundles. When blank, all index cards are identical, one side ruled and the other side plain. On the ruled side margins are provided at the top and on the left hand side. In case of the cards of the Zoology Section of the Museum, on top, above the margin is printed the following:
Like in any other museum, the most important tool used for documenting the collections in this museum too, is the “Accession Register”. Primarily, all new collections are entered into the Accession Register then, the information is verified from time to time with the specimens, while they are displayed in the galleries or have been stored in the reserve. Information pertaining to each new acquisition by the Museum is entered into the Accession Register under the following headings: Serial No.; Date of Entry; Description of Article; Locality; Received from; Price; Reference; Remarks.

Digitization of the collections of the Zoology Section has been undertaken by the Government Museum, Chennai. Efforts are being made to digitize the zoological collections by adapting the Nataraj Software, which is generally used for digitizing the archaeological collections of the Museum. Besides the few number of the staff employed for the purpose of documentation of the zoological collections of the Museum, students of the Women’s’ Christian College and Bharathi Women’s College have also been engaged. As part of the digitization work data sheets are being used by the Museum, to categorise the information pertaining to each specimen. The data sheets are enclosed in loose folders according to their classification.

Of the total collection of insects of the Museum, a meagre 10% is on display, because insects are very minute to attract the attention of the visitors. Examples of a few specimens, from the numerous exhibited, in the different types of showcases of the Museum, are as follows. *Ephemera diffusa* Chopra (Mettupalayam); Family Tettigonidae – *Mecopode elongate*, Linnaeus (East Indies, Japan, India, Australia), *Schizodactylus monstrosus*, Don (its eggs), etc.; Order Dermaptera (Ear-wigs) – *Kalocrinia picta* (Madras); Family Pieridae – Genus Leptosia – *Leptosia nina nina*, Fabricius (India, Ceylon, Burma, Andamans), Genus Pieris – *Pieris canadia canis*, Evans (South India, Western Ghats) and Genus Huphina – *Huphina nadina remba*, Moore (South India); Family Sphiniidae – *Theretra pallicosta*, Walker (Eastern Himalayas, South India, Ceylon and Burma to HongKong); *Apis florate*, Fabr. (The small honey
bee – workers, queens, drones); Family Cicindelidae – *Cicindela aurofasciata*, Dejean (India); Pests of paddy – Yellow hairy caterpillar (*Psalis secures*), Semilooper caterpillar (*Tarache nitidula*), Striped bug (*Tetreda histeroides*), etc.; Pests of pulses – Leaf roller (*Sylepta derogata*), Horned caterpillar (*Melanitis ismene*), Gram caterpillar (*Heliothis obsolete*), etc.; Cholam stem borer (*Chito zonellus*); Castor shoot and seed borer (*Dichocrosis punctiferalis*); Black scale on orange (*Aspidiotus ficus*). Several pictures of exotic beetles from the British Museum of Natural History, had been noticed in more than one showcase(s) of the Museum, by the researcher. An example is *Orthetrum chrysostigma* (Nilgiris caves). The lac and silk industry has been well illustrated, for the visitors to the Museum, through an array of specimens and pictures, alongside relevant information. (Plates 13.24 and 13.25)

Of the total collection of insects at the Government Museum, Chennai, 90% are in the reserve. The Government Museum, Chennai, uses drawers with cork lining and a framed glass lid, fitting tightly on the top, for storing insects. Such drawers are present below the divider showcases used for displaying entomological specimens, in the galleries of the Museum. Again, a large number of such drawers with knobbed handles are arranged one below the other in almirah – like insect – cabinets made out of wood. In the two rooms that house the reserve collection of insects, the wooden almirahs are present. The wooden drawers of these almirahs have insects. About (50-60) dry preserved insects are present in each such drawer-cum-storage box. Insects, when stored in this manner must be protected from the ravages of the different pests that may attack them so, it is necessary to employ certain disinfecting agents. Powdered naphthalene or para-dichlorobenzene crystals may be placed, in the narrow perforated chambers present on all the sides in the insect storing drawers. In addition to this, a compact plug of cotton rolled around a long, stout pin, may be dipped in a strong solution which is a mixture of Lysol and camphor, or a mixture of chloroform, creosote and naphthalene, and then pinned in the corners of the insect storage boxes inside the drawers of the almirahs. Dilute solution of xylene with spirit are also coated along the sides of insect boxes, sometimes.
In one room of the Government Museum, Chennai, there are two almirahs, one smaller than the other. The drawers are arranged in columns inside the almirahs. The smaller almirah has fifty drawers, equally divided into two columns. This almirah is entirely devoted to the collections pertaining to the Order Diptera. The bigger almirah is actually broader, having a hundred drawers in total, equally divided into four columns. In this almirah twenty-five drawers have been set aside for the collections belonging to the Order Rhynchota and another twenty-five for the Order Orthoptera. For storing the specimens belonging to the Order Lepidoptera, a total of fifty drawers have been allotted in this almirah. The collections, pertaining to the different Orders of insects have been arranged in the different drawers, family wise, by following the classification of insects. A chart with the names of the families and the number of specimens belonging to each such family has been pasted on the inside of the doors of the wooden almirahs for easy verification at any point of time. (Plate 13.26)

The other room used by the Museum for storing the reserve entomological holdings has four almirahs each having fifty drawers divided into two equal columns. The collection in these drawers, are devoted to the Orders Diptera, Orthoptera and Lepidoptera. The arrangement of insects in the almirah drawers and the method followed for the verification of the collection stored, in this room are similar to that followed in the room.

Reserve collection, of the Government Museum in Chennai, does not only comprise dry-preserved insects, but wet-preserved specimens are also available. Mostly caterpillars are subjected to wet preservation, either in formalin or in rectified spirit.

**Government Museum, Udaipur**

Government Museum in Udaipur, visited during November 2014, is basically an archaeological museum (collection wise). Neither does it have insects as exhibits, nor as part of any exhibit. It does not even have any product or object derived from any insect, on display. (Plate 13.27)
Government Museum, Chittor

Collection wise this is an archaeological museum, visited in November, 2014. The Government Museum in Chittor is housed in a building of historical significance, and is under the supervision of the Archaeological Survey of India (ASI). Neither does it have insects as exhibits, nor as part of any exhibit. It does not even have any product or object derived from any insect, on display. (Plate 13.28)

Indian Museum, Kolkata

The Indian Museum, the earliest and the largest multipurpose museum in Indian sub-continent began with the idea of acquisition, documentation, dissemination, preservation and recreation in the year 1814 only with a few galleries. The Zoological Galleries were introduced in the Museum later, in 1878. The collections of the Zoological Galleries of the Indian Museum have been obtained mainly from the old collections of the Asiatic Society of Bengal. Secondly, the collections made by successive Surgeon Naturalists on board by the Royal Indian Marine Survey Ship Investigator from the depth of 100 to 1900 fathoms down the Indian seas. The third place, from where the Museum has received the invaluable specimens, were, different military and political expeditions. The fourth source comprise mainly the private donors, too numerous to individually mention. Another important source of obtaining more collections for the Museum has been the departmental survey parties. Lately, the main sources of collection have been the private donors, survey parties and zoological garden. The Zoological Survey of India carries out stray collection of insects. In the field generally an insect net is used for the collection of certain insect species. As soon as the insect is trapped in the net, it is killed. Some, like butterflies may be killed by pressing the thorax. In case of other insects, they are killed by placing them inside killing jars after having trapped them. The reagent used in killing jar may be liquid benzene or ethyl acetate or chloroform. Cotton soaked in either of these reagents is placed inside the killing jar before placing the insects inside them.

After collection and killing the individual insect specimens are temporarily stored inside separate packets known as the insect envelope. Each of the
insect envelopes containing insects is next exposed to some amount of heat either from the sun or from any artificial source like, a lamp, to dry the specimens, inside. Then each insect envelope is labelled, under – Locality, Date of collection, Name of the collector. If possibly obtained, the latitude, longitude and the altitude of the place are also noted.

Once, the field work for collecting insects has been completed, the collections transported from the field to the Zoological Survey of India inside insect envelopes, are sorted out and sent to the different Sections, for the different Orders of insects. Zoological Survey of India is the custodian of exhibits displayed in the Insect Gallery.

Once, the specimens pertaining to a particular Order have been brought into the respective Section, the insect envelopes containing the collections are transferred into a box called the collection box. Inside this box, naphthalene is kept in powdered form in order to protect the insects from the attack of any macro or microorganisms. Next, the insect(s) are kept for a day in petri-dish (covered with another petri-dish), each containing a blotting paper which has been moistened with a few drops of water. This step is important, in order to dampen the insects, so as to soften them, to be able to carry out the next step of preservation, i.e., the spreading of the insects.

Each of the relaxed insect is taken and then spread on the board using specialised entomological pins. Depending on the type of insect, a particular part of the body is pinned on to the board. Then, the antennae of the insects are stretched and pinned on to the board. The wings of the insects are covered with small pieces of paper in order to stretch them. Also important here is the labelling. The label containing the following information – Locality, Date of collection and Name of the collector, is attached to the respective insect by means of yet another pin. The insects are kept in this manner on the spreading board for a period of 7 days. Then after a span of one week the insects are removed carefully from the spreading board and transferred into a box, known as the insect box.
The insect box also contains a board on which the insects are attached again by using entomological pins. Labelling in this case is same as in the case of the insect spreading board. Cotton balls dipped in a solution (which is a mixture) of carbolic acid and camphor taken in the ratio of 3:1, are placed at the four corners of the insect box. There is a gap between the outer boundary of the insect box and the board inside it on all four sides. This gap should be filled up with naphthalene in powdered form and this is further, covered with cotton properly on all the sides.

The Museum was surveyed during the years 2008 and 2009; the zoological collections were housed in the following six galleries, i.e., Insect, Fish, Amphibia, Reptile, Bird and Mammal. The Insect Gallery was located on the first floor, at the southern wing of the Museum. The Insect Gallery had 1548 exhibits. The Insect Gallery had 29 Orders of insects on display, of which the members of Orthoptera, Odonata, Dictyoptera, Phasmids, Hemiptera, Coleoptera, Diptera, Lepidoptera, Hymenoptera, were the main objects. These insects were displayed both taxonomically, and also on the basis of their activities (beneficial, harmful, colouration, mimicry, etc.). Hence, economically important insects – lac insects, silk moths, termites – were also on display. Besides the evolutionary tree of an insect, insects of different orders were on display; a few of the several specimens on display are as follows, Poecilocoris hardwickii; frog-hoppers (Acanthaspis sp.); Lygeus pandurus (Scop) – chinch bugs; Pamela indica Sen; Chrysochroa gratiosa Deyr.; Mylabris pustulata Thumbera – Blister beetles; Spider wasps (Pompilus unifasciatus Sm.); Thread-waisted wasps (Sphex lobatus Fabr.); Leaf insects (Phyllium athanysus West), Stick insects (Pharnacia rigida Redt.), etc. (Plates 13.29 and 13.30) The Insect Gallery of the Indian Museum was under renovation, when visited by the researcher, during June, 2014.

