CHAPTER 3

COLEOPTERA OF GIR PA: A STUDY ON ITS SYSTEMATICS AND DISTRIBUTION THROUGH SPACE AND TIME

INTRODUCTION

We live in the "Age of Beetles", claims The Coleopterist Society. Beetles are a particularly successful group of organisms. There are six or seven described beetle species for every one of vertebrates! Even so, the beetle species already named represent only the tip of an iceberg (Harde, 1998). The order coleoptera to which the entire beetles belong was first time used by Aristotle in the fourth century B.C. If Insects account for more than three fourth of all forms of life on earth, just one of the 29 insect orders, the Coleoptera, includes more species than all other life put together, and makes up about 40% of all insects (Chadwik, 1998).

Information about beetles is known from the Permian period to the present (Arnol' di *et al.*, 1992), a recorded history of some 250 million years. This history shows that two major faunal changes took place, the first in the mid Jurassic period when primitive lineages of beetles lost their dominance, and the second in the mid Cretaceous period at which time modern forms acquired dominance over all other terrestrial arthropods.

The oldest fossils of beetles known to us from the Permian period are thus around 250 million years old (Arnol' di *et al.*, 1992). But at that time towards the end of Paleozoic era, there were not yet many species of Coleoptera. In the course of their evolutionary history beetles have become adapted to the most diverse ecosystems. As terrestrial animals breathing atmospheric air they occupy a multitude of ecological niches on dry land (Harde, 1998). They are predominantly terrestrial insects; however, some groups are secondarily aquatic. Except for the open sea, they have colonized all possible habitats on earth. Beetles participate in virtually all aspects of ecosystem processes; they are predators, herbivores, folivores, detritivores, scavengers, fungivores, wood eaters and grazers. They tunnel and mine and are able to chew nearly every substrate. Some are ectoparasites, others are nest parasites, and some others are even found living in the fur of vertebrates. Beetles,

like other insects play a role as food for amphibians, reptiles, fish, birds and mammals. There are some beetles that play important role in environment as pollinators. A fairly large number of beetle species may be classified as pests. However, their depredations are frequently on a relatively minor scale. Besides all this many of them are predators. Beetles have provided invaluable information in the control of damaging insects and invading weeds. They continue to be major pollinators whereas some are notorious munchers of crops, stored grains or timber. Because they are hyperdiverse group on planet, offer direct insights into total biodiversity and evolution of that biodiversity as well as how this diversity is distributed in time and space across microenvironments, habitats, biomes and seasons (Erwin, 1982).

Against the estimated 179 families of Coleoptera known from the world, about 103 families are recorded from India. Approximately the total described species of Coleoptera in the world is 3,50,000 of which less than 10% are known from India. The national Zoological survey of India has information regarding eighty six families covering about eight thousand species, collected from different localities of India and adjacent countries.

Our knowledge of the Indian coleoptera at present is far from complete. Leaving aside the case of little known groups, new taxa of specific or generic level is constantly being discovered (Z.S.I., 1991). India being situated in the tropics is well known for her richness of coleopteran fauna. The dense and evergreen forests of northeast India and Nilgiri hills as also the Vindhyachal and Satpura ranges provide enormous variety of habitats and innumerable variety of beetles. They are predominant insects of present epoch and their adaptability and the structural modifications are the main cause of their dominance in the animal world. There is no other order of insects, which can invade the land, air and water in about equal degree (Sengupta and Pal, 1998).

Our knowledge of Indian Coleoptera in general is still based on Junk's coleopteran catalogue (1910 – 1940) and "Fauna of British India" volumes (1906, 1939). Junk's coleopterans catalogue has included 133 families, and Crowson (1955) has included 157 families. In order Coleoptera there are eight major families that have more than 10,000 known species in each one of them. These are Carabidae (18,259), Buprestidae (11,391), Tenebrionidae (14,6411), Cerambycidae (18,937) and Curculionidae (34,500) (Z.S.I; 1991). In India, beetle fauna of above families are

abundant and extremely diverse. One of the reasons for their diversity is their habitat selection, which makes them successful in every type of environments suitable for their existence. Apart from the naturalists who collected the specimens from India during the early nineties and whose work has laid foundation of our knowledge of the common species of coleoptera, very few attempts have been made to study this group in recent days (Lefroy, 1909; Stebbing, 1914 and Beeson, 1941). In Gujarat no special attempts have been made to study coleopteran fauna of any particular region but few bioinventory studies like Sardar Sarovar environs, (Sabnis and Amin, 1992), Gujarat Biodiversity (Pilo, 1996), Avifauna of Shoolpaneshwar Sanctury (Desai, 1996), have enlisted coleopterans during their studies.

During the present study species belonging to different families were collected/photo documented and identified using the standard published reference material by Lefroy (1909), Gahan (1906), Fowler (1912), Stebbing (1914), Maulik (1919), Dover and Ribiero (1923), Subrmanyam (1925), Blair (1930), Arrow (1931), Mehta (1932), Cameron (1933), Beeson and Bhatia (1937), Marshall (1938), Beeson (1941).

OBSERVATIONS

SYSTEMATICS AND MORPHOMETRY

Order Coleoptera is classified into four suborders *viz.*, archostemata, myxophaga, adephaga and polyphaga. In India three of these sub orders are recorded by Zoological Survey of India, of which members of two suborders polyphaga and adephaga are described and identified. During present study representatives of both these two sub orders are recorded. In all 114 species of beetles and weevils were observed. Photographs of a few representative species are given at the end of this chapter (Figures 3.1 – 3.51). However, all of them were measured for its total length and width as described elsewhere, and represented in the form of an annotated list as follows:

SUBORDER: ADEPHAGA

FAMILY: CICINDELIDAE

They are predacious and feed on variety of small insects which they capture with their long sickle like mandibles. Tiger beetles as their name suggests are purely predators however, they do not play a major part among the predators controlling forest insect pest. Two species from this family are recorded, only one species has been identified and one species is unidentified.

Cicindela cardoni

Description: Brown beetle with yellow marking. Long slender legs. Head broader than pronotum, eyes big. Antennae thread like.

Habitat: Terrestrial- predatory beetle

Length- Width: 2.0 cm- 0.7 cm

Observation: Rarely sighted species of beetle at study area.

FAMILY: CARABIDAE

Ground beetles are to be found everywhere from sea level up to as high a point as the base camp of the Mount Everest expedition at 16,500 ft. They live in almost every kind of habitat, under stones and logs and loose bark of trees, in soil and soil litter, on foliage, in termite's and ant's nest at the edges of ponds, rivers, in caves and in the desert. There are two monographs in fauna of British India series and a complete catalogue of the species of Indian region all by Andrews (1935,1930,1929,1928) and all are dedicated to carabids.

The majority of species of carabidae are carnivores and predators mainly on other insects, arthropods and worms and snails but some forms are herbivorous. They are rarely specific in their choice of food except when the preferred diet is abundant, in times of scarcity. The economic importance of carabids as a natural check on the population of the defoliating and soil living insects are considerable and they form very desirable elements in the predatory association of a pest.

In Gir this family was observed and collected from almost all study sites of Gir PA. Seasonal variation was very less. Throughout study period they showed their presence. The study area harbors a total of eleven different species.

Anthia sexguttata:

Description: A large wingless beetle, black with six big round white spots on elytra.

Habitat: Terrestrial. Flightless beetle can be seen running on ground. More common in arid and desert regions. This insect ejaculates glandular fluid when trapped which serves as a means both as protection and as offense. It was experienced during collection of this beetle at study site. This discharge causes irritation in eye and face. Generally observed after first showers of rain. This is the single representative

of Genus *Anthia* in India. Which occurs in the plains and uplands plateau and particularly in the more arid or desert regions.
Length- Width: 5.2 cm-2.2 cm
Observation: Common in all the three study sites from monsoon to winter.

Brachinus reyi
Description: Small beetle, elongated and slender. Antennae, appendages, pronotum and head yellow coloured. Elytra brown with yellow spots, three on each elytron. Antennae filiform.
Habitat: Terrestrial- Nocturnal.
Length –Width: 1.9 cm-1.4 cm
Observation: Commonly found in Gir P.A.

