

## **CFL-Sanctuary Insect Study**

Over the past 6 years, many of the groups at the Centre for Learning have spent varying periods at the Gurukula Botanical Sanctuary. One intent of these stays has been to engage in a learning that is ensconced in direct and careful observation in the natural world, that provides a space for all senses to come alive, that invites both surprise and wonder. Amongst the themes that have come into focus over the course of these explorations are:

*the place of learning through living contact with nature;*  
*sharing one's observations, both orally and in writing;*  
*learning to work in a group as well as by oneself;*  
*enhancing a sense of well-being through vigorous exercise and yoga;*  
*sharing of hesitations and concerns as they arise.*

As part of the ongoing interaction between the Sanctuary and CFL, two groups spent time at the Sanctuary in 1997-98. The first group was the Ketakis (Bhargav, Siddharth, Narayan, Steven and Gregory). They delved into the Ant world and have documented their observations and questions in "Ant Watching: A GBS-CFL Nature Study Project".

The Palashas (Akshay, Anand, Priyanka, Anna, Abhishek, Rohit, Grishma, Ashish and Ayesha) were at the Sanctuary for six weeks in early 1998. They too have told the story of their stay and of their bird study project (guided by Alan Morley) in "Bird life at the Gururkula Botanical Sanctuary".

Students from CFL continue to frequent the Sanctuary, both on their own as well as part of the continuing Sanctuary-CFL "School in the Forest" program.

In 1998, our 14 and 15 year olds (Ketakis and Parijatas) spent two weeks each at the Sanctuary in October and November.

This report is an account of the 1998 Ketaki-Parijata "Insect project". While the Parijatas (Lakshmi, Bhamati, Rahul, Leon, Angela, Sahadev, Tanushree, Sneha) recorded their observations of insects in individual reports, the Ketakis (Namesh, Nikhil RN, Lavanya, Vinod, Nikhil F, Vijay) compiled their written and pictorial observations in a large Insect map. Portions of the map are reproduced here.

## **A closer look at Insects**

The Parijatas and Ketakis, explored the Insect World at the Sanctuary. The process of study for both groups was similar. It included observation sessions as well as frequent discussion meetings. During the meetings, we developed an understanding of classificatory systems, under Supi's enthusiastic and careful guidance. We also shared our observations and planned subsequent phases in the Insect Project. The description of meetings that follows is drawn from the Parijata stay. A collectively written piece on the Ketaki Insect project is also part of this report.

### **The Insect Project: October-November, 1998**

#### *What is an insect?*

Thanks to the rain, the first week's meetings took place in the warmth of the kitchen, or when it was less damp, on the back porch. We began by listing the creatures we considered to be Insects. Along with ants, flies, mosquitoes and grasshoppers, crabs, millipedes, centipedes and leeches also joined the list. We surveyed the list and cancelled the creatures we thought may not be insects (still unsure about why). Then we pondered over the question of what it is that defines an insect.

Here again, we generated a list which included physical and other characteristics:

**six to eight legs**  
**some have wings**  
**mostly two eyes**  
**some change shape**  
**can go anywhere**  
**most bodies divided into 3 parts**  
**have antennae**  
**hard bodies**  
**jointed legs**  
**the ability to occupy many different kinds of places,**  
**the tendency to be abundant**

The rain abated. We set out on a collective insect search, combing a small area carefully and stopping to closely observe insects that any of us encountered. We didn't have to move very far to come across a plethora of insects. Having observed insects together for a while, we set out individually-- observing and drawing as clearly as possible, the insects we saw.

While sharing our descriptions verbally, we found that even lengthy depictions may not convey a clear picture of the insect to a listener. We discovered the need to both clarify an "observational" definition of an insect as well as to draw up a common scheme for describing observed insect characteristics.