**Isoptera Section, Zoological Survey of India, Kolkata**

The Section has numerous specimens belonging to 400 identified species, from around the world. It has more species from outside, than indigenous. The collection is in approximately 600 big jars. An approximate number of more than 180 type specimens are present here. (Plate 13.31)
Identification process is manual. Two fauna of India and many publications are referred, for correct identification. It is essential to collect the soldier (caste), when collecting in the field, so that up to the species level, identification is possible. Actually, the soldiers (of particular species) shows the best development in some of the characteristics, which help in identifying the respective species. The KEY contains the basic characters that help in primary identification, when referred.

The best method to collect termites is the hand picking method, using forceps and/ camel hair brush dipped in 70%-80% rectified spirit, used both as the killing agent and the preservative. For collecting the swarming population, a sweeping net proves useful. The kit for collection, now being done, as part of survey for the different states, also includes hand axe, shovel, vials (glass/ plastic, of convenient sizes), chopper, knife, etc.

After the collected material is brought to the Section, the individual samples are placed in separate petri-dishes. This is done to clean the insects or stages collected, using brush or hand. Then the cleaned specimen, devoid of (soil and dust particles), is put in fresh solution of the preservative, i.e., 70%-80% rectified spirit. Only for the imagoes (swarming population) collected, a killing bottle with benzene as the killing agent is used. After narcotization, these are preserved permanently in 70%-80% rectified spirit.

Primarily wet collection, the individual insects or groups or part of the sample (collected together) are stored in vials of different kinds. Usually glass is the preferred choice as the vial material, plastic is used only rarely. Each such vial is fitted with a cotton plug near the mouth, beside the regular respective stopper. Vial sizes vary, depending on the size of the specimen(s). Many such vials are placed together inside bottles or the jars, also preferable of glass and of different sizes. The individual bottles and jars are then filled up with the liquid preservative (as used inside the vial), up to the brim of the container(s). The container used (provided) nowadays for individual specimens, or for bulk storage is necked. The usual choice is container(s) with straight sides, rarely available and/ provided now. The containers storing the vials have plastic tops.
these days, earlier they were made of glass and either had a structure (of glass itself), or a metallic handle, to hold. (Plate 13.32)

The material generally used for labelling the specimen(s), is cartridge paper. The pen used for writing the label(s) is Rotring pen, usually, at times Pigma pen (as now), is used. Due to problems with the black ink quality these days, computer generated labels are being used by the Section. The label data include the following – Species name with author; Locality (Details included distinct, sate, country now with introduction of geo referencing latitude, longitude and attitude, also included); Date of collection; Collector’s name; Extracted from (i.e., the habitat, denoted as ‘Ex’); Number of different morphs (for example, 2 soldiers represented as ‘2S); Accession No.; Determined by (denoted as ‘Det by’ in italics or is underlined); Special remarks.

Documentation was only manual, until two years back. With the start of digitization, photo documentation has also begun in the Section. Manual documentation is done in ‘Accession Registers’. Data collection is categorized under the following heads – Reg. No., Zoological Name, Locality, etc. on one page and on the adjacent page under – Collector/ Donor, Date of Collection, No. of Example, Determined by, Date of Entry, Remarks.

Besides this, cards are also present, but no more as extensively used as earlier. These include one kind of card for any new species invented from around the world; a second kind on the basis of the type of species existing at present; a third one for the species present in the collection of the Section at Zoological Survey of India, Kolkata and the last type being the reference cards for bibliographical sources.

According to the digitized documentation started, what is prepared is known as RFD – Result Framed Document. The information recorded in the digitized format, pertaining to individual specimens include Date of registration; Date of identification; Phylum; Class; Order; Genus; Species; Author; No. of example; Collection; District; Locality; State; Latitude; Longitude; Altitude; Habitat; Status of the specimen; Remarks; Cataloguer’s name. These fields are part of the common format provided by the administration (Zoological Survey of India) to
each Section. Now, it is up to the Section to add to or alter any of the fields. The field “No of example” provides in detail, the number of specimens collected corresponding to each caste (worker, soldier, king, queen), of the respective species of termite collected.

The Type Specimens are stored in a shelved steel almirah, with steel framed glass doors. Earlier these and shelved wooden almirahs with framed glass doors were used to store the containers having bulk specimens and vials with individual or a group of specimens. New racks have now replaced most of the old ones. The racks have five shelves each. They are provided with sliding doors and locking system.

The usual mode of arrangement of specimen(s) is according to genus and then, species wise. In this room a very few dry collections were also seen. All of these were nests of different termite species. Actually the nests collected are of different sizes, but the storage system has shelves of fixed dimensions. So, only those nests that are able to fit into the existing racks are placed on a piece of clean cloth. A few others are kept on open wooden shelves, and such nests have been covered with a bell jar.

Unique items with all potential of becoming interesting exhibits were the Sections of some of the nests and an original royal chamber, with an impression of the queen termite, created artificially, inside it. All of these are safely kept inside glass topped wooden boxes, being provided with thick cotton padding at the bottom. To prevent bio deterioration, a mixture of para-dichlorobenzene and naphthalene (in the provided form) are provided in the grooves of the boxes on all of their sides. Six such boxes were seen placed one on top of another, three in each of the two adjacent columns, kept on top of the table.

Earlier the Isoptera Section was involved in loans and/ exchange of materials with the American Museum of Natural History (AMNH). Actually, new rules and regulations regarding biodiversity that have come in the recent years prohibit any exchange of materials (pertaining to natural heritage), between India and any other nation. If at all, loans are to be sent, individual glass vials are first
sealed with wax, to prevent any preservative from oozing out. Then each vial is individually wrapped in cotton and put inside a box, already lined with cotton at its bottom. Another layer of cotton padding is provided from the top, after placing all the vials, and before the lid. For shipping a good box of either wood or cardboard is taken. Inside this box padding with thermocol sheets should be provided on all sides, before placing the boxes inside. Thermocol makes the box shock proof. It is necessary to write ‘FRAGILE’ against this box.

**National Science Centre, New Delhi**

This science centre, under the National Council of Science Museums (NCSM) had been visited during October, 2011. In the first gallery on “Human Biology – The Miracle of Human Life”, there are instances, where one comes across displays related to insects. On the left hand side from the entrance to the gallery, there is a display titled “We are one – The genes we share with other animals”. At the centre a labelled diagram of a human body can be seen, radiating from which are circular discs, three, on either side. The disc at the top, on the right hand side, has a picture of *Drosophila* with information on the insect being used by human beings for research in the field of genetics.

A little further there is a display titled “Nature the great leveller”. There are 5 panels with information and corresponding graphics. One of these throws light on “Malaria”, the carrier of this disease (mosquitoes), the transmission of the disease, the life cycle of the protozoa causing malaria, etc.

In the second gallery on “Information Revolution “, the first exhibit on the left hand side is titled “Information imbibed in nature”. The third picture from the left is that of a beetle. (Plate 13.33)

**National Museum of Natural History, New Delhi**

The National Museum of Natural History, surveyed twice during October 2008 and 2010, displays through its theme based exhibition galleries, namely - Introduction to Natural History; Nature’s Network – An Introduction to Ecology; Conservation; Cell – The Basic Unit of Life. The first three of these display visuals, literature and original specimens pertaining to the Class Insecta.
The gallery on “Introduction to Natural History,” delves into and portrays the origin and the subsequent evolution of life, as well as presents the diversity and the variety of the flora and fauna of our country. A section of this gallery depicts animals and plants in their natural habitat followed by pollination in flowers, harmful and beneficial insects, camouflage, etc. Insects can survive in varied types of environment. On the right hand side of this gallery, the dioramas depicting the ecologies of pond, desert and mountain respectively, mentions about the adaptations by insects in such areas, in the labels provided for each, but the dioramas do not contain any insects’ replica/ model/ picture/ painting. On the left hand side of the gallery, a wooden panel is dedicated to the types of pollination. At the top is depicted insect pollination (entomophily). Pollination of this kind and others, have been shown through models and pictures.

A little forward, is a large rectangular panel titled Joint logged animals Arthropoda. The major part of the panel is dedicated to the Class Insecta. Replicas, original specimens, slides, diagrammatic representations and literature pertaining to insects have been displayed here. The different classes of animals included under arthropods have been represented using three-dimensional models. Pictures portraying the life cycle of a butterfly, sections of nests of insects, original specimens mounted on slides (glass tablets) classified as useful and harmful, might be seen on display in this Museum. A portion of the panel, stresses on the ability of insects, to camouflage (deceive the enemy).

The butterflies displayed in this panel (first five rows), include *Papilio helenus*, *Appias wardi*, *Tirumala limniace*, *Graphium sarpeder*, *Graphium doson*, *Hypolimnas Bolinas*, *Euploea Sylvester*, *Euploea mulute*, *Pachliopa hector*, *Kalimna inachus*, *Euthalia patula*, *Parthenos sylcua*, *Salatura genutia*, *Anegia chrysippus*, *Neptic mian*, *Neptic sankara*, *Junoxia orithyas*, *Mycalesis oculus*, *Phalasita phalanthea*, *Colias ferildu*, *Argyroa hyperius*, *Colias erates* and *Eurema hecale*. Rows 6 and 7 display, other insects, which include *Diastocera wallichi*, *Plocaedera obesus*, *Diastocera wallichi Hipe*, *Acilesthes holosericeae*, *Stibaro nigricornus*, *Batocera rubas linni*, *Leptaulux dentatus*(Fabrias), *Batocera rubas Linni*, *Mimelia hetrochorpus* Blanch,
Aceraias grandis, Polistes sagittaninus sauss, Pompillidae, Colias nutriginosa Fabr, and Pompilus unifasiatus smith.

On entering the gallery on “Nature’s Network,” one comes across different pictures on display on the wall, on “The variety and diversity of life”, alongside related literature. One of the pictures showed a honey bee, sucking nectar. The adjoining section has a series of exhibits explaining the flow of energy in ecosystem providing with more visual appeal than printed information on food chain, food web and energy flow in any ecosystem. The exhibit “Energy flow in an ecosystem,” tell the visitors about the major components of the ecosystem, i.e., producers, inorganic substances, organic compound, saprotrophs, decomposers and consumers. Out of these, insects constitute the group consumers (pictures of insects are given here).