Chlaenius nepalensii (Hope)
Description: Black long beetle, elytra with yellow marking. One yellow band on each elytron. Antennae filliform.
Habitat: Terrestrial – mainly on ground, under stones or rocks.
Length –Width: 2.8 cm-1.8 cm
Observation: Common throughout at all the sites of the study area.

Chlaenius quadricolor
Description: Elongated slender beetles with metallic green and pink pronotum and head, appendages, antennae yellow and filiform. Elytra black with metallic green shine and smooth ridges.
Habitat: Terrestrial – Mainly on ground, under stones or rocks.
Length –Width: 2.5 cm- 0.7 cm
Observation: Commonly found at site-1 and site-2, but was not to be found at site-3.

Chalenius nilgiriensis
Description: Black elongated beetle with metallic copper pronotum. Each elytron with yellow spot. Appendages and antennae yellow coloured. Antennae filiform.
Habitat: Terrestrial – mainly on ground, under stones or rocks.
Length –Width: 2.4 cm – 0.7 cm
Observation: Commonly found at site-1, site-2 but was not recorded at site-3.

Omphra rafies (Klug)

Description: Elongated slender body, pronotum cup shaped, visible mandibles. Head not broad as pronotum. Antennae filiform.

Habitat: Terrestrial- mostly found on ground – Predatory

Length –Width: 2.7 cm – 0.9 cm

Observation: It was encountered only at site-1 and site-2.

Calosoma maderae:

Description: Black ground beetle with regular punctures on elytra. Antennae filiform.

Habitat: Terrestrial. Found on ground as well as on bark. Predatory, both larvae and adult are active hunter.

Length – Width: 3.2 cm. – 2.1 cm.

Observation: Found commonly at all the sites of the study area.

Scarites eurytus:

Description: Long slender beetle, pronotum not broader than head, shiny black in colour, elytra with regular punctures and ridges. Antennae filliform.

Habitat: Terrestrial – commonly found under bark, stones.

Length –Width: 1.7 cm – 0.5 cm

Observation: Commonly sighted at all the study sites.

Scarites indicus

Description: Black beetle, long and with strong visible mandibles, which are visible. Prothorax bigger than head. Antennae filiform.

Habitat: Terrestrial- observed under stones, leaf litter and bark.

Length –Width: 1.9 cm – 0.5 cm

Observation: Common beetle at all the sites of the study area.

Scarites bengalensis Dej:

Description: Elongate, black, with stout prominent mandibles, prothorax broader than head. Antennae filliform.

Habitat: Terrestrial - found on barks. The beetle is predaceous upon the woodborer.

Length- Width: 1.46 cm – 0.4.

Observation: Was common at all the sites of the study area in all the seasons.

Lesticus desgodinsi

Description: Elongated black beetle, mandibles obvious, pronotum as broad as abdomen, antennae filiform.

Habitat: Terrestrial – Found on ground

Length –Width: 1.3 cm-o.5 cm

Observation: Was to be found all over study area.

FAMILY: DYSTISCIDAE

Dystiscids are aquatic beetles. Larvae as well as adult are predaceous. Help in controlling noxious aquatic species, the most important being mosquito larvae. Three different species are identified from the study area during the studies from this family.

Hydraticus vittatus

Description: Oval black brown beetle, antennae filliform.

Habitat: Aquatic-Near water points

Length –Width: 3.5 cm – 2 cm

Observation: Found near water bodies of study site and common during monsoon.

Cybister confuses (Sharp)

Description: Large black water beetle with the lateral brown stripes, antennae filiform.

Habitat: Aquatic- found near water points, ditches etc.

Length – Width: 3.6 cm – 0.7 cm

Observation: The most noticeable observation was that this species was not found at site 2 in both the years of the study period. But was reported from site 1 and 3.

Cybister tripunctatus (Sharp)

Description: Elongated oval beetle. Brown coloured lateral side and tip of head creamish in colour. Antennae filliform.

Habitat: Aquatic

Length- Width: 3.7 cm- 0.8 cm

Observation: Common at permanent water bodies, rivulets, and ditches from the sites of the study area.

SUBORDER: POLYPHAGA:

FAMILY: HYDROPHILIDAE:

Hydrophilids are commonly known as "water scavenger" beetles. Adults are phytophagous or saprophagous and larvae are predaceous. Members of this family are of minor importance in the forest biome. Two species from this family are recorded.

Stenolophus rufipes

Description: Elongated oval, shiny, smooth, black beetle. Antennae short and clubbed with fine pubescence at apical end.

Habitat: Semi aquatic- found in the vicinity of water

Length –Width: 1.0 cm – 0.4 cm.

Observation: Common from entire study area in the surroundings of water bodies and wherever there was enough moisture and humidity available.

Hydrophilus olivaceus (Fabr.)

Description: Dull black coloured insect, oval in shape. Head, prothorax and abdomen fit together. Antennae short and clubbed.

Habitat: Aquatic

Length–Width: 1.4 cm- 0.5 cm

Observation: Common water beetle found at all the sites of the study area wherever there is little water available.

FAMILY: STAPHYLINIDAE

These beetles are commonly known as "Rove beetles". They are active insects. These beetles occur in variety of habitats, but are probably most often seen about in decaying materials, particularly dung or carrion. They also occur under stones and other objects on the ground, along streams, in leaf litter and in fungi, in nests of ants, termites, birds and mammals. Many species appear to be predaceous. The larvae usually occur in the same places and feed on the same things as the adults. A few are parasites of other insects. Termitophilous, myrmecophilous, prey including larvae

and pupae of diptera, other coleoptera, spiders and mites. Staphylinidae is one of the common families of beetle found in Gir PA through out the year.

Staphylinus spp.

Description: Elongated slender body, five abdominal segments visible, black beetle with dull black elytra, filiform antennae.

Habitat: Terrestrial – Found near humid habitat

Length –Width: 2.5 cm – 0.3 cm

Observation: It was not encountered from site-2 during the study.

FAMILY: SCARABAEIDAE

The scrabs vary considerably in habitat. Many are dung feeders or feed on decomposing plant materials, carrion etc. Some live in the nests or burrows of vertebrates or in the nests of ants or termites. A few feed on fungi. Many feed on plant materials such as grasses, foliage, fruits and flowers. The larvae (grub) develop in soil, where they live on roots, or are found in dung and other decaying organic matter. Few Scrab beetles are unisexual, the male differ from the female by having cephalic horn (e.g. Heliocopris, Liatongus, Copris, Cthersius). This is the most interesting group of beetles studied worldwide and is of great ecological Importance. They help in recycling the nutrients but some are harmful as they feed on roots. Traditionally, dung beetles have been divided into the dweller, roller, and burrower guilds (Halffter and Matthew 1966). Dwellers live within a dung pat, and therefore do not bury seed. Rollers constructs ball from the dung and roll them away, usually no more than 5 m from the source. The dung balls are then buried in shallow nests. Burrowers make burrows directly below a pat, and pull dung from pat into the burrow. These beetles are often large and bury a considerable amount of dung seeds.

In Gir PA this family is very common, members of this family shows the highest diversity in order coleoptera. All the study sites show their presence in almost all the season. However, numerical change is noticed according to season.

Catharsius molossus Linnaeus

Description: Broadly oval and robust, black coloured pronotum with two-pointed spine like elevations at the anterior edge. Antennae lamellate.

Habitat: Terrestrial – found on or nearby dung of ungulates and cattle.
Length-Width: 3.3 cm – 2 cm
Observation: Very common dung beetle of Gir, more dominant during monsoon.

Heliocopris gigas Linnaeus
Description: Broadly oval beetle with pronotum and head dark brown and punctated elytra with smooth lining and lighter in colour than pronotum and head. Lateral margin of body on ventral side having pubescens. Antennae lamellate.
Habitat: Terrestrial – found near dung.
Length- width: 3.1 cm – 1.8 cm
Observation: Very common beetle of study area.

Gymnopleurus cyaneus
Description: Black blue broad oval beetle. Antennae lamellate
Habitat: Terrestrial. Observed rolling dung ball
Length - Width: 2.1 cm –1.3 cm
Observation: Common dung roller of Gir PA.