From our own observations, we came up with the following observational description of an insect:

**\*All insects have six legs (thus spiders, mites and worms, which were part of our initial exhaustive listing are excluded).**

**\*Most insects have wings at some point during their life cycle.**

**\*Insects have a fairly rigid exoskeleton.**

**\*Adult insect bodies are divided into three parts--  
head, thorax and abdomen.**

**\*Insects have some form of antennae.**

**\*The young form may be different from the adult.**

The **descriptive scheme** we devised for recording observations included details of the:

**1. Entire insect**

Size (in cm.)

Shape (overall--long, triangular, round...)

Colour (most prominent colours)

**2. Body parts**

Head-- size, shape, colour

    Additionally: antennae- length, other characteristics

        eyes- shape, size, colour

        mouth parts

Thorax-- shape

    legs-- how many parts, other details

    wings-- shape, colour, venation

Abdomen-- shape, size colour

**3. Habitat** where the insect was seen

**4. Behaviour**

This meeting was followed by further scouting for insects. We wandered individually, observing and drawing insects we met. Several large drawings were made.

The following day we had an "insect drawing" session, in which people took turns to draw perceived versions of various insects. The insects that featured were: mosquito, butterfly, cockroach, ant and beetle.

The main characteristics of each insect as derived from the drawings were:

**Flies** (which include mosquitoes)--

1 pair of wings. A second pair may be present in a reduced form.  
Poking or piercing mouth parts; Bodies usually plump.

**Beetles--**

hard thorax which resembles an armour plate,  
wings cover abdomen completely,  
wings don't overlap,  
biting mouth parts

**Cockroaches--**

thorax covers head, leathery wings on top of abdomen, membranous wings underneath, body shape is flat, long antennae

**Butterflies--**

2 pairs of wings with tiny scales, mouth part consists of a proboscis

**Ants, wasps, bees--**

have a distinct waist or petiole between the thorax and abdomen

We then set out to find each of these insects and draw them from actual observation.

## **Taxonomy**

A few classes on Taxonomy ensued. Again, the starting question addressed our own current notions:

How would we group creatures together, if we were asked to do so?

Lakshmi suggested "sea creatures" as a classificatory group, then saw that this group would include a variety of organisms. It appeared that habitat needn't be a significant criterion for classification. It emerged that physical similarity is a key factor in the prevalent classificatory scheme. As one moves from larger to smaller groups in the classificatory tree, members of groups are increasingly similar in terms of their physical features.

We considered the main Kingdoms in the classification of life forms. These Kingdoms are:

Plant, Animal, Bacteria, Fungi, Protozoans

We further scrutinized the Animal Kingdom and the Subphylum Arthropoda.

Phyla: Invertebrates (Arthropods, Molluscs, Annelids, Platyhelminthes)  
Vertebrates ( Fish, Mammals, Reptiles, Amphibians, Birds)

<b>Arthropods</b>				
Class: Insects	Arachnids	Crustaceans	Centipedes	Millipedes
	ticks	crabs		
	mites			
	daddy long legs			

Orders:

Diptera-- flies

Lepidoptera-- butterflies, moths

Hymenoptera-- ants, wasps, bees

Odonata-- dragonflies

Coleoptera-- beetles

Blattodea-- cockroaches

Mantodea-- mantis

Hemiptera-- bugs

Orthoptera-- grasshoppers

Another session on Taxonomy occurred. This time we traced the groups that dogs and cats belong to, starting from the "bottom" of the classificatory tree at the "Species" level and working our way to the "top" or the "Kingdom" level.

We found that dogs, wolves, coyotes, foxes and jackals are various species of the Family Canidae while lions, tigers, panthers and cats belong to the Family Felidae. Both of these families belong to the Carnivorous Order of the Class Mammalia. Mammals belong to the Subphylum Vertebrata which in turn is part of the Phylum Vertebrata. Vertebrates are members of the Animal Kingdom. This exercise, of tracing the place of familiar animals in a classificatory scheme gave us a better feel what Phyla, Classes, Orders, Families, Genera and Species are.

Observation and discussion sessions also occurred to look at food and feeding and movement in the Insect world.

Amongst the points that emerged were:

### **About movement**

The six legs of insects move in "tripod " formation. Three legs are always on the ground and this provides stability.