The adjacent showcase puts up a diorama to help visitors understand the concept of a food chain. With a painting showing vegetation and animals of different kinds as the backdrop of the diorama, models of the animals involved in the food chain depicted as an example in the label provided, are shown in the forefront.

Plants – Butterfly – Frog – Snake – Hawk – Leopard

(p) (H) (C1) (C2) (C3) (C4)

The above complex food chain involves four carnivorous links (C1-C4). Butterfly forms the herbivorous. Next to this is the showcase that tries to explain a food web. The hexagonal showcase contains pictures of different components of a food web. All pictures bear a label and their interrelations are shown through digitised arrows red and yellow in colour; butterflies, ants, and caterpillars have also been shown in this food web.

The inter-dependence of plants and animals has been highlighted in the exhibits on inter-relationship, depicting different kinds of interactions among the organisms of a community. One of the exhibits in this panel shows a leaf being fed up by a caterpillar, but this was labelled only in Hindi. The showcase on the adjacent wall (The Living Tree) shows how a single leaf can be the shelter to organisms of different phyla, Arthropoda being the most common. Amongst arthropods, insects are the major occupants (14) on different areas of a leaf.
Pictures of the varied organisms are on display on an enlarged leaf, exactly on the positions they are actually found. (Plate 13.34)

Then there are exhibits portraying the concept of conservation including the four pillars of conservation, i.e., ethical, scientific, economic and aesthetic. The aesthetic aspect of conservation is displayed on the four panels of an island showcase. On one panel of this showcase several original dry preserved specimens of butterflies of different species have been displayed. None of these butterflies have been labelled.

Gallery number 3, on “Conservation,” display exhibits to promote the importance of conserving the components of nature. One of the showcases on a wooden panel along the wall puts up the importance of soil. Insects have also been included in the list of organisms that may be found in the soil. This exhibit titled, Soil – A mini ecosystem, informs the visitors that, it takes about 600 years to from 2.54 centimetres of soil. Pictures of rove beetle, wood, roach, carpenter ant, cicada, nymph, sow bug, etc., are seen here.

Original specimens of insects like butterflies, moths and beetles have been displayed in a wooden frame glass showcase, inside another panel. This is the seventh exhibit from the right. The specimens are not labelled individually, but the panel as a whole is labelled, India – Nature’s bounty. There are some insects that are the natural enemies of many pests and are responsible for destroying our valuable crops. The increasing use of pesticides not only destroys the targeted pests (depicted in the exhibit through enlarged pictures on white coloured circular boards), but their natural enemies as well, thereby adversely affecting other living organisms and important food chains. This problem has been portrayed in this gallery through painting inside a panel. This showcase is seventh from the left and is titled “THE PESTICIDE PROBLEM” – The fight against pests is one of the main tasks in agriculture. The concept of ‘Biological control’ has also been stressed upon, in this panel.

The Reserve Section of the National Museum of Natural History, comprise only butterflies, amongst the entomological holdings. The butterfly collections have been stored in insect boxes that serve both display and storage purposes.
These have not been arranged in order inside the insect boxes. Thus, butterflies of varied sizes and species have been kept inside individual boxes. No specially designed almirahs or shelves have been allotted for housing the insect boxes. A multipurpose almirah of wood with doors of glass and wooden frames contains the boxes. In all, eight boxes of butterflies were shown, at the Museum, exact number of boxes, are not known. A total of 265 specimens were present in the eight boxes. As examples, *Byasa dasazada* Mo., *Ssp. Ravana, Graphium sp., Delias belladonna and Ssp. Horsfieldi*, are the species represented in one of the boxes containing 20 specimens. *Papilio proteox, Papilio belenus, Ssp. Cashmirensis, Aporia agathon, Ssp. Caphusa and Parantica nilgirensis* M., are the species represented in another box, containing 15 specimens. The insect box containing 30 butterflies were not provided with separate labels for individual specimens.

Besides acquiring collections through field work, the Museum has also acquired entomological specimens through gifts and donations. One such collection obtained by the Museum as a gift is present in the Reserve Collection room. It read – WEST AFRICAN BUTTERFLIES; Collected at Ngala, Borno State, Nigeria; By Atul S. Nischal; N0.873. June-July, 1985, Mayo College, Ajmer. The specimens in this box included: *Catopsilla florella, Syntarueus telicarus, Precis hiertia, Acraea ters, Vanessa cardui* (Painted lady), *Danaus chrysippus, Tereas brigitta, Hypolimnas misipus, Colotis danae and Colotis evippe*. (Plate 13.35)

The National Museum of Natural History is housed in a rented building and the administration has decided to shift the museums exhibits and reserve collections to a new building. For this reason, no field trips were being undertaken to require new holdings of any type including insects, so there was no question of any conservation work, at the of by the researcher. Only if any entomological collections came to the museum as gift, or donation, or through loan and required any treatment, it is then subjected to conservation. No conservation laboratory is present as such in the Museum. Two rooms are allotted for serving the purpose if required. In one room are present different kinds of chemicals. The other room contains the equipment required for conservation treatment.
If any entomological specimen is collected at all then – collection is done using nets. Then the specimen is killed by introducing it into the Kilner or Damping Jar. Earlier potassium cyanide was used to kill the insect, but now either benzene or chloroform is used to serve the purpose. After the insects are killed they are taken out of the kilner jar and kept inside the insect envelope so as to relax the insect before it is being subjected to stretching and pinning. There is a definite time period up to which an insect after being killed should be subjected to relaxation for example if the specimen is kept in the envelope at about (5-5.30) p.m. in the evening, early the next morning it might be taken out from its temporary storage and stretched, then pinned. No information on the methods of collection on the ways of documenting the collections was available.

**Nehru Science Centre, Mumbai**

The Nehru Science Centre was surveyed during October in 2012. In the second gallery, which is on 'Science for Children,' the third panel from the right hand side, is on – “World biomes,” the top most portion is labelled ‘Rainforests’. It has a pictorial representation of the biome showing colourful butterflies fluttering about in the vegetation and a boy trying to catch them.

Moving forward to the seventh panel, beside this there is a corner for children activities and a play area. Here, pictorial representation of insects can be seen in a few places (dragon flies, grass hoppers, butterflies, mantid, etc.). A little further, the panel on “Nature” has a computer kiosk videos and providing information on the different components of nature, including insects. At the top, above the title (main label) there are pictures of different animals, including insects. One of the two butterfly pictures show their mud puddling activity. A little far off, the fourth Section of the twelfth panel, titled “Tiling & polygons in nature,” has pictures and corresponding descriptions on Wasp's nest, honey combs and bumble bee’s eye. The 14th panel on ‘Shapes in nature’, has a butterfly picture. (Plate 13.36)

In the second gallery, on “Climate change”, the 23rd panel from the left hand side, is on “Early Spring”. This panel explains that the onset of spring before time (due to climate change), induces premature hatching of caterpillars, which
are the food of the young birds of the ‘Pied fly catchers’, thus become unavailable. The next panel with the title “Who is at risk?,” has pictures of butterflies (probably, exhibiting their mud puddling activity). From the left hand side, the 25th panel of this gallery is on “Health.” This panel discusses the effects of climate change on mosquitoes, which in turn is affecting human health. This rise in temperature will lead to the migration of malaria causing mosquitoes, even to extremely cold places (not occupied by mosquitoes, at present), resulting in greater incidence of the disease. Here is a computer kiosk to provide the visitor with information, on Impact, Public health, Mass effect and remedy.

In the gallery on “Prehistoric life,” on the first floor, there is a computer kiosk telling “The Story of Evolution,” to the visitors. This provides with information (supported with illustrations) on Evolution of universe, Origin of life, Evolution of life in water, Evolution of plants, Evolution of reptiles, Evolution of mammals/human, Endangered species and Extinction. The icon on ‘Evolution of life in water’ gives information on the ‘Evolution of invertebrates, letting the visitors know, about the evolution of the different insects (cockroaches, flies, beetles, odonates, etc.).

In the “Light and Sight” Gallery, the 23rd panel from the left hand side (inside the ‘VISION’ area) is on “Whose eyes are these?” Here, there is a picture of an insect (probably of the order Orthoptera).

**Nehru Zoological Park, Hyderabad**

Visited during December 2014, it has a ‘Natural History Museum’ and a ‘Butterfly Park.’ Besides information on the Butterfly Park, the Museum has information panels telling visitors about biodiversity, pollinators (including insect pollinators), besides providing information on the chronology of events at the Park.

The Butterfly Park is an open kind, has plants and trees in the open. Amidst these there are boards with information and pictures. Actually there is a pathway, on either side of which the host plants and nectar plants of butterflies beside, other plants are present. Some boards are on the left while some on
the right. The first board on the left, informs the visitors on the ‘Threats to Butterflies,’ ‘Conservation Measures,’ and things to be done to protect the butterflies. Interestingly, the legal protection that butterflies have through the ‘Wildlife Protection Act’ of 1972, in India has also been mentioned in this panel. Another board on the left titled, ‘Butterflies – Nature’s flying Jewels,’ begins with general information on insects followed by a general info on butterflies; their lifecycle, the needs of every stage; behaviour of butterflies; their role in nature; etc. Interestingly again a unique information is on the number of butterflies and the number of families.

A little ahead, the first board on the right depicts through a diagram the life cycle of a butterfly. Then there are panels on the right and the left informing visitors about the particular butterfly species which are usually seen in the Park. There are three boards displaying the pictures of the different species of butterfly available at the Park. The first board included Plain Tiger, Blue Tiger, Painted Lady and Yellow Orange Tip. The second board included Common Gull, Common Jezebel, Common Leopard and Common Crow. The third board included Crimson Rose, Peacock Rose; Blue Pansy and Yellow Pansy.

Midway through the Park, some steps lead up to the ‘Insectarium’. Here, there are many panels on insects, along the wall and in the centre, all around a pillar. Moving from left to right, the first panel gives information on insects alongside pictures, and tells about the difference between insects and non insects (similar in appearance or usually mistaken by common man as an insect). Depending on the order of visit there is a showcase with charts and pictures. The central one focuses on the ‘Common butterflies of Maredumilli and Rampa.’ Then there is another panel, providing information on ‘Insects’, and ‘Insect Evolution’. It gives the etymology of the word ‘insect’ and has the diagram of an insect with all its parts labelled.

Exactly at the centre of the ‘Insectarium’, there is a pillar. On all the sides of this, information panels have been put up. In all there are 7 such panels. The first panel discussed the various ecological roles played by the arthropods. From this panel itself, information pertaining to the various characteristic features of the insect order with the corresponding pictures, have been put up.