Gymnopleurus miliaris Fabricius
Description: Black medium sized beetle. Dull black with shiny black spots on pronotum and elytra. Antennae lamellate.
Habitat: Terrestrial- dung roller
Length - Width: 1.1 cm – 0.6 cm
Observation: Commonly found during monsoon always in pair rolling dung ball.

Gymnopleurus koenigi
Description: Broadly oval black beetle, elytra with prominent ridges, pronotum smooth. Antennae lamellate
Habitat: Terrestrial – dung roller
Length - Width: 0.9 cm – 0.5 cm
Observation: Found throughout the study area.

Copris numa Gillet
Description: Body shape broadly oval, antennae lamellate. Abdomen shiny black, pronotum black and has one spine like elevation. Pronotum as broad as abdomen.

Legs digging type.
Habitat: Terrestrial- found near dung
Length - Width: 2.0 cm – 1.1 cm
Observation: Was a very common beetle and was found at all the sites of the study area.

Onthophagus catta Fabricius
Description: Broadly oval beetle with metallic copper pronotum, antennae lamellate
Habitat: Terrestrial
Length - Width: 1.1 cm –0.6 cm
Observation: This species was found at all the sites of the study area and also showed seasonal variation.

Onthophagus tragus
Description: Body shape broadly oval, small in size. Pronotum with spine like elevation on the anterior edge. Pygidium not covered with elytra. Antennae lamellate.
Habitat: Terrestrial
Length - Width: 0.7 cm – 0.4 cm
Observation: Present at all the sites of the study area.

Onthophagus rana Arrow
Description: Broadly oval beetle with metallic dark green elytra with smooth lining. Two minor elevation (spur like) on the anterior edge of pronotum. Antennae lamellate.
Habitat: Terrestrial
Length- Width: 1.0 cm – 0.6 cm
Observation: This species was not found to be present at site 3 all throughout the study period.

Onthophagus falusus Gillet
Description: Typical black oval dung beetle. Antennae lamellate
Habitat: Terrestrial- found in vicinity of dung.
Length -Width: 1 cm- 0.5 cm
Observation: Commonly found at all three sites of the study area.

Onthophagus pactolus Fabricius
Description: Broadly oval, black in colour. Antennae lamellate
Habitat: Terrestrial.
Length - Width: 1 cm – 0.5 cm
Observation: Recorded from all the three study sites.

Onthophagus atropolitus Arrow
Description: Very small oval black beetle. Antennae lamellate
Habitat: Terrestrial
Length - Width: 0.6 cm – 0.3 cm
Observation: Present at all the three sites of the study area.

Bolbocerus quadridens
Description: Oval Black brown, pronotum darker than abdomen. Antennae lamellate.
Habitat: Terrestrial. Nocturnal insect. Is common on dung during monsoon.
Length - Width: 1.5 cm –o.5 cm
Observation: Sited throughout study area.

Caccobius himalayanus jekel
Description: Very small beetle broadly oval in shape. Pronotum as broad as abdomen and black in colour, elytra dark brown. Antennae lamellate
Habitat: Terrestrial
Length - Width: 0.6 cm – 0.3 cm
Observation: Found at all the three sites.

Drepanocerus exsul widdedmann
Description: Oval, black beetle, small in size. Antennae lamellate.
Habitat: Terrestrial
Length- Width: 0.7 cm – 0.3 cm
Observation: Recorded from all the three sites.

Disphysema candezei Harold
Description: Small black beetle, oval in shape. Antennae lamellate.
Habitat: Terrestrial

Length - Width: 0.6 cm – 0.3 cm
Observation: This species was not found at site –3.

Scarabaeus erichsoni Harold
Description: Broadly oval but not robust. Metallic green in colour. Elytra with smooth lining and punctures. Pronotum with serration on lateral sides and punctated. Antennae lamellate.
Habitat: Terrestrial
Length - Width: 2.2 cm – 1.3 cm
Observation: Found throughout the study area.

Trox indicus (Herbst)
Description: Body shape broadly oval. Dull black colored beetle elytra with smooth ridges. Pronotum laterally plate like, head concealed under thorax. Antennae lamellate
Habitat: Terrestrial. Found on dry excrement of animals.
Length - Width: 1.2 cm- 0.8 cm
Observation: This species was not found from site-2 and site-3, but was found present at site-1.

Trox granulatus
Description: Body broadly oval, dull black coloured beetle. Elytra granulated with ridges. Pronotum laterally plate like and is granulose. Antennae lamellate.
Habitat: Terrestrial. Found on dry excrement of animals.
Length - Width: 1.2 cm-0.8 cm
Observation: Common at site –1, not sighted at other study sites.

Oxycetonia versicolor Fabricius
Description: Shining, small, reddish coppery, margins of thorax and elytra, also along the suture of the thorax and elytra, dorsal surface of the insect covered with small white spots, being especially numerous on the elytra. Pygidium also has two yellowish white spot. Antennae lamellate.
Habitat: Feeds on Pollen. Commonly observed on grass during the monsoon season population decreases when grass dries up.
Length - Width: 1.3 cm –0.8 cm

Observation: This beetle was very commonly observed at site –2, however it was not encountered at the other two sites.

Oxycetonia jucunda Faldermann

Description: Body shape broadly oval. Beetle with brick red colour, bordered with black and marked grey. Antennae lamellate.

Habitat: Terrestrial. This species was found in decaying leaf litter.

Length: 1.5 cm- 0.9 cm

Observation: This species was found at site -2 during the monsoon season.

Oxycetonia albopunctata Fabricius

Description: Broadly oval beetle. Brown coloured with margins of elytra dark brown, has numerous cream irregular spots. Pronotum as broad as abdomen with two dark brown irregular spot and cream margin. Antennae lamellate.

Habitat: Terrestrial

Length - Width: 1.2 cm – 0.6 cm

Observation: Noted only at site-2.

Ochodius spp.

Description: Broadly oval beetle shiny black coloured, elytra with few smooth lining. Antennae lamellate

Habitat: Terrestrial

Length - Width: 1.2 cm – 0.6 cm

Observation: This species was found only at site-1.

Dichodonatus coronatus Bumeister

Description: Broadly oval black beetle. Pronotum as broad as abdomen and abdomen with smooth lining on it. Pronotum nearly square shape. Head has spine at the anterior edge. Antennae lamellate.

Habitat: Terrestrial

Length -Width: 1.3 cm – 0.7 cm

Observation: Found throughout the study area.

Adoretus kanarensis Arrow

Description: Body shape elongated, oval shiny rust coloured beetle with brown belt

passing from head, pronotum till the end of the abdomen, this belt becomes tapering at the end. Antennae lamellate.
Habitat: Terrestrial
Length - Width: 1.2 cm – 0.6 cm
Observation: Recorded from all the three sites of the study area.

Adoretus stoliozkae
Description: Beetle broadly oval in shape. Shiny rust coloured beetle with brown marks on the middle of pronotum and abdomen. Pygidum almost brown. Antennae lamellate.
Habitat: Terrestrial
Length - Width: 1.2 cm – 0.7 cm
Observation: Occurrence of this species was shown at all the study sites.

Anatona stillata
Description: Black oval beetle, head smaller than prothorax, yellowish marking on the body.
Habitat: Terrestrial
Length - Width: 1.2 cm – 0.5 cm
Observation: Found throughout Gir P A, except Gir east.

Clinteria spilota
Description: Brown beetle with orange markings, head smaller than prothorax. Antennae lamellate.
Habitat: Terrestrial
Length - Width: 1.2 cm – 0.5 cm
Observation: Found throughout Gir P A, except Gir east.

Anomala bengalensis Blanchard
Description: Elongated robust beetle, antennae lamellate. Shiny brown coloured beetle. Pronotum serrated on lateral sides.
Habitat: Terrestrial
Length - Width: 2.2 cm – 1.2 cm
Observation: Found throughout Gir P A.

Halotrichia reynaudi Blanchard

Description: Body shape elongated robust, antennae lamellate, brown coloured beetle. Fore limbs digging type

Habitat: Terrestrial

Length - Width: 1.7 cm – 0.8 cm

Observation: Recorded from all the three sites of the study area.