Important aspects of movement include speed, agility and balance.

The structures associated with movement include  
*insect legs*-- these are used to grip, jump, dig and swim;

*insect wings*-- sleek wings enhance speed (such as in dragonflies) wings used for flight are generally soft with veins that provide blood which strengthens the wing;  
*thorax*-- fast insects have more powerful thoraxes.

### **About food and feeding**

Students were asked to focus on the following points while observing the feeding habits of a wide range of insects:

*\*What do insects eat?*

*\*How do they eat?*

*\*What do the mouth parts look like?*

The reported observations consisted mainly of types of food consumed by seven different kinds of insects.

<b>Insect</b>	<b>Food</b>
mantis	juice from flower
fly	dung/dung juice
buterfly	nectar
caterpillar	leaves
ants	dead insects, caterpillar, rice grains (this material was being carried by ants, not eaten)
bees	nectar
cricket	leaf

The discussion on food and feeding addressed the assumptions we make while describing behaviour. There is a tendency to interpret behaviour in terms that may not reflect factual situations. The following expressions reflect our own notions of a situation:

"(insect's) stomach was full",

"insects were 'looking' for food",

insects wanted to/didn't want to share food.

We realised the need to describe what we see as directly as possible, without including our own ideas of what we think a creature may be doing.

### **Insect vision**

Richard facilitated a session on vision in insects. He described the structure and function of "ommatida"-- visual sensory organs in insects.

### **Further Insect Observations**

Each student adopted one of eight orders and spent a good deal of time on subsequent days observing insects of their chosen order and describing their features and behaviour.

During the second week of their stay, the Parijatas made insect models, using natural materials. This was a demanding process. The intent was to observe further features of body parts-- such as how they articulate with one another, while assembling large three dimensional insects.

**The Ketakis described the process of their Insect Study in the following collectively composed piece:**

In November '98, we the Ketakis, studied insects in Wynad. We started out by trying to figure out what insects are by listing all creatures we thought were insects. Then we discussed the characteristics of insects and disqualified some of them. The original list included: flies, crabs, spiders, bugs, cockroaches, lizards, beetles, ants, bees, fleas and so on.

We agreed upon the following features that define an insect. These are: six jointed legs, a segmented body in three parts (head, thorax and abdomen), two pairs of wings, compound eyes, exoskeleton (whose hardness varie between the insects), antennae, generally small sized bodies, egg laying, young ones deifferent from adults. After making this list we eliminated crabs, lizards, spiders, ticks, earthworms, centipedes and daddy long legs!

We went out in the Sanctuary and looked at the various insects and gave a brief description of them. We also drew pictures. We realised that our descriptions were not detailed enough. So we agreed upon a scheme which we used each time we wanted to describe an insect. The scheme included:

1. Size (in cm.)
2. Colour and design
3. Overall shape
4. Shape and size of each body part
5. Habitat
6. Behaviour

During the next two days we used the scheme and did several detailed drawings and descriptions of the many insects we saw. We then had a class in which we realised that though we had never studied insects before, we had fairly dclear ideas about different groups of insects. We were able to draw quite accurate pictures of some of the main groups.

Every body knew the structures of dragonflies, ants, waps, grasshoppers, flies, butterflies and beetles. We then talked about the classification of insects ( look at the tree of life given in a separate box). We found our that our groups roughly agreed with the different "orders" used in classification. We each chose an order and discussed the main features of each order.

We spent three days looking for examples of our orders. Some of our orders were easy to find and some of our orders were difficult. Beetles and bugs were the hardest to find. Grasshoppers, ants and flies were usually always around. Damsel flies and butterflies came out with the sun. For the following three days, our project change. We went out looking for all insects and especially noting exceptions to the eight orders, behaviour, habitat and diversity.

In this chart we have shown various habitats ( a place or environment with certain features that make it unique-- rocky, shady, damp, swampy, wooded, dense, grassy, dry, with or without vegetation--usually includes certain goup of organisms), insects that live in these habitats, our respective orders and a few behavioural details.