Two more of such panels one lay on the ground, leaned against the wall. One had information and pictures on Orders Odonata, Plecoptera. The other panel depicted Orders Diplura, sub class 2: Pterygota, Orders Ephemeroptera, Odonata. Back to the wall panels, there is one on the ‘Helpful Insects’. This provides with information and illustrations on the insect and the product of importance and utility, derived from it. A general information is followed by short notes on – ‘Honey’, ‘Silk’, ‘Beeswax’, ‘Lac’, ‘Dyes’ and ‘Medicinal products’. There is also a showcase with insects and related objects pertaining to “Helpful Insects.”

There is a panel on ‘Insect Engineering’. This board begins with some information on ‘Nest Building’, discussing the capability of insects, alongside pictures of the nests of different insect groups. This is followed by another heading ‘Insect Architects’, with pictures to show the insect as an architect or the architecture created by the insect (termite, ant, bee, wasp). There is also a showcase with exhibits titled “Insect Engineering”. This has around 20 specimens. The researcher found that a completely new aspect of insects has been put up here. The creative qualities of different (selected) insects have been exhibited in this showcase. Although haphazard, the display includes Paper Wasp nest (Top extreme left), Dragon fly – Helicopter shape (a little below), Grasshopper – Long jumping (at the same level as dragonfly on the right), Cricket – musician (centrally located in the showcase), Dung Beetle (below towards the left), Stag Beetle (at the same level as dung beetle on the right) and Weaver – Spinning – three cocoons (below dung beetle). (Plates 13.37)
Near the ceiling, on the walls all around the display area there are (much smaller, rectangular) panels. These pertained to ‘Few questions about insects’. Again there are seven panels. Each has at least two or more questions and corresponding illustrations. A few interesting ones include, Panel 1 “Is it an insect ?”, “Is the insect an adult ?”. Panel 2 “Where does it live and when is it active?”, Panel 6 “Do insects sleep ?‘, ‘Where do insects go in winter ‘, ‘Can insects hear and how ?” Panel 7 – ‘Can insects learn?

One showcase at the Insectarium only displays dry preserved butterflies and moths, as exhibits. Displayed in five columns with four specimens in each, are the butterflies, occupying the major portion of the showcase. These include Rice butterfly and the Lime butterfly, with two specimens of each. The Common Gull also has two specimens, out of which one is a male. The remaining butterfly species are represented by one specimen only. These are Blue Tiger, Plain Tiger, Small Grass Yellow, Crimson Rose, Plain Orange Tip, White Orange Tip, Tawny Coaster, Common Jezebel, Common Blue Bottle, Danaid egg Fly, Common Crow, Common Mormon and Great Egg Fly. The lower portion of the display consists of moths. Out of 9 specimens displayed the names of only three moths could be understood, the remaining, are either partly legible or completely illegible. The three legible ones include – Owl Moth, Hairy Caterpillar and Castor Semilooper. (Plate 13.38)

Towards the exit there is a panel on the ‘Wonders of the insect world’, issued by the ‘Wildlife Education and Extension wing, A. P. Forest Department. The board begins with general information on insects and their evolution. In the middle a painting shows the habitat of different insects. In the lower portion, the visitor is enriched with knowledge on some interesting facts and figures about those insects. On the wall of the building jutting out on the right of the exit (entry as well) there is a painting on ‘Honey Bees Dance’ (the unique means of communication, amongst the bees).

**Natural history Museum, Jaipur**

The Natural History Museum, in Jaipur located inside the Jaipur Zoo, visited in November 2014, has no representation from the Class Insecta, collection wise, or in its display. Neither does it have insects as exhibits, nor as part of any
Orissa University of Agriculture and Technology, Bhubaneswar

The researcher surveyed the insect collection maintained in the Zoological Section of the Orissa University of Agriculture and Technology in December-January 2008-09. In this Museum (comprising of one big room), numerous insects were displayed. These include Insect pests of Rice, Paddy leaf roller (Gaphalocrocris medinalis Guen), Pulses, Arhar pod borer (Nanaguna breviscula Walk.), Vegetables, Brinjal lace bug (Urantius sentis), Sugarcane – Top shoot borer (Tryporyza rivella). Specimens portraying, the ‘Mimicry in insects’, have been also displayed. Chaffer beetle (Anomala bengalenses); insect pests of ornamental crops, Rose – Microserica quadric notata and green manuring crops, Dhanicha – Pericyma glarcinans, constitute showcases 15-19.

Insect pests of trees – Hairy caterpillar of Siris, Rhisala impareta; Mango stem borer, Biotocera rufomaculata, Devi; Banana skipper, Evionata tones Evans, Leaf eating caterpillar of country almond, Gastropacha paroale nandina Moore., etc., have also been displayed. Economically important insects – lac insects, varieties of silk worm, pollinators, predators and parasitic species of insects; are displayed, as well.

Neither any information on the modes of acquisition, killing, preserving, pinning and setting techniques were available, nor any information on the climate control methods or documentation, have been provided, at the Museum.

Orthoptera Section, Zoological Survey of India, Kolkata

The insects and/ orders of insects in the holdings of the Orthoptera Section include Phasmida, Mantids, Blattids, Dermaptera, Tettigonids (long-horned grasshoppers) and Acridids (short-horned grasshoppers). The count of dry and wet collections includes 13,000 identified specimens. Type collections are also present in this Section (holotypes).

The habits and habitats of the insects/ groups mentioned above are the main considerations, during expeditions planned, to collect these insects. Almost all
of these insects are handpicked. The winged Phasmids might be caught against light. Nocturnal mantids might be caught using lights traps.

Identification is done using keys of earlier scientists, set up by themselves, for respective family, sub-family, genus and species. Two different species, even if similar in most ways, will have at least one characteristic that separates it from the other. Such a pair of characters differentiating the two very closely related species is known as ‘Key couplets’.

Documentation in the field is considered mandatory. The field notes include Latitude and Longitude readings using GPS (Global Positioning System), date, Locality, Habitat, Host plant name (if possible), Collector’s name.

Once caught, the insects are killed in a killing jar, prepared using ethyl acetate as the killing agent. Two to three consecutive layers of blotting paper (circular piece) and cotton constitute the bottom of the killing jar. To this about (15-20) drops of the killing reagent are added, the lid closed and the jar kept aside for a while, before use. Chloroform is another alternative, as the killing reagent but disadvantageous, causing decolourisation of the insect.

Rectangular tracing paper envelops, with blotting paper on one side, are used for temporarily storing the insects in the field and until being brought to the Sections. The gut waste if any excreted by the insect is absorbed by the blotting paper. Various sizes of envelops are used, depending upon the size of the insect. The field notes are written on a separate piece of paper using pencil or a ball point pen, and provided inside the corresponding insect envelope. Many such envelops are packed inside a box, to which parachlorobenze crystals have been added, as a means to discourage fungus. The best practice tried to be pursued, is to sun-dry the insects after they have been killed, on the same day or the following one. This prevents fungus growth. Within a span of the next two to three days the insect should be pinned. If not dried and/ pinned in the field, then the insects are dried under an electric bulb of 40 watts. Then the insects should be relaxed in a glass chamber. In this is present carboxylic acid solution, the relaxing fluid, prepared by mixing camphor and phenol, in the ratio 30:70. This is then kept in the sun, for some time, to use it to the best of its
strength. The insects should be placed on a blotting paper placed in turn atop the relaxing fluid. The number of insects placed together, will depend on the sizes and shapes of the insects.

Then, the insects are stretched and pinned, following the standard techniques. For instance, grasshoppers and praying mantids should be pinned on the right side of the prothorax. Specialised entomological pins are used here. Only the bigger insects collected are subjected to direct pinning. Pin sizes normally used are 3 and 4, although stocked are from numbers 0 to 5, the size of the pin is directly proportional to the size of the insect.

For proper stretching, a stretching board is used. Made up of hard wood, it has a lining of soft wood to allow pins to be inserted into it. Moreover, sheets of paper are stuck on top to provide with a neat and clean surface, to work upon. It has adjustable screws on both the shorter sides, to accommodate the body of the insect into the groove created, as required.

The dry preserved insects are stored inside wooden boxes. They may be completely wooden, provided with hinges with different types of lid opening systems, as used earlier by the Section. Else they may have a completely removable glass top (with wooden frames), as used nowadays. (Plate 13.40)

The insect boxes old and new, all are provided with powdered naphthalene. The new storage boxes have grooves with a divider in between on all its four sides to contain the crushed naphthalene balls to the powder, is then covered with cotton. All boxes will have cotton balls soaked in carboxylic acid, which is then dried up a little, before being pinned on the four corners of the boxes. The cotton balls are replaced or re-soaked in the preservative solution, after every three months.

Although dried parachlorobenze, wrapped in muslin and then if nailed in the boxes, will act similarly, it is not used in this Section, due to its lethal side effects. The number of insects stored in a single box depends on the size and shape of the insects and the surface area of the box.
The individual dry preserved insects are provided with three separate labels. With the changes being introduced now, it has now been decided to use four labels for each specimen. At present there are, the locality label, this includes the determination/identification label as well as the species label and lastly the label with the registration number of the specimen.

**Patna Museum, Patna**

Visited in December 2012, the collection consists of prepared specimens of butterflies and moths, purchased from Kolkata. From the group labels in some of the display cases, the researcher is able to confirm the presence of Lepidoptera specimens, mostly belonging to the family Nymphalidae, but families Pieridae and Satyridae also have representations but, in decreasing number. (Plate 13.41) As informed to the researcher, the collections undergo fumigation, during May-June and October, on an annual basis. The showcases are usually provided with silica gel as the buffer material, to maintain optimum humidity. The humidity captured by the silica gel is extracted, for re-use by drying under sun, or by using a heater or a tava (in Hindi). Para dichlorobenzene wrapped in a cloth bag has been hung inside the showcases (with insect collections), for fumigation purposes.

**Raman Science Centre, Nagpur**

Unlike, the other science centres under the National Council of Science Museums, there is no depiction of insects in any way what so ever, in any portion of the galleries of the Raman Science Centre, visited during October 2012.