Chiloloba acuta (wied)

Description: Metallic green beetle covered with light yellow small hairs. Antennae lamellate.

Habitat: Terrestrial. Beetle devouring the flower, tender grain. Not serious pest.

Length - Width: 2.2 cm- 1.3 cm

Observation: This species was present at all the study site during the study period.

Rhinyptia indica Burm

Description: Broadly oval beetle. Testaceous yellow coloured with brown margins. Pygidium not covered by elytra. Antennae lamellate.

Habitat: Terrestrial

Length - Width: 1.6 cm – 0.8 cm

Observation: Sited throughout study area.

Aserica spp.

Description: Broadly oval dark brown and velvety elytra.

Habitat: Terrestrial – found on tree canopy and ground.

Length-Width: 0.9 cm- 0.6 cm

Observation: Seen only at site-1.

Lachnosterna serrata

Description: Elongated beetle, black in colour, antennae lamellated.

Habitat: Terrestrial

Length - Width: 2 cm – 1 cm

Observation: Found throughout Gir P A.

FAMILY: BUPRESTIDAE

Buprestids are often brilliantly coloured with metallic luster and pure tints of considerable beauty, rivaling anything in the class insecta. Nearly 12000 species have been described. Most Buprestid larvae bore under bark or in wood, attacking either living trees or newly cut or dying logs and branches. Many do serious damage to trees and shrubs. The eggs are usually laid in cervices in bark. The larvae, on hatching, tunnel under the bark and some species eventually bore into the wood. Cosmopolitan family adults active in sunlight, generally found at nectar bearing flowers. In Gir this family is common. Adults of this family were commonly sited from site-1 and site-3 during monsoon and post monsoon till onset of winter after these seasons they were not observed. Six species are identified from this family.

Psiloptera spp.

Description: Elongated robust and tapering at the end of the abdomen. Metallic green and pink tinge.

Length –Width: 6.1 cm –2.8 cm

Habitat: Terrestrial – larva as pest of *Acacia* spp.

Observation: Sighted from site-1and site-3. At site-2 this species was not observed.

Psiloptera coreulea

Description: Elongated robust and tapering at the end of the abdomen. Antennae short serrated.

Habitat: Terrestrial- found on *Acacia spp.*

Length –Width: 5.8 cm-1.5cm

Observation: Commonly sited at Gir east (site-3) and Gir west (site-1) during monsoon and onset of winter.

Sternocera spp.

Description: Elongated robust and tapering at the end of the abdomen. Pronotum punctated. Antennae short serrated. Shining brown beetles.

Habitat: Terrestrial – larva as pest

Length –Width: 5.3 cm – 2.3 cm

Observation: Easily sighted during monsoon at site-1 and site-3.

Evides elegans

Description: Most beautiful beetle with metallic green and pink colour with regular punctures on elytra. Antennae short serrated.

Habitat: Terrestrial – larva as pest

Length –Width: 3.3 cm – 1.1 cm

Observation: This species is encountered at site-1 and site-3 during monsoon season.

Spenoptera curta

Description. Elongated˜ slender nearly parallel–sided, metallic brown colour. Antennae short serrated.

Habitat: Terrestrial

Length –Width: 2.7 cm –0.8 cm

Observation: Commonly found at the study site-1 and 3.

Chryscochora spp

Description: Greenish –bronze with violate reflections. Antennae short serrated.

Habitat: Terrestrial

Length –Width: 1.2 cm.- 0.4 cm

Observation: Commonly seen at all the three sites during monsoon season.

FAMILY: ELATERIDAE

The click beetles constitute a large group. These beetles are peculiar in being able to "click" and jump. Their characteristic shape can usually help in recognizing the click beetles. Most elaterids are inconspicuously coloured with black or brown. Adult click beetles are phytophagous and occur on flowers and under bark. The click beetle larvae are very characteristic with their long thin body and are known as 'wireworms'. Many Elaterid larvae occur in rotting logs and some of this feed on other insects. Pupation occurs in ground, under bark or in dead wood.

Elaterids of Gir are not much diversified but are ecologically more important. They were noted from all the study sites. Two different species are recorded from the study area.

Lanelater fucipes (Fabr.)

Description: Elongated beetle tapering at the tip of abdomen. Black in colour, with smooth longitudinal ridges.

Habitat: Terrestrial- found in the canopy, leaf litter.

Length –Width: 3.3 cm – 1.0 cm

Observation: Found at all the study sites.

Melonotus telum

Description: Long slender and nearly parallel-sided beetle. Dull brown in colour.

Habitat: Terrestrial

Length –Width: 2.0 cm – 0.3 cm

Observation: Common at all the study sites of Gir PA.

FAMILY: LYCIDAE

This family is generally found in warm, forest areas. Feeding habits are controversial they can be predatory or not. They are commonly known as net winged beetles. Member of this family are found living on vegetation, flowers, and foliage usually in wooded areas. Larvae are predaceous and occur under bark.

This family is recorded in Gir and is commonly found during monsoon.

Plateros spp

Description: Commonly they are yellow or reddish, with black marking.

Habitat: Terrestrial- considered as pest.

Length –Width: 1.4 cm –0.6 cm

Observation: Is sighted throughout the study area, emergence was noticed during monsoon (Aug- Sep).

FAMILY: LAMPYRIDAE

This family was monsoon dominant and was observed more prominently during monsoon 2001 than 2000 monsoon. Single representative is recorded from the study area.

Lamprophorus spp

Description: Minute beetle, brown coloured with orange pronotum.

Habitat: Terrestrial
Length-Width: 0.8 cm- 0.2 cm
Observation: Found throughout the study area, more prominent during monsoon.

FAMILY: CANTHARIDAE

Cantharides are commonly known as "Soldier beetles". In general they prey upon other insects. The velvety larvae are predaceous too. Cantharides were common at all the study sites during monsoon. Two species from this family are recorded from the study area.

Tylocerus Khasianus

Description: Long slender beetle, pronotum yellow, elytra metallic green.
Habitat: Terrestrial
Length –Width: 1.5 cm- 0.3 cm
Observation: Common cantharid of the study area, during monsoon season.

Cylindrothorax audioniui (Haag)

Description: Elongated slender body, head and elytra black, pronotum yellow, antennae thread like.
Habitat: Terrestrial
Length –Width: 1.6 cm- 0.3 cm
Observation: Common throughout the study area.

FAMILY: BOSTRICHIDAE

Bostrichids are woodborers, and attack living trees, dead twigs and branches. Relatively more is known about the food plants of the family Bostrichidae than any other family of beetles in the oriental region. The family is commonly known as "branch and twig borer". All members of this family are destructive to plants.

The representatives of this family were observed throughout the study area. Two species are recorded from this family at study area, of which one is identified.

Sinoxylon sudanicum

Description: Beetle is very small black, elytra reddish brown, under surface clothed with a fine long silvery silky pubescence. Prothorax convex. Elytra rugged, punctuate

and its denser near declivity, later with two small sharp teeth placed fairly closed together in upper half.
Habitat: Terrestrial – Borer known as pest of *Acacia spp.*, *Albizzia spp.*, *Butea monosperma*, *Casuarina equisetifolia*, *Dalbergia sisoo*, *Magnifera indica*, Bamboo etc. and several unidentified woods (Beeson, 1941).
Length-width: 1cm-0.4 cm.
Observation: Common throughout the study area.

FAMILY: TROGOSTIDAE (OSTOMIDAE)

Members of this family are commonly known as "bark gnawing" beetles. Adult and larvae of this family normally live under bark, in fungi. The forest species of this family are known to be predaceous in both larval and adult stages. Some species are important as they keep check on wood and bark boring pests in very considerable level.

Trogostidae family is helpful in controlling the woodborers; this family is represented by single species from single family, which was collected from site-1

Alendria orientalis (Redtenbucher)
Description: Elongated slender nearly parallel-sided body. Head not broad as pronotum. Black coloured beetle.
Habitat: Arboreal- predatory feeds on woodborers.
Length –Width: 1.7 cm –0.3 cm
Observation: The occurrence of this species was observed at site-1 and site-2.

FAMILY: CUCUJIDAE

They have mostly very flat-body and have widely differing modes of life but many live under bark. Most of the cucujids are predaceous on mites and small insects that they find under bark. They are commonly known as flat bark beetles. Cosmopolitan family. Member of this family are phytophagous with several species known as pests of stored products.

Two species from this family are recorded during the study period from the entire study area.

Oryzoephilus surinamensis (Linn.)

Description: Long, narrow, flattened dark brown beetle. Prothorax is provided with teeth like structure. Antennae clavate.

Habitat: Terrestrial- found under bark, more than one in number.

Length –Width: 0.25 cm- 0.3 cm

Observation: Noted throughout the study area.

Laemotmetus insignis

Description: Reddish brown beetle, body elongated and greatly flattened.

Habitat: Terrestrial - commonly observed under loose bark and in dry or decaying plant.

Length –Width: 0.8 cm – 0.2 cm

Observation: Commonly found under bark.

FAMILY: COCCINELLIDAE

Coccinellidae are predaceous. They play an important role in biological control. Their prey includes aphids, coccids, and mites. They oviposit near prey. "The Lady Bird Beetle" is the common name of coccinellidae. They are easily recognized by their rounded or oval shape. Both as larvae and as adults they are useful to forester. They help by eating plant-sucking bugs, especially aphids. Ladybirds hibernate as adults, frequently in large aggregations under leaves or in debris. This family was observed only during monsoon throughout the study area.

There are four species of this family found from the study area mainly during monsoon season. Some of the species showed preference for specific sites.

Chilomenes sexmaculata:

Description: A widespread species is yellow beetle, with black spots or bands of variable shape and number.

Habitat: Terrestrial - Predaceous

Length –Width: 0.6 cm – 0.4 cm

Observation: Common at all the sites but was observed only during monsoon.

Coccinella sevenpunctata

Description: A wide spread species, yellow beetle with black spots, seven in number.

This species appears in monsoon only.
Habitat: Terrestrial - Predaceous
Length –Width: 0.6 cm – 0.4 cm
Observation: Common at all the sites but was observed only during monsoon.

Coccinella repanda:
Description: In this species markings are in the form of three black curved bands and a small center spot.
Habitat: Terrestrial- Predaceous, found on ground.
Length –Width: 0.6 cm – 0.5 cm
Observation: This species shows a noticeable huge numerical presence at one of the sub sites of the site 1 and 3.

Coccinella transversalia (Fabr):
Description: Oval small beetle with black marks like "waves " on the elytra.
Length –Width: 0.6 cm – 0.5 cm
Habitat: Terrestrial- predatory.
Observation: This species was not found to be present at the study site 3.

FAMILY: TENEBRIONIDAE
The family tenebrionidae is one of the largest families in the animal kingdom (Allsopp, 1980). Such varieties of forms are exhibited by various tenebrionids that there is scarcely another beetle family to which some resemblance can be found. "darkling" is appropriate name as many of them are black in colour and are smooth. Their habitats are very diverse, various species can be found in decaying or rotten parts of plants, in tree fungi and fungus infested wood, under loose bark, under fallen leaves, stray and hay and in bird's nests. Throughout the arid region these beetles takeover the ecological niches that are occupied by carabidae. In the more verdant areas like under stones and rubbish and beneath loose bark and are even attracted to lights at night. Cosmopolitan, primarily detritus feeder with many species highly adapted to xeric habitats.

Tenebrionids were commonly found at each study site of Gir P A and almost throughout the year. They were generally collected from the ground, under stone, leaf litter, tree canopy, etc. More than one specimen was observed at a time. The

entire Gir Protected Area showed their presence throughout the study period. This family was represented by five different species.

Platynatus Perforatus

Description: Black beetle robust and relatively parallel sided. Pronotum as broad as abdomen. Elytra with regular punctures.

Habitat: Terrestrial- found on ground, leaf litter.

Length –Width: 3.5 cm – 2.5 cm

Observation: Found throughout Gir P.A.

Gnocephalum spp

Description: Dull brown, black beetle.

Habitat: Terrestrial- found on ground, bark of tree, under stone etc.

Length –Width: 1 cm- 0.4 cm

Observation: Showed their presence throughout the study area and practically in all the seasons.

Mesomorphus villiger

Description: Elongated slender nearly parallel – sided dull brown beetle.

Habitat: Terrestrial- commonly encountered from ground, tree canopy

Length –Width: 0.9 cm – 0.3 cm.

Observation: Common species observed at all the sites.

Opatroides vicinus Fairm:

Description: Body oval elongate, black in colour, little shining. Surface uniformly, densely and finely punctuated. Prothorax wider than long, anterior edge straight, sides slightly curved the posterior angles pointed, uniformly and finely punctuated, elytra convex, depressed.

Habitat: Terrestrial- found on ground, tree canopy.

Length Width: 0.7 cm – 0.5 cm

Observation: Found throughout the study area.

Rhytinota impolita (Farim):

Description: Black beetle, antennae filiform, abdomen tapering towards the tip and head broader than pronotum.

Habitat: Terrestrial - predaceous and facultative omnivore.
Length -Width: 2.3 cm – 0.6 cm
Observation: This was the only species, which was sighted throughout the tenure of the studies in all seasons and at all the sites. Most common beetle found in large numbers in Gir (East) during 2001. Common beetle found in Gir PA.

FAMILY: MELOIDAE

Meloidae beetles are commonly known as "Blister Beetles". Generally these beetles occur in flowers and foliage of various plants. The name "Blister" beetles is based on the fact that body contains Cantharidin, a substance capable of blistering the skin. This chemical is extracted from the body of certain species and used medically. Adult blister beetles are plant feeders and some are serious pests. The larvae are parasitic and generally beneficial; they usually feed on grasshopper eggs, but some feed on eggs or larvae of bees (Borror, 1998). Several species are pests of agricultural crops and occasionally in forest.

Meloidae, in Gir are of limited varieties but were found on varied vegetation. However, they were present at all the sites of Gir P A. Three species are recorded from the study area.

Mylabris pustalata (Thumb)
Description: Long and robust from the abdominal region, head and thorax small and narrower than abdomen. Three orange band present on each elytron. Antennae beaded, legs slender and long.
Habitat: Terrestrial – found on ground and grass.
Length –Width: 3.0 cm – 0.9 cm
Observation: Found throughout the study area, this species was once noticed in thousands at Gir N.P (site-2) during a visit in Monsoon, 2001.

Cyanealytta actaeon
Description: Deep blue beetle, antennae beaded. Abdomen visible.
Habitat: Terrestrial
Length –Width: 1.8 cm – 0.8 cm
Observation: Sighted at all the sites of Gir P A. Common during monsoon.

Epicauta spp

Description: Bluish black beetle, antennae beaded.

Habitat: Terrestrial- found on foliage, grass and flowers

Length –Width: 2.5 cm – 0.9 cm

Observation: Common species at all the sites during monsoon season.

FAMILY: ANTHICIDAE

These beetles appear like ant. They are common flowers and foliage as well as ground. They are minute in size. Single species has been encountered from the study area.

Formicomus spp

Description: Ant like minute beetle, antennae filiform, prothorax narrower at the base than the elytra, head is deflexed and strongly constricted behind the eyes.

Habitat: Terrestrial- predaceous. Found on tree canopy, foliage and even on ground.

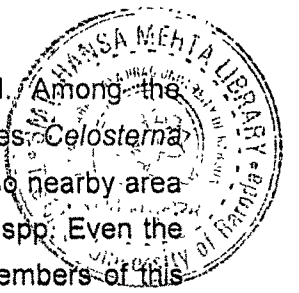
Length –Width: 0.3 cm – 0.2 cm

Observation: Common species at all the sites during monsoon season

FAMILY: CERAMBYCIDAE

Cerambycidae have long antenna. Their considerable appearance has always made them popular with collectors. They are plant eaters, and many of them visit flowers. The larvae of almost all species live either in wood or in herbaceous plants. Most longhorn beetles like sunshine, but some are active only in the evening or at night. Few are active only in the evening or at night, and few others get attracted towards lights. Some are encountered during the day may be found under bark or resting on trees or logs. Most of cerambycidae are wood boring in the larval stage and many species are very destructive to orchards, forest and fruit trees and to freshly cut logs. The adults lay their eggs in cervices in the bark and larvae bore into the wood. Different species attack different types of trees but most species appear to prefer freshly cut logs or weakened and dying trees or branches. The number of species of cerambycidae now known to occur in the Indian region is 1200.