**Ramoji Film City, Hyderabad**

The Ramoji film city in Hyderabad, visited in December 2014, has a ‘Butterfly Park and a ‘Museum’, on butterflies. The ‘Museum’ has about 20 panels and boards with information (facts and figures), supported with appropriate pictures and illustrations. The panels are distributed in two adjoining rooms. Although unusual, but the arrangement of panels, orients the visitors from right to left.
Panel 1 has a write up titled, ‘the vibrant colours amidst flowers’. Panel 2 points out the differences and the similarities between the butterflies and the moths. The next panel discusses the mystery behind the name ‘butterfly’. Further, there are panels on the ‘Biodiversity of some butterflies around the world and in India’, and ‘The metamorphosis’, (the latter is a diagrammatic representation, of the butterfly life cycle). The former discusses the population of Swallowtails, Whites and Yellows, Brush footed butterflies, Blues and Skippers. Comparisons between the populations of world; North East Himalayas; Peninsular India; North, North East and Hyderabad, have been made, alongside a picture of each variety, as well. Another panel, a little further is on ‘Protect butterflies the colourful winged beauty’. This panel, points out the role of butterflies in pollination, in biological control, maintaining biodiversity; as a component of the food chain and as a source of attraction.

Other information boards in the Museum include one on the “Common fact about butterflies.” Another one says, “Butterflies have names just like us.” This informs the visitors that all butterflies have a common name and a scientific name. The last information board of this room gives an idea about the ‘life span of common butterflies’. General information is supplemented with details on the life span of swallowtails, copper butterfly, small blue butterfly and monarch. A picture of each of these has also been provided. On the opposite side, a panel puts up some ‘fun facts about butterflies’ for the visitors to know. In the next room also, the orientation is from right to left. The first information board tells us about the ‘Classification of butterfly’, from kingdom to suborder.

Next we come across “Different butterflies around Hyderabad”. Through this, we come to know that Common tiger and Common crow are the butterfly types, occurring throughout the year in Hyderabad. In the rainy season Mottled emigrant, Lime butterfly, Pioneer, Jokes and Yellow orange tip, are among the many butterflies seen. The summer season is visited by Tawny coster and Common leopard varieties. In the winters Common evening brown, Common jezebel, Crimson rose, Common wanderer, amongst other butterflies, can be seen, in this part of the country. Lovely pictures of each of these kinds can be seen here.
The next information board brings forth ‘More amazing facts about butterflies’, in terms of size and occurrence. The following panel on ‘The dangers butterflies face, allows the visitors to know that human interferences like deforestation, pesticides and insecticides, poaching; along with the natural forces, affect the butterfly population. The first information board on the adjacent wall is about “The largest and the smallest butterflies”, informing that the size of a butterfly is expressed in terms of the width of the wings, when spread fully. Also, there are mentions of the world’s largest and smallest butterflies, i.e., Queen Alexandra’s bird wing (Ornithoptera alexandrae) and western pygmy blue butterfly (Brephidium exilis), respectively. India’s largest butterflies are the female swallow tail and southern bird wing (Triodes mines). The smallest Indian butterfly is Grass jewel (Freyeria trochylus) from Hyderabad.

The board beside, bears an illustration, to tell that patience is the key, if one has to catch a butterfly successfully. On the wall opposite to this there are three more panels, before we exit from the Butterfly Museum. The first and the second panels together put up ‘Butterfly – Symbolic representation across the world’. Thus, we come to know about what the butterfly symbolizes in countries like Egypt, Columbia, Japan and Greece, followed by Russia, China, India and USA. Interestingly, in the first panel we find that butterflies are considered to bring good luck by the Indians. Moreover, the people of West Bengal consider that butterflies represent marriage. (Plates 13.42)

The last panel discusses the ways to invite butterflies into our own gardens and to develop it suitably by growing flowering plant, citrus species and the larval food plants (of the butterflies).

After coming out of the Butterfly Museum one shall be guided into the Butterfly Park. This is almost a rectangular enclosure made up of green net. With a setup similar to the Butterfly dome of the Bannerghatta Biological Park in Bengaluru, the visitors are guided along a brick pathway. There are plants (nectar/ host/ larval food/ ornamental) along one side. One shall find brilliantly colored butterflies fluttering around, and many feeding on the nectar from the lovely flowers. The artificial plants with artificial flowers, having a cotton swab
dipped in honey or other source of carbohydrate (glucose/ fructose solution) are present, as seen at the Butterfly Park in Bannerghatta, Bengaluru. Three such plants might be seen along the walls (around the enclosure).

At the centre there is a fountain. There are a variety of plants surrounding it. Here also there is an artificial plant, with similar arrangement for supplementary nutrition of the butterflies. Again, there is a water source at the corner directly opposite the entrance (exit as well) of the park (just like the artificial waterfall created at the Bannerghatta Biological Park), to regulate the temperature conditions for the butterflies to thrive in extreme conditions. Instructions are have been given to the visitors for instance, ‘Do not disturb the butterflies’, to protect the butterflies. (Plates 13.43)

Beside this enclosure, the nursery of the larval food plants and the host plants for the particular butterfly species is being maintained. In the portion just opposite the enclosure, along the visitors’ pathway, nectar plants have been grown. Species of *Lantana* and *Ixora* have been noticed.

**Regional Museum of Natural History, Mysore**

Surveyed in the month of August, 2013, most of the insects in the collection of this museum have been collected from within the museum premises and surroundings, broadly during the period 1993-98. Some of the entomological specimens were donated by the Zoological Survey of India, while a few others were donated by philanthropists from their personal collections. There are around 280-300 insect specimens in the custody of the Museum in Mysore. Of which only 30%-35% are on display while the remaining are part of the reserve collection of the Museum.

After being killed the insects are stored temporarily and thus relaxed, inside envelopes made using butter paper. Although cheap, these are valuable as the cellulose protein of which it is composed, does not allow moisture retention of any kind; being translucent these allow viewing of the insect from outside; in case of any liquid discharge from the specimens, it gets absorbed by the envelope and can be viewed from outside too, intimidating change of the envelope by the museum personnel.
In the field thermocol or styrofoam sheets were used for immediate stretching, in case of some of the insects. At the Museum, the insects were dried at the required optimum temperature, under any incandescent light source. All the insects in the collection of the Museum, Mysore are dry mounted, as per the standardised norms, on the pinning board, using the appropriate entomological pins. The pin sizes used vary from 000 to 8. The most common one used at the Museum is no. 3. Being coated with protective chemicals, these pins never react with the body of the insects in the collection of the Museum.

One shall come across boxes of three different designs and specifications, used for storing the insect specimens at the Museum. Earlier, the boxes used to keep all the collections had cork sheets. They could be used for pinning insects only on one side. Then the boxes used had rubber sheets for pinning insects. Another type of insect storage box purchased had spring lock and insect specimens could be pinned on either side of it. At present there are around 10-12 boxes, all made up of quality teak wood, compared to the 2 boxes used earlier for preserving insects.

To preserve the insect collections, earlier naphthalene balls or dichlorobenzene were used inside the insect display or storage boxes as insect repellent, but these caused, discolouration of the insects after some time. Since, any insect can be identified up to 60% just by its colour such chemicals are no longer used. At present no insect repellents are used by the Museum, actually the boxes being used now, are completely airtight, maintaining the dryness as required on the inside of the boxes. Absence of any moisture has prevented the collection of this Museum from any kind of fungal attack. In case of fungal infection, if any at all, the specimens are subjected to treatment with 100% pure ethanol.

Museum personnel have always documented any insect they have collected, during their field trips. The information has been collected under the following headings: Locality/ Place of Collection; Date of Collection; Institution, if any; Name of the Collector; Genus Name; Species Name; Male/ Female.
Insect storage boxes constituting the reserve collection of the Museum are kept in a room, inside a cabinet with three shelves and sliding doors. There are 10 boxes storing insects. Examples from the various entomological specimens, inside these boxes, with place of collection and number of specimens (inside the box) are: Mainly from Mysore like: Death head moth, Wild silk moths, Giant water bug, Elephant dung beetle – from Tamil Nadu (25), Swallowtail butterfly, Some personal collections, for example from K.M.Das, Kerala (21); Cicada Beetle – three varieties, all available in Mysore, Dragonflies, Bumble bees, Members of the Order Hymenoptera (30); Collections (butterflies) from the museum campus: Great egg fly, Tigers, Cabbage butterflies, a few type specimens (25); etc. One of the boxes had 12, unlabelled specimens. (Plate 13.44)

On entering the Museum, the first hall on the left hand side (temporary exhibitions hall), had an exhibition on the Natural Heritage of Mysore, and was titled “Namma Mysooru.” Walking from the left, the eighth and the ninth panels at this exhibition were on ‘Mysore Silk,’ informing the visitors about the silk moth from which this silk is obtained and the details of the silk type itself.

Next to this is a permanent exhibit hall, on “Biological Diversity.” The third panel from the right hand side displays insects. There are two boxes housing original entomological specimens. The one on the left hand side titled “Insects,” has 39 specimens, while the one on the right has 37 specimens, and is titled “Butterflies & Moths.” On the same side, but at the top are pictures of insects, namely, Moon moth, Death head moth and Peacock pansy. The next panel has a painted tree as the background. Painted along with labels on round boards we have the insects found on and around a tree. For example one shows ‘Insects’, another such board shows ‘Isopods.’ Panel number 10 has pictures of insects on rectangular shaped boards. The next panel also has pictures of insects. The label asks the visitors to try and identify the creatures shown on the panel. The twelfth panel titled “The Value of Wetlands,” has the paintings of dragon flies at the centre. The entire wall adjacent to the nineteenth panel is dedicated to the thought on ‘what we should do to protect our environment?’ Here, we find the labelled painting of an Atlas Moth. (Plate 13.45)
In the next permanent hall titled “Life Through the Ages,” only the first exhibit has the paintings of insects corresponding to the Carboniferous Period. This exhibit shows the evolution of the different types of organisms through the different periods of the Geological Time Scale. A forthcoming exhibit hall at the Museum has been titled “Such Treasure & Rich Merchandize – Early Plant Heritage of India.”

Just at the entrance of the Discovery Room in the ground floor, on the right hand side along the wall of the Bio Science Room, two framed small size posters adjacent to one another are present; one on “General Zoology” and the other on “Insectivorous Plants.” Exactly on the diagonal opposite corner of this, there is a series of three showcases titled “Forest Research Laboratory.” In the second showcase the first framed small size poster depicts the “Life History of Mosquito.” Walking right onwards, we come across a framed small size poster titled “Earth History.” Here, we shall come across the figure of an insect. Exactly on the diagonal opposite corner of this, we shall come across a box, all sides of which are made up of fibre glass. This box houses the nest of a “Paper Wasp.” Another such nest has been kept in a wooden box provided with a glass top, near the “Forest Research Laboratory” showcases.