In Gir, cerambycidae are present in all the areas during the entire tenure but could not be having pestiferous effect. Because observed species were never encountered in big number indicating their population is under control. In Gir west (site-1), Gir N.P



(site-2), in Gir east (site-3) member of this family were collected. Among the collected specimen *Acanthophorus serraticornis* was the biggest species. *Celosterna scabrator* was most commonly observed in Gir east & Gir west and also nearby area of Sasan Guest house. The food plants of this family were of *Acacia* spp. Even the availability of food plant didn't show any increase in population of members of this family. This exhibit the prey predatory chain of the ecosystem operating naturally that could be controlling them. Cerambycids of the study area never showed any swarm or aggregation that can lead to serious problem for the forest tress. Seven different species are recorded and identified from the study area.

Acanthophorus serraticornis (oliv)

Description: Brown coloured species with strong mandibles, which are bigger in male then in female.

Habitat: Terrestrial- found from the bark, known as pest.

Length – Width: 9 cm- 2.5 cm

Observation: This species was always found at site-1 and was always in pair. At other sites this species was not sighted during the studies.

Apomecyna perroteti

Description: Small brown beetle with white spots.

Habitat: Terrestrial

Length- Width: 1.5 cm – 0.5 cm

Observation: This species showed its occurrence at all the three sites of Gir PA.

Apomecyna saltator.

Description: Dull brown beetle with irregular white spots.

Habitat: Terrestrial

Length- Width: 1.9 cm – 0.5 cm

Observation: This species was sighted throughout the study area.

Celosterna scabrator

Description: Dull yellowish brown, the sides of body and legs bluish, elytra yellowish grey with large number of black spots varying in size from pin's head to minute specks.

Habitat: Terrestrial. Known to feed on *Acacia spp.*, *Cassia spp*, *Casurina equisetifolia*, and *Prosopis juliflora*, *Tectona grandis*, *Zizypus jujuba* (Beeson, 1941). The beetles feed voraciously mainly at night on the bark of young shoots, scraping it away with the mandibles down to the surface of the wood in irregular patches and band, so that the shoot is completely girdled and killed.
Length – Width: 8 cm- 2 cm
Observation: Commonly found at all the sites of Gir P A.

Hypoeschrus strigosics
Description: Brown beetle, elytra not wider than prothorax. Antennae filiform.
Habitat: Terrestrial
Length- Width: 3.5 cm - 0.7 cm
Observation: This species was encountered only at site-1. At other sites this species was not observed during the studies.

Xystrocera globosa (olive):
Description: Beetle reddish brown, part of prothorax metallic blue or green, elytra testaceous yellow, each with a metallic blue or green longitudinal band.
Habitat: Terrestrial. Known pest for *Acacia spp.*, *Albizzia spp.*,
Length - Width: 7.5 cm – 1.6 cm
Observation: This species was not sighted at site-2 and 3 during the studies.

Overia brevis
Description: Small rufous beetle, antennae long thread like, twice the body size.
Habitat: Terrestrial
Length - Width: 1.1 cm – 0.3 cm
Observation: Found in good number at site-1 than in other sites.

FAMILY: BRUCHIDAE
Members of this family are commonly known as seed beetles and are found in stored seeds and foliage. This family is considered as major pest of stored grains. They are found throughout the world. Single species was encountered from all the study sites.

Bruchus spp.

Description: Yellowish brown, small head, elytra broader than thorax and possesses short hairs.

Habitat: Terrestrial – found on tree canopy and bark.

Length - Width: 0.5 cm – 0.4 cm

Observation: Encountered throughout study area.

FAMILY: CHRYSOMELIDAE

Second largest family of herbivorous insects. Larvae and adults are phytophagous feed on same food plant and rarely feed on wood. Chrysomelidae is related to longhorn beetles and like them feed on plants, although extremely varied in forms. Many Crysomelids are brightly coloured. Adult leaf beetles feed principally on flowers and foliage. The larvae are phytophagous. Some larvae are free feeders on foliage, some bore in stems. Many member of this family are serious pest. In Gir this group is noticed in all the three sites. Like other families this family also shows its presence during pre and post monsoon period.

Oides bipunctata

Description: An oval, orange colour beetle with black blotches of varied size on each elytron.

Habitat: Terrestrial. This species occurs plentiful during monsoon. Observed feeding on *Acacia catechu* and on wild creepers/lianas.

Length - Width: 2.0 cm – 0.4 cm

Observation: Observed throughout Gir Protected Area, from June to end of Aug.

Sindia clathrata (Fabr.)

Description: Body broad oblong. Colour orange with black markings on the prothorax and elytra. Antennae long.

Habitat: Terrestrial - found on tree canopy and foliage.

Length- Width: 1.1 cm- 1 cm

Observation: Found throughout the study area during monsoon.

Corynodes decemnotatus (Baly)

Description: Metallic green beetle elongated robust, capitated antennae, appendages and antennae black in colour. Elytra with metallic blue spots. Ventral

side metallic blue.
Habitat: Terrestrial
Length - Width: 0.9 cm – 0.6 cm
Observation: Observed at all the sites except site-2.

Conchyloctenia nigrovittata (Boh)
Description: Oval beetle, orange pronotum. Elytra orange with black marking irregularly marked lining and two spots on lateral sides. Ventral side black.
Habitat: Terrestrial
Length - Width: 0.9 cm – 0.6 cm
Observation: Observed at site-1 and 2 only.

Clytra succincta
Description: Elongated beetle with black head, pronotum, antennae. Elytra yellow with two black marking on each elytron, former dot shaped and later horizontal band like.
Habitat: Terrestrial
Length - Width: 1.2 cm – 0.7 cm
Observation: Very common.

Clytra spp1
Description: Elongated beetle with black head, pronotum, antennae. Elytra yellow with black marking.
Habitat: Terrestrial – on tree canopy and foliage
Length-Width: 1 cm - 0.3 cm
Observation: Commonly found from entire study area.

Clytra spp2.
Description: Elongated beetle with black head, pronotum, antennae. Elytra yellow with black marking
Habitat: Terrestrial – on tree canopy and foliage
Length-Width: 1.2 cm - 0.3 cm
Observation: Common throughout the study area.

Hispa armigera

Description: Small, black beetle covered with conspicuous spines.
Habitat: Terrestrial - found on tree canopy and foliage.
Length-width: 0.4 cm- 0.2cm
Observation: Present throughout the study area.

FAMILY: BRENTHIDAE

This family of the Rhynchophora is characteristic of forests in tropics and subtropics with very few representatives in temperate region. There are about 1500 described species. What is known about their habits is based on observations made on few Indo-Malayan species.

Only single female specimen of this family was collected from site-1 during monsoon season.

Prophtalmus tridentatus

Description: Elongate, moderately thick dark red brown to blackish in parts. Elytra lighter with several orange spots and patches. Head small, punctuate. Rostrum moderately long curved. The antennae from near base of the rostrum. Prothorax widest just above base narrowed in front, legs rather short
Habitat: Arboreal, larvae as well as adult are pest. Woodborers.
Length-width: 6.5 cm – 0.3 cm
Observation: This species was not found at site-2 and site-3.

FAMILY: CURCULIONIDAE:

Members of this family may be found almost everywhere. All snout beetles except a few occur in ant nest and are plant feeders and many are serious pests. Almost all part of a plant may be attacked from the roots upwards. The larvae usually feed inside the tissue of the plant and drill holes in fruits, nuts, and other plant parts. They have characteristic rostrum or snout but show considerable variation in size, shape and the form.

In Gir almost all the sub sites and in all the seasons this family showed their presence. Mostly they were collected under bark of Teak tree. Helps and protects

the tree from small insects and mites. Their presence shows the health of the wood. Ten different species are recorded from the study area.

Atactogaster djeani

Description: Weevil brown in colour. Elytra with yellow markings. Antennae clubbed and elbowed.

Habitat: Terrestrial

Length: 1 cm –o.4 cm

Observation: Harboured at Gir east (site-3) and Gir west (site-1).

Amblyrrhimus poricollis

Description: Brown weevil with yellowish band at the end of elytra.

Habitat: The beetle feeds on the foliage of *Aegle marmelos*, *Albizzia lebbek*, *Casurina equisetifolia*, *Dalbergia sisoo*, *Mangifera indica*, *Nephelium litchi*, *Terminalia* spp. and *Zizyphus jujuba*. The larva lives in the soil and feeds on rootlets of the same spp.

Length –Width: 0.5 cm – 0.2 cm

Observation: Found throughout the study area.

Myllocerus pubscens (Faust)

Description: Black weevil with smooth channels on elytra. Antennae clubbed and elbowed.

Habitat: Terrestrial - Defoliates *Cassia fistula*.

Length - Width: 0.5 cm – 0.3 cm

Observation: Found throughout study area.

Myllocerus pustulatus (Desbr)

Description: A greyish white weevil spotted with black. Antennae clubbed and elbowed.

Length - Width: 0.6 cm –0.3 cm

Habitat: Terrestrial – found on canopy of tree.

Observation: This species was not encountered at site-3. It was recorded from site-1 and 2 of the study area during the tenure of the studies.

Myllocerus discolor (voheman)

Description: Black with fawn and pale marking. Antennae clubbed and elbowed.

Length: 0.7 cm – 0.3 cm

Habitat: Terrestrial - They are generally known to feed on *Acacia Spp.*; *Dalbergia spp.; Tectona grandis* and fruit trees in new leaf; the larvae feed on the roots of grasses, maize, sugarcane, etc.

Observation: Encountered at all the three sites.

Myllocerus spp.1

Description: Speckled brownish weevil, antennae clubbed and elbowed.

Habitat: Terrestrial – tree canopy and foliage

Length - Width: 0.5 cm –0.2 cm

Observation: Found throughout the study area.

Myllocerus spp.2

Description: Greyish brown, speckled weevil. Antennae clubbed and elbowed.

Habitat: Terrestrial

Length – Width: 0.5 cm – 0.2 cm

Observation: Found throughout the study area.

Myllocerus spp.3

Description: Greyish with darker spots. Clubbed and elbowed antennae.

Habitat: Terrestrial

Length – Width: 0.5 cm – 0.3 cm

Observation: Found throughout the study area.

Crytozemia dispar (Pasc)

Description: Black shiny weevil with rounded abdomen. Elytra with smooth Channels.

Habitat: Terrestrial – commonly found on tree canopy.

Length: 0.7 cm – 0.4 cm

Observation: Found throughout the study area.

Lixus truncatulus:

Description: Robust oval weevil grayish-brown in colour with yellow markings.

Habitat: Is a borer of the branch and stem of *Amaranthus caudatus*, *A.gangeticus*, *A.spinosus* and *A.viridis* causing gall and swelling.
Length: 1.0 cm – 0.5 cm
Observation: Found throughout the study area.

COMMUNITY STRUCTURE AND DYNAMICS

Diversity indices provide important information about quantification of the population, which in turn helps to understand community structure. This diversity index provides more information than a mere checklist showing the number of species present.

Species Number

The coleopteran fauna of Gir P A is represented by a total of 114 species belonging to twenty-three families. Out of these, few families like Scarabaeidae, Carabidae, Staphylinidae, Tenebrionidae, Crysomelidae, Cerambycidae, Buprestidae, Meloidae and Curculionidae were dominant families of beetle community at study site. Four of these families are purely herbivorous *viz.* Crysomelidae, Cerambycidae, Curculionidae and Buprestidae. Others are omnivorous. Seasonal variation in species composition was also apparent.

Site – 1 (Gir west) was much diverse and rich in terms of coleopteran fauna. During the study it was found that all the species recorded were sighted from this study site. There is a definite seasonal change in the occurrence, monsoon was the favored season during which the richness increased and was declining from winter to summer (Table 3.1 – 3.3). However, this was the common trend for all families of coleoptera at all the study sites. While quantifying the species few of them were dominant at site – I. The dominant species are *Cyanealytta action, Oides bipunctata, Ryniptia indica, Onthophagus pactus, Gymnopleura miliaris, Rytinota impolita, Lampyrous spp, Omphra ruphipes, Cathocirus molasus, Celosterna scabrator, Oryzaephilus suramensis, Plateros spp.*

Site – 2 (Gir NP) is showing good number of beetle species record, eighty species were recorded from this site during the favoured season – the monsoon. Here also the seasonal trend in species richness was apparent similar to site – 1 (Table 3.3). Few species like, *Mylabris pustulata, Oides bipunctata, Oxycetonia versicolor, Celosterna scabrartor, Mesomorpha billiger*, Unidentified spp. (Cicindellidae) and *Rytinita impolata* are the commonly encountered beetles at this study site. However,

seasonality affected occurrence of species recorded. During monsoon 2001, a huge swarm of *Mylabris pustulata* was found and *Oxycetonia versicolor* was abundant throughout this site. This phenomenon was not observed at any other sites. Members of *Oxycetonia* genus are sited only at this site.

Site – 3 harbors least number of beetle species. Seventy four species are recorded during the peak season (monsoon) from this site. Frequently noticed species at this site are *Cyanealytta actaeon, Chiloloba acuta. Celosterna scabrartor, Psiloptera spp, Rytinota impolita, Lamphorous spp.*, unidentified spp (Cicindelidae), *Mylabris pustulatus, Playtynotus perforatus, Gonocephalum spp, Oryzaephilus surinamens*is. Here too themporal changes in species number was observed (Table 3.1 – 3.3)

Species Diversity and Equitability

Species diversity includes both the number of species and the number of individuals in a community/ecosystem. During the current study Shannon Wiener index (H') was computed using the data, in order to facilitate comparison between sites and to study the seasonal variation in community structure. The coleopteran diversity altered between sites and also with season (Table 3.3). Site – 1 appeared more diverse in terms beetles and weevils in all the seasons. However, as a general rule H' reached the maximum during the monsoon season whereas in other two seasons this figure showed downward trend. An obvious deviation from this general pattern of diversity was observed in site – 2 during 2001. This is because of a swarm of *Mylabris pustulata* that appeared during monsoon 2001 (Table 3.2 and 3.3). Evenness of the species also showed the same spatial and temporal changes as the diversity index indicating similar changes in number of individuals and also in number of species with time and space (Table 3.3).

Similarity Index

Similarity index (Cj) is used for understanding the community similarity between sites during various seasons. When all the three sites are compared for similarity, site 2 and site 3 showed maximum similarity. Nevertheless, site 1 and 2 and site 1 and 3 when compared showed less similarity (Table 3.4). This trend is common during all the seasons. Almost 70% of the species are shared between site 2 and 3 during the entire tenure of the study. Whereas site – 1 and site - 2 are found sharing nearly 59% of the coleopteran species all throughout the study period. A different finding

emerged when site – 1 and site – 3 are compared, 63% of species are similar during 2000 and 48% during 2001. However, though not to this magnitude similar reduction in shared species between the sites was vivid between 2000 and 2001 (Table 3.5). Nevertheless, the pattern of change through season was found to be same in both the years (Table 3.4).

DISCUSSION AND CONCLUSION:

Few coleopteran families are commonly encountered in the entire study area. These families are Carabidae, Scarabaedae, Staphylinidae, Tenebrionidae, Curculionidae, Crysomelidae, Cerambycidae. However, Carabidae and Scarabaeidae were the most divers and found all over Gir P A. The dominance of these families may be due to the availability of their preferential habitats. Moreover, these are the major families of Coleopteran fauna of India (ZSI, 1991).Nevertheless for precise conclusion more intense studies on niche preference are needed.