**Regional Museum of Natural History, Bhubaneswar**

Visited during December 2008 and January 2009, various galleries and an exhibition corner of the Museum depict the vibrant biodiversity of Chilika, Bhitarkanika, Simlipal, Andaman and Nicobar Islands and North East. The three Galleries are Unique Creation of Nature – Gallery 1, Biodiversity Gallery - Gallery 2, Discovery Centre – Gallery 3. The Exhibition Corner comprise of (1) Body’s Hardware (2) Insect Corner. The corridors on either side of the central dome, also has different kinds of displays along the walls. These corridors lead to a new area where the store and the two rooms consisting of the reserve collection are present. The corridors in the area have displays too, but inside panels (constructed).

Representatives of the class Insecta have found place in all the corners of the Museum, as part of different aspects portrayed and in different forms as well, beginning from the splendid campus of the Regional Museum of Natural
History, from left to right, a rectangular socket in the wall panels representing “Campus Biodiversity.” In this socket are 8 panels, which have been arranged in two tiers and made up of wooden frames provided with glass tops. In these panels, one will find pictures of different portions of the campus and of the diverse life forms available in the campus. Acrylic sheets of the size of the panels have been used to display the “Campus Biodiversity”. Individual pictures are circular or hexagonal in shape, arranged in rows or in clock wise manner and labelled in white. Examples of insects represented in this socket are Tier 2 – from left to right – Panel 1: Row 1 – Blue Tiger, Crimson Rose, Blue Mormon; Row 2 – Evening Brown, Common Crow; Row 3 – Red Pierrot, Glassy Tiger, Striped Tiger; Row 4 – Common Leopard, Peacock pansy; Row 5 – Common Silver Line, Lime butterfly, Tailed Jay. Panel 3: Row 1 – Caterpillar, Indian Skipper, Striped Tiger, Grasshopper; Common Rose caterpillar, Long-horned Katydid, Common Tiger, Grasshopper, Grasshopper; Row 2 - Bumble bee, Caterpillar (Moth), Common Tiger, Common Crow.

The first gallery, i.e., “Unique Creations of Nature” includes a picture of a butterfly in the ‘Introductory Note’, to the gallery. Walking out of the first gallery towards the Exhibition Corner, enlarged and framed photographs were seen along the walls of the corridor of the Museum, put up as part of a photographic exhibition titled “Living Heritage of Temple City”. Organized so as to enhance the basic knowledge about biodiversity, the photographs were of organisms which live in association of mankind, and included that of a Common Emigrant butterfly (sitting on a flower).

In the “Exhibition Corner“, there are two Sections. In the “Body’s Hardware” Section, dry preserved specimens of insect have been displayed in a shelf of a glass showcase supported by wooden frames. On top of this showcase is an ‘Insect Box ‘, that displays miscellaneous orders of insects, all of which are dry preserved. At the “Insect Corner”, one can come across a very interesting display. This consists of a participatory exhibit on hornets and other wasps, displayed in a rectangular glass showcase supported by wooden frames and mounted on a boat shaped steel base provided with wheels. Fascinating facts on different kinds of wasps have been put up in printed form on rectangular acrylic sheets along the steel base of the showcase. Information on the life cycle of wasps has also been displayed on such sheets. Inside the showcase a
A diorama has been created, so there is a painting on the background and in the forefront are the models of hornet wasps. An artificially made hornet nest has been hung from a tree branch, which also has artificial leaves. A LCD (Liquid Crystal Display) monitor is fitted on the background inside the same showcase, on which the visitors might see how the Museum has prepared the display. An original hornet nest is on display, but in another rectangular showcase.

In the “Biodiversity Gallery”, different types of living organisms that are found in the different kinds of ecosystems, for example, wetland, fresh water, marine, forest, etc., have been represented in the form of pictures in separate glass top wooden panels. The two panels where insect picture may be seen are (1) Sal Forest panel – picture of insects found in Sal forest are shown, example, beetle, moth, cluster of moth eggs & excreta of wood borer. (2) Wetland Biodiversity panel – pictures of water strider, water beetle and nymph of dragonfly, that occur in wetlands. (Plate 13.46)

In the “Discovery Centre”, the class Insecta has been very well presented, both through original dry preserved specimens as well as using visual aids. Soon after one enters this gallery, an island showcase in combination with desktop cases, right at the centre of the gallery attracts the attention. This showcase has two main parts (halves). On the upper half, four panels adjacent to one another, forming the four sides of a pillar. One such panel is dedicated to ‘INVERTEBRATES’. Here, one can see the picture of a butterfly. Corresponding to each panel in the lower half are present sloping showcases (adjacent to one another) and below each such showcase there is a column of drawers. In the sloping showcase attached to the INVERTEBRATES panel is displayed a dry preserved butterfly specimen, beside other animals of the group. On the left hand side of the island showcases are two sloping showcases, fitted back to back and supported by box like structure constituted of a column of drawers, display original dry preserved specimens of butterflies and moths. One of the showcases had the following specimens: Row 1 – from left to right – Moth, Common mormon, Lime butterfly, Plain tiger, Common emigrant (Female), Tawny coster, Grass yellow; Row 2 – from left to right – Moths, Common crow, Common mormon, Common emigrant (Male), Common gull, Psyche. In a section of this gallery named the “Amazing Animals Section“, 294
picture of many butterflies are present, for example – The Largest Indian Butterfly i.e. the Southern Bird wing, amongst others.

The reserve collection of the Regional Museum of Natural History in Bhubaneswar includes both wet and dry preserved specimens. Wet preserved specimens include Bee wasp, termite (queen), ants (very shiny black, very red, orange coloured thorax, black with round abdomen, very small red and other unidentified varieties), potter wasp and larvae, aphids, chalcids, Eumenidae specimens, scorpion ant, Diptera larvae and insects, hornet wasp (Vespa affinis) and pupal form, Apis florae, 5th instars larvae of Eri silk worm, aquatic beetle (Gallerucella birmanica) – adult, pupa, cocoon, 3rd, 2nd and 1st instars stages, eggs), besides other insect specimens. Dry preserved insects include Oleander hawk moth, hornet wasp, praying mantid, grasshopper, dragon fly, driller wasp, various butterflies, pupa of Common Rose butterfly, cockroach, Angel Castor parasitoid, Xylocaps sp. 20 species of Lycaenids are present, about 19 species of Skippers and 3 forms of Common Pirate present. 2 species each of Paris Peacock and Sword Tail are present. 2 species of Common Sailor and rare butterfly species also present. For example: Rare species of Orissa, collected from dense forest Collection is done using nets (sweeping and butterfly, types). The killing bottle used for the large insects is prepared in a wide necked bottle (plastic pet jar). On a layer of saw dust, a layer of cork pieces is laid out, followed by a layer of plaster of Paris solution. When the plaster of Paris dries then many holes are made on this layer such that it penetrates down to the end of the bottle so that killing/ narcotizing agent can reach. Then benzene/ paradichlorobenzene, is preferably used for narcotization of insects. Then a layer of cotton is maintained. At last insects to be narcotized (generally large with more chitinous covering) are introduced in to the jar like, butterflies and moths. The killing bottle used for small insect is prepared in a small sized but wide necked bottle. First is a layer of cotton, followed by a layer of blotting paper. Followed by the killing agent, the small insects to be killed are introduced in to this jar like flies, etc. Diethyl ether and chloroform are also used, as the killing reagents.

Before stretching the insects on the thermocol (PUF – polyurethane foam), insect spreading board a drop of benzene is used to treat the collected
specimen. Instead of the usual adjustable insect spreading board, one with a fixed diameter is used here. Insect capsules used for resting the abdomen on it, so that the wings and antennae of butterflies & moths, and the antennae and legs of smaller insects like wasps, etc., might be spread, properly. If insect capsules are not available, medicine capsules are emptied and used to serve the purpose. Here, in the groove of the insect stretching board, a layer of cotton is used to fill the groove to provide protection to the insects to be pinned, against any kind of shock. The cotton is also used to absorb the liquids if any, coming out from the bodies of insects, being pinned on the board. If the cotton sticks to the body of the insects after it has absorbed any liquid oozing out from the body of that insect, thinners might be used to release the body from the cotton. While pinning 1/3rd of the pin should remain on the lower side of the body after penetration while 2/3rd of the pin should remain above. Special insect pins are used for the pinning.

Very small insects, which can hardly be stretched or measured, may be attached to a small paper generally used for making labels. Then a label is made mentioning the place and date of collection.

Drying of insects is carried out inside a dry chamber. It consists of a rectangular wooden box painted white in and out, a 100 watts bulb (fitted inside). In this the specimens are prepared within time limits, which depends on their size and the amount of flesh they have. For example, Dragon fly – within 15 minutes, others with less flesh or small size – (5-30) minutes, Beetles – 2 Days.

Finally, the insects are stored inside insect boxes made out of wood and provided with glass covers, manufactured at a unit of the Museum itself. Benzene, dichlorobenzene, creosote solutions in the ratio 30:40:30, is a mixture used as a preservative inside the insect boxes. Cotton soaked in this mixture is stuffed at the four corners of the insect boxes. Naphthalene balls are used inside pet jars and glass jars preserve the insects, in dry state. The preservation methods help to prevent attacks by mites, ants, lizards, etc.

70% alcohol is considered best to be used as the preservative for the wet preservation of the insects. But using alcohol only preserves the outer surface of the body of insects, the inside of the insects are not penetrated causing the
decay of the insects. So alcohol should be injected into the body of insects, to fix the inner contents of the insects and preserve them completely. If alcohol is not injected into the body of the insects, then the insects have to be dissected and the inner contents of the insect abdomen is cleared out to prevent decay of insects.

Absolute Alcohol (95%-98%) is also used as a dehydrating agent (preservation). Formalin 4% (prepared from formaldehyde solution (37%-41%) w/ v, may also be used as a dehydrating agent, although it can make the insect body rigid. Such preservatives are used to reduce the water quantity of the body of the insects. Until the insects’ body is completely free of water content it still bears the risk of being attacked by fungus & getting decayed. In case of any fungal infestations on the insects collected, such specimens are to be treated with phenol.

In the afternoon of 1st January, 2009, the researcher had an experience in the field, when the museum personnel invited to accompany them for collecting a nest of hornet wasp, i.e., *Vespa affinis*. On reaching the location, a personal garden, the hornet’s nest was seen lying on the ground under a tree. It had broken off from a branch of the tree, and most of the inhabitants were hovering around it. The mosquito net carried along was used to wrap the nest very carefully, so as to prevent breaking it up in to two halves by any chance. To keep the net in place, a rope was used to tie up the entire nest after the wrapping was completed, without exerting any kind of pressure to avoid damage. The nest still contained some live hornet wasps, so the mosquito net was not thought to be sufficient. To protect the museum personnel (handling the nest) from the sting of the wasps, a bed sheet was used to form another wrap around the mosquito net. This was in turn tied up using a rope. Holding the properly covered nest from the end it was attached to the tree, it was carried to the car (used as the transport). Inside the car it was placed horizontally, with two museum personnel supporting its two ends. On reaching the Museum premises, the nest was held in the similar manner and carried to one of the empty panels in the inner corridor of the Museum. It was decided that the nest would be hung vertically in that panel. For this, a wooden rectangular rod was attached on the upper open end of the panel. The bed sheet was removed from the nest, after cutting all the knots of the ropes
binding it. It was seen that a few wasps hovered around the nest. These were to be killed in addition to those still alive and inside the chambers of the nest. So, benzene was brought and cotton pads soaked in this killing reagent were carefully inserted by lifting the net’s open ends. Before introducing the benzene soaked cotton pads into the net, a plastic sheet was wrapped around it. As the benzene evaporated, it was seen that the wasps which moved around got affected and those inside the nest were drawn out and got killed as well. After this the nest was hung (the way it supposedly was hanging from the tree branch), from the wooden rod with the help of ropes. It was photographed from different angles after this final set up. The adult wasps and other stages if any, were supposed to be collected from the nest chambers and around it, later on to be subjected to the usual conservation procedures.

Rajiv Gandhi Regional Museum of Natural History, Sawai Madhopur

Inaugurated in March 2014, the Regional Museum of Natural History in Sawai Madhopur has two main galleries – Biodiversity of Rajasthan and Biodiversity of Western Ghats, besides the painting gallery. This Museum is still in its developmental phase. New sections and galleries on ‘Biomes and Ecosystem,’ ‘Desert Ecology,’ 'Origin of Life;' are being planned.

At present there are no displays pertaining to insects, though an ‘Insect Corner,’ shall come up in the near future, at an appropriate location, in the ‘Biodiversity of Rajasthan,’ Gallery. As of now insect collection of any kind/ size is not present in the Museum. To build up a collection, saplings have been planted in the open areas of the Museum campus. These include medicinal plants, nectar and host plants of insects. Around 650 plants, of 55 species are being grown. Such plantations and gardens are important, as these attract insect(s). The butterflies especially require specific host plants for egg laying, feeding of larval stages, emergence of butterflies from pupae, etc. When the researcher visited the Museum, in November, 2014, she was informed that several butterfly species have already started visiting the plants, which were about to flower. These include Common mormon, Blue pansy, Silver pansy, Peacock pansy, Yellow tip, Orange white, Grass yellow, Lycaenids. A few of
these plants include Guava, Lemon, Bel, Chandni, Ashok, Mango, Amla, Shishum, Gurhal, Anar, etc. (Plates 13.47 and 13.48)

**Science City, Kolkata**
The first adults for a beginning of the butterfly rearing were collected from the campus of the Science City itself. The Science city has assigned seven people, the work of maintaining the ‘Butterfly Nursery’ and the ‘Butterfly Enclave’. On any given day at least six of them should be available with any one of them having on off day on that particular day.

**Butterfly Nursery:**
The plants required as host plants for the propagation of the butterfly rearing, are grown here within the campus of Science City itself. This is possible with the collection of seeds from the fruits of the existing plants. This is done in the area on the backside of the ‘Butterfly Nursery’ and the adjoining areas on the side and the back of the ‘Dynamotion’ building. The sapling of the lime plants and the *Lantana* sp. are bought by the authorities from the large nurseries of the city. Present at any given time or on any given day, the number of plants (hosts/ nectar producing) are usually not recorded. The number of plants stocked (grown) is directly proportional to the number of the corresponding larvae feeding on them. For instance, if 500 larvae of any butterfly species are present, then around 2000-3000 specific host plants are required, to feed the larvae.

The number of eggs and individual larval stages of the particular butterfly species are also not counted. As reported, it is something impossible as is keeping the count of host plants, due to their high vulnerability, which leads to their death in no time in the presence of any kind of unfavourable situation/condition. But, a daily record of the numbers of pupae formed and adult butterflies of the difference species that have emerged are maintained, as in the number of dead. For example, on the second day of visit by the researcher on 03.06.2014, around 25 pupae were obtained, of which 5 were of Tiger, 5 of Tawny coster and likewise. On the third day of visit, i.e., on 06.06.2014, the count of pupae formed was around 25, of which 13 were of Blue Tiger and 8 of Tawny coster butterfly. This was the count at the Butterfly Nursery. The number
of pupae left for emergence in the Butterfly Enclave, were 15 and 10 respectively in two pupa boxes. Out of 15 pupae hanging from crocodile clips one was of emigrant butterfly and the remaining of Tawny coster butterflies. All of the ten in the other (adjacent) box were of Common rose, and kept in holes of the thermocol strips. From pupae to the hatching of butterflies, takes about 6-7 days.

Some times the number of butterflies emerging from the pupae may be as less as 20-30, at times there may be as many as 150 butterflies. 60, 70, 80, upto 100, the number varies but the respective numbers increase with the increase in number of larvae (final stage) and pupae. On an average, 40-50 pupae and/or butterflies are obtained per day, the decrease or increase in number is on account of difference in environmental or any other conditions. Everyday count maintained for the butterflies in the Science City involves collecting information (numbers) under certain heads on a documentation sheet. The production and the death of butterflies of each are recorded in separate sheets. Such sheets are kept assembled in a file.

The breeding cages used are of two types, the size varies. One is smaller than the other, both are rectangular, some have all four sides made of netted front door. The breeding cages are both made at the workshop of the Science City and bought from outside as well, as is the requirement. In all thirty three breeding cages of mixed varieties were seen in the ‘Butterfly Nursery’, but seven out of these, were found empty. The breeding cages have a haphazard arrangement, not present in equal numbers along the opposite sides. The larval feeding plants placed individually in the separate breeding cages are checked every morning, so that replacement with fresh plant specific to the larvae is possible as soon as all leaves of the previously kept plant has been completely fed upon. (Plates 13.49)

Butterflies are under risk from known as well as unknown predators. The known predators include spiders, lizards, rats, ants, etc. The unknown predators are the micro organisms namely virus, bacteria etc. To keep off the known predators, a closed area has been designed to provide with a protected area, free from pollution; recreating real natural environment/ habitat, with the host and the food plants around, also serves the purpose. In the Nursery, the plants
before being used as the food plants, the soil in the pots is treated with
gammaxene powder. This measure helps to keep off ants. Keeping the larval
stages inside caterpillar (rearing) boxes and the pupal stages of the respective
butterflies inside pupa (hatching) boxes, also help to protect them from
predators.

**Butterfly Enclave:**

Being a closed enclave, it was taken care that only shade loving trees are kept
here, so that they are able to survive the prevailing conditions. Besides the
original trees, artificial plants are also present, but in the outer larger room only.
In the large and in the small room as well, are present white hexagonal plates
raised on short white tubular structures. Each such plate has six circular disc
like areas, alternately red and yellow in colour, provided with perforated
surfaces. The ones present inside the small room in turn are placed on a plate,
raised on stands which are anchored in mud, contained in earthen pots. Three
such arrangements were seen inside the small room. The ones (ten of them)
present in the larger room were placed inside plastic containers. A few of these
had solutions of a carbohydrate source (glucose/ sucrose) in water on the
coloured discs for the butterflies, in addition to nectar. On the hexagonal plate
in the large room at its centre was present a slice of banana, as a feed for the
butterflies. At times slices of watermelon, oranges, etc., are also supplied as
the food. Circular plates with only a red circular patch are also used as feeders
and provided with supplementary feed (nectar) for butterflies. Three such plates
were evident in the large room of the Enclave.

The actual source of nectar in the ‘Butterfly Enclave’ was the nectar producing
*Lantana* plants, like the one in the small room. Another is *Ixora* sp. present in
the garden area. Butterfly activities in the ‘Butterfly Enclave’ include mating
which takes place in the small room; eggs are laid on host plants present (kept)
in this room; eggs hatch into the larva in the large room. Further
metamorphosis from 1\textsuperscript{st} instar stage of larva into the formation of pupa through
the next larval stages takes place in the ‘Butterfly Nursery’. This entire process
of metamorphosis, i.e., hatching from egg to formation of pupa takes about 3
weeks, but it varies from species to species. Once the caterpillars are
transformed into pupa, they are removed gently from their respective caterpillar
rearing boxes and placed in pupa boxes. Here they are allowed to develop into
butterflies and hatch. For mud pudding the personnel of ‘Science city’ have provided with mud and sand respectively inside plastic containers, to create areas for the mud pudding activity of butterflies, in both of the rooms of the ‘Butterfly Enclave’. (Plates 13.50)

The pupae are difficult to remove from their particular host plants (in the caterpillar rearing boxes). To ensure their safe handing, the branches where they have formed are cut and then hung with the help of adhesive and crocodile clips in pupa boxes. Besides crocodile clips the pupa boxes are provided with thermocol strips with holes, in which the pupae are placed for hatching. Newly hatched butterflies are kept in their pupa boxes, till they dry and blood is pumped in their wings. At the Science City, the pupa boxes are kept in the Butterfly Enclave itself, more in the smaller room than in the larger one. This is the practice to avoid, transferring butterflies from these boxes to the exhibition area, which might cause damage due to bad handling. Moreover, this practice allows the adult butterflies to directly emerge in the Butterfly Enclave which is in the area of display.

The Butterfly Enclave has small structures on which printed information is provided to the visitors on interesting facts related to the butterflies. On the left hand side of the entrance, to the Enclave two panels are present, providing information alongside pictures on ‘Life cycle of butterfly’ and ‘Butterfly facts’.

**Shri Krishna Science Centre, Patna**

This Science Centre, also under the National Council of Science Museums, surveyed by the researcher in December in the year 2012, has three galleries. These are – Fun Science, Ocean and a gallery on Evolution. It is only in the third gallery that the researcher has found display related to concepts of nature (including insects). At first, there is a display panel discussing how genes of a fruit fly damaged at various points produce odd flies. (Plate 13.51)

From left to right the first panel, the second, third, fifth and eleventh panels have displays related to insects. The panel enclosure on ‘Food Chain’, has square blocks with pictures including that of an Odonate and a beetle. The information board on ‘Food Web’, shows the interrelation and interdependence of one living organism (smaller) to another (higher). Thus, one finds the
pictures of insects at four instances which have been shown to have been eaten by birds (insect eating) at three instances. The panel enclosure on ‘Food Pyramid‘ has a three dimensional model depicting a food pyramid, showing the producers and the different levels of consumers; on all the sides. On two of the sides there are pictures of insects beetles on one side and grasshoppers on another; both at the second level. (Plate 13.52)

An information board on ‘Camouflage‘, mentions insects (as some of them, exhibit this character as well). Like at the Birla Industrial and Technological Museum in Kolkata, the Shri Krishna Science Centre also has a panel titled the – ‘Procession of Life’. Both are exactly the same, the only exception being the languages of the heading and the write up; besides English, Hindi has been used, instead of Bengali.