Dominance of carabidae could be due to their broad geographic ranges and ability to occupy all the major habitats except the drier part of deserts (Lövei and Sunderland 1996). Due to this dominance they are well known both taxonomically and ecologically (Lövei and Sunderland 1996, Niemelä 1996) and are also widely used for different kinds of indicator studies because of their sensitivity to slightest habitat alteration (Rainio and Niemelä, 2003). This sensitivity of theirs is been studied in most of the surveys focusing on the response of the species to changing environmental conditions, e.g. forest fragmentation (Niemelä *et al.* 1988) or management practices (Rushton *et al.*, 1990). In addition to this ground beetles have been used in studies for the effect of insecticides (Basedow 1990), effects of military tanks (Mossakowski *et al.*, 1990), classification of habitat type (Eyre and Luff, 1990), assessment of site quality (Eyre *et al.*, 1996) and studies on urban ecology (Vernn, 2000). Their ubiquitous presence was very prominent all over the study area irrespective of any microhabitat during the entire span of study. This supports the observation that they are abundantly found in deciduous forest (Turin and den Boer, 1988). Their ability to survive on a varied range of insects makes them successful in any habitat type they are found in. They being predatory may help in keeping the noxious insect species under control. Their role as predators of pest species is exploited in India (Beeson, 1941). The larva of *Calosoma* and *Chlaenius* are active above ground and are known to feed on caterpillars. It feeds on caterpillars and

pupae, Grasshopper and cockroaches and on beetles of Bostrichidae. The species was introduced to some of the irrigated plantation of Punjab in 1938 and 1935 to control the Shisham defoliators. Artificial distribution of *Anthia sexguttata* and *Calosoma maderae* and other species attacking caterpillars of *Plecoptera reflex* a (Noctuidae) has been tried as a control measure in the Shisham plantation of the Punjab species of *Calosoma* have been used in other parts of the world for biological control (Beeson, 1941).

Scarabaeidae (Dung Beetles) are essential component of forest ecosystem, several recent studies have emphasized the potential role these insects play in dispersal, seed burial and germination (Howard and Zanoni, 1989; Estrada and Coates-Estrada, 1991; Shepherd and Chapman, 1998; Andresen, 1999; Feer, 1999; Vulinec, 2000). They do valuable work in quickly mixing raw manure with the soil before the termites gain access to it. This makes them very important part of the ecosystem in which they are found. By burying the dung and carrion as food for their offspring, dung beetles may increase the rate of soil nutrient cycling (Halffter and Mathews, 1996; Bornemissa and Williams, 1970; Nealis, 1977). Large number and diversity of scarabids in the study area can be coupled with the presence of larger wild mammalian species. Scarabids play a major role in pastures and grassland biomes removing vertebrate feces of many domestic and wild ungulates, which in turn help in forest regeneration. By carrying out this activity they become significant component of the forest ecosystem (Fincher, 1981; Rougan *et al.*, 1988; Halffter *et al.* 1992; Vulinec, 2000). Rensburg (1999) is of the opinion that dung beetles assemblage can match the floral and vertebrate diversity of any habitat. Since the study area is already known for its floristic as well as amazing vertebrate diversity (Singh, 2001), these beetles are found proliferating and sustaining themselves. They exert important control over the egg and larva population of parasitic flies present in fresh dung of mammals (Bergstrom *et al.*, 1976). Because of essential role, loss of this beetle fauna can directly affect not only biodiversity, but also soil structure, nutrient cycling and even the population dynamics of hitchhiking organisms (such as predatory mites and nematodes).

Recently dung beetles have been suggested good indicators for measuring biodiversity as indicators of disturbance in the tropics (Halffter and Favila, 1993; Davis *et al.*, 2001). As occurs in all order of insects (Samways, 1993; 1994; Martín-

Piera, 1997) concern has been increasing over dung beetle conservation in the last decade (Klein, 1989; Lumaret, 1994; Martín-Piera and Lobo, 1995; Barbero *et al.*1999; Van Rensburg *et al.*, 1999).

Staphylinidae was one of the leading families of the study area. They have a preference for moist atmosphere, dung, decaying matter, etc. White (1993) has also studied that rove beetles are often abundant in habitats with large numbers of fly larvae -- especially decaying fruit, decaying matter, carrion, and dung, where some are important predators of maggots and others prey upon mites or nematodes. Among leaf litter inhabiting beetles, the family staphylinidae is the most species rich and among numerically dominant taxa in the leaf litter community (Olson, 1993). Gir being a deciduous forest, formation of leaf litter is prominent feature of this ecosystem, which supports in formation of rich organic material in turn supports large number of decomposers organisms, staphilinids are one of them.

Tenebrionid beetles were one of the beetle families, which occurred throughout the study area irrespective of seasons. Adults of this family are generally herbivores and/ or detritivorous feeding on stems, leaves or buds of plants, although decaying or dead plant matter has been recorded as food for some species by Rogers and co workers (1978) and Allsopp (1980). They are considered as ideal study organisms for exploring environmental scaling because they are abundant, conspicuous, and easy to identify. They have been used as model organisms for many other studies on the short grass steppe by Crist *et al.*, (1992); Crist and Wiens (1995); Mc Intyre (1997); Wiens *et al.* (1997).

Buprestidae, metallic beetle are easily recognized by their striking colouration. At the study site adults of this family were commonly observed on *Acacia spp.* Adults of this family don't damage forest trees because on emerging the adults feed, mate and then die in a relatively short time. Ecowatch project (2002) has found that the life span of buprestid beetle is short and depending on the species, adult beetles may live for just one or two days upto about two weeks, their larvae are considered as pest (Ecowatch project, 2002). They are considered as pest of *Acacia spp, Albizzia spp, Bauhinia spp, Shorea robusta, Butea spp. Zizyphus spp, Terminalia spp, Ficus spp.* (Beeson, 1941; Holm, 1979; Hutacharern, 1989; Balu *et al.*, 2001; Jamal, 1994)

all this plant variety are profoundly dominant at study site which attracts this beetles to thrive at study area.

Cerambycidae beetles are known pest for forest plants. They are known pest of *Acacia spp. Cassia spp., Casurina equisetifolia* and *Prosopis juliflora, Tectona grandis, Zizypus Spp., Albizzia spp.* (Stebbing, 1914; Beeson, 1941; Ralph, 1985; 1990, Jain *et al.*, 1993, Wylie *et al.*, 1998), a dominant floral component at the study site, which helps to sustain this group of beetles. It is studied by Beeson91941) that one of the species of this family, *C. Scabrator* is practically immune from parasitism and predator control in the larval and pupal stages, bacterial disease is infrequent, and the extensive babul plantation offers a very favourable food supply however, he has also stated that the pest has not multiplied to a permanent epidemic characterized by 100% attack.

From the forestry aspect chrysomelidae are ubiquitous and abundant, but don't cause appreciable damage except in pure plantations or in stands of gregarious spices (Stebbing, 1914; Beeson, 1941; Verma, 1985; Pillai and Gopi, 1990; Lee and Morimoto, 1991; Yadav *et al.*, 1992). Grass and herb cover was the main factor influencing the composition of the chrysomelidae family (Řehounek, 2002).

Meloidae beetles moreover feed on cucurbitaceae, leguminousease and malvaceae (Beeson, 1941). *Mylabris pustulata* species of family was observed in huge number, a common phenomenon observed in this species (Beeson, 1941). Larvae of this species help in controlling grasshopper population by feeding on its eggs (Borror, 1998).

Curculionidae are purely herbivorous family and show different mode of feeding habit the species recorded from this family at study site are defoliators, shoot and stem borers, soil dwellers. Studies by Ahmad and co-workers (1997) have observed that wide variety of food plant Mango, Citrus, *Zizyphus spp., Acacia spp., Terminalia spp.,* majority of food material listed by eminent entomologist like Stebbing (1914) Beeson (1941) is easily available, which help them to thrive at study area.

Concluding the observations, the variation in species diversity among the beetles noted at study site, could be due to different species having different ecological

requirements, some species are generalist and some other are specialized demanding certain habitat characteristics (Dufrene and Lengendre, 1997). Insect species differ considerably in the constancy of their population levels. Some are relatively constant from one generation or year to the next; others are frequently varying, while others remain at fairly consistently low levels only to out break very occasionally (Whittaker, 1975). Increase or decrease of species number or abundance might be directly caused by change in abiotic and/ or biotic factors (Blake *et al.*, 1996) or indirectly by change of species assemblage of other species (Haila *et al.*, 1994). As stated by Eyre and Luff (1990) Change in species number and abundance are predominately affected by soil water content, fragmentation and vegetation (