Almost at the Centre of the hall constituting the Evolution gallery, there are the following panels, linked to insects. The panel on ‘Looking at variation‘, there has a portion on ‘Garden tiger moths‘ informing the visitors that these insects are of one species, still the individual insects vary with different markings on them. On a panel titled ‘How many Species‘, on the right hand side, there is an example discussing and/ explaining the concept showing a butterfly and a caterpillar. A panel on ‘Natural Selection‘, also exists. This is an interactive panel. (Plate 13.53)

**Visvesvaraya Industrial and Technological Museum, Bengaluru**

During her visits in July, 2013 and in November, 2014 to this museum, under the National Council of Science Museums, the researcher found in four floors there are seven permanent exhibition halls, and two special exhibits. The permanent exhibition halls include 1. Engine Hall. 2. Electro Technique. 3. Fun Science. 4. Space – Emerging Technology in the service of mankind. 5. Biotechnological Revolution. 6. BELL – Hall of Electronics. 7. Children’s Science. Out of these, it is only in the ‘Biotechnological Revolution Hall‘ that one gets to see a few panels dedicated to class Insecta directly, or indirectly. As soon as one enters this hall, he/ she found a colourful model of DNA (deoxy ribo nucleic acid), surrounding which there are boards protected with fibre glass, raised on pedestals. Amongst these boards, each with a picture of a
living being and corresponding information on the amount of DNA it shares with human beings, one has been dedicated to fruit flies.

As one move from the left side of the hall, one finds a panel with the heading “Flowering plants and pollinators“. In this panel, visitors will be getting an idea on the different types of living beings acting as pollinators, two of them being insects, bees and butterflies. (Plate 13.54)

When turning to right, the first panel is titled “Human Genome Sequencing“. This panel has a portion titled, “The unity of life“. Here, visitors would be informed about the results obtained on sequencing the genome of certain living beings, one of them being the fly. As one moves forward, one finds a panel with the heading “Medical Applications “. On the top left hand side of this panel is a Section titled, “The Immune System“, divided into three portions. In the first portion, one finds info-graphics on how the human body develops immunity against cuts or bites, for example, from mosquito bites.

As one proceeds through the same side, one comes across a panel, on “Pharmaceuticals and Bio Engineering“. On the top left hand side of this panel, is the picture of a mosquito sucking blood. Moving forward towards the other end of the hall, an exhibit labelled “Zoom the object “, has an interactive kiosk, alongside a panel on the background. On the panel there are two pictures, one showing how a termite appears on magnification and, the other showing how an insect head looks like on being magnified.

On taking the next right turn, one comes across a panel titled “Biodiversity“. At the bottom of this panel, one gets to know about a new concept known as “Seri Biotechnology“. Going forward further, there is a panel on “Medical Advances“. In this panel there is an enclosure (towards the bottom), where original specimens of different types of cocoons (Normal/ Bivoltine/ Univoltine), are on display inside transparent boxes of fibre glass. (Plates 13.55)
Plate 13.1: Lace decorated with green beetle wings at the Albert Hall Museum in Jaipur

Plate 13.2 (left): One of the big nets at the Conservation laboratory, as seen by the researcher, in 2008, to the Butterfly Park, Bannerghatta Biological Park, Bengaluru

Plate 13.3 (right): Only one big net is present, as observed in the Park in 2013, as the breeding chamber for the adult butterflies (Conservation laboratory)

Plate 13.4 (left): Lantana plant in the garden of the Park (at present)

Plate 13.5 (right): This water body on the back side of the Butterfly Park in Bengaluru, is being developed as a zone for the mud puddling activity of the butterflies
Plates 13.6: Insects from different orders on display in the Insect Section, at the Bengal Natural History Museum in Darjeeling (left). Insects in a display case in the basement of the Museum (right)

Plate 13.7 (left): Enlarged models of mosquito and hornet wasp at the Birla Industrial and Technological Museum (Kolkata)

Plate 13.8 (right): The right side of a panel with the general features, habit, habitat, food and feeding habits, diseases transmitted by mosquitoes and the methods of biologically controlling them, at the Museum

Plate 13.9: The number of species of insects displayed on the panel titled ‘Life’s rich tapestry’, at the Museum
Plate 13.10: Storage boxes with insect collections as part of the EIA Studies Projects, at the Bombay Natural History Society in Mumbai

Plate 13.11: Confiscated frame containing butterflies, at the Bombay Natural History Society in Mumbai

Plate 13.12: A box storing the type collection of insects at the Bombay Natural History Society (Mumbai)
Plate 13.13 (left): Blue butterflies, whites and yellow varieties also on display, at the Chhatrapati Shivaji Maharaj Vastu Sangrahalaya in Mumbai

Plate 13.14 (right): One of the drawers housing the reserve collection of the Museum

Plates 13.15: Handling card mounted specimens at the Coleoptera Section, Zoological Survey of India, in Kolkata (on the left). Drying chamber used at the Section (on the right)
Plate 13.16: Wet collections stored in another room of the Coleoptera Section

Plate 13.17: Section on fruit fly at the base of the model of DNA in the Life Science gallery of the Digha Science Centre

Plate 13.18: Rearing cages arranged side by side, at the Insectary, Forest Research Institute (Dehradun)
Plate 13.19: Infested (by insects) wood samples on display at the Entomology Museum, Forest Research Institute in Dehradun

Plates 13.20: A display board with dry pinned insects at the National Forest Insect Reference Collection (NFIRC) in the Entomology Division of Forest Research Institute in Dehradun (left). Rare butterflies in the NFIRC, Dehradun (right)

Plate 13.21: H. A. Gass, the founder of the Gass Forest Museum in Coimbatore, the plaque below states that the museum displays a major portion of his collection
Plate 13.22 (left): Ten showcases displaying mainly insects of the Order Coleoptera, at the Museum in Coimbatore

Plate 13.23 (right): Specimens belonging to the Order Lepidoptera displayed in cases along the wall in two tiers, at the Gass Forest Museum

Plate 13.24 (top): Nests of insects on display at the Government Museum in Chennai

Plate 13.25 (bottom): Aquatic insects on display at the Government Museum
Plate 13.26: Insect specimens belonging to the Order Diptera stored in drawers of an almirah in the room housing the reserve collection of the Government Museum in Chennai

Plate 13.27 (top): The entrance to the Government Museum in Udaipur

Plate 13.28 (bottom): The entry gate of the Government Museum in Chittor
Plate 13.29 (left): Evolutionary Tree of Insects, as displayed earlier in the Insect Gallery of the Indian Museum

Plate 13.30 (right): Friendly insects on display, at the Museum

Plate 13.31: A jar containing some of the type specimens of the collection in the Isoptera Section of the Zoological Survey of India in Kolkata (above)

Plates 13.32: The jars with different types of caps (metallic – left, plastic – centre and glass – right) housing the collection of the Isoptera Section (below)
Plate 13.33: A panel depicting a beetle (picture) in the ‘Information Evolution’ gallery of the National Science Centre (New Delhi)

Plate 13.34 (left): The exhibit titled ‘living tree’ in the Nature’s Network Gallery of the National Museum of Natural History in New Delhi

Plate 13.35 (right): View of the insect box with specimens obtained as gift by the Museum

Plate 13.36: Picture showing the mud puddling activity of the butterflies in the panel titled – ‘Nature’, at the Nehru Science Centre in Mumbai
Plates 13.37: The information board (left) and the insect and related objects (right), on ‘Insect Engineering’, displayed at the Insectarium (Nehru Zoological Park, Hyderabad)

Plates 13.38: Dry preserved butterflies and moths exhibited in a showcase, also at the Insectarium
Plates 13.39: The entrance of the Natural History Museum in Jaipur (above), inside the Jaipur Zoo (below)

Plate 13.40: New kind of storage boxes with completely removable glass tops, seen at the Orthoptera Section, Zoological Survey of India, Kolkata

Plate 13.41: The showcase on the left hand side of the entrance of the Zoological Gallery at the Patna Museum, (Patna), displaying butterflies
Plates 13.42: Panels at the Butterfly Museum, Ramoji Film City in Hyderabad

Plates 13.43: Green net enclosure for the butterflies adjacent to the Butterfly Museum in the Ramoji Film City (left). An instruction board for the visitors inside the enclosure
Plate 13.44 (left): An insect collection box, from the reserve collection, at the Regional Museum of Natural History in Mysore

Plate 13.45 (right): Insect pictures accompanied with a board written ‘Insects’ on it, from a panel in the Biodiversity Gallery of the Museum

Plate 13.46: Pictures of insects from the habitat case on Sal Forest, at the Regional Museum of Natural History, Bhubaneswar

Plate 13.47: Building of the Rajiv Gandhi Regional Museum of Natural History in Sawai Madhopur
Plates 13.48: The entrances to the galleries on the – ‘Biodiversity of Western Ghats’ (above) and ‘Biodiversity of Rajasthan’ (below), on two opposite sides of the entrance hall at the Museum in Sawai Madhopur

Plates 13.49: The Butterfly Nursery at the Science City, Kolkata (on the left). A view of the Butterfly Nursery from the entrance, showing breeding cages arranged on either side (on the right)
Plates 13.50: Above - The ‘Butterfly Enclave’ at the Science City in Kolkata (above left). Blue tiger butterfly sucking nectar, on a lantana plant inside the smaller room of the Enclave (above right). Beside plates for providing food, sand in a plastic container for mud puddling activity of butterflies, in the larger room of the Enclave (below)

Plate 13.51: This panel, at the Shri Krishna Science Centre in Patna, depicts the production of odd flies with the variations in different points of a gene
Plate 13.52 (left): Labelled diagram of beetles on one side of the ‘food pyramid’ in the enclosure with the same title, at the Science Centre in Patna

Plate 13.53 (right): A portion of the panel on ‘How many species’, depicting insects, at the Shri Krishna Science Centre

Plates 13.54: Portions of the panel on ‘Flowering plants and pollinators’, with information on bee pollinated flowers (left), and butterfly pollinated flowers (right), at the Visvesvaraya Industrial and Technological Museum, Bengaluru

Plates 13.55: The panel on ‘Seri Biotechnology,’ at the Museum (on the left). Specimens of different types of cocoons at the Museum (on the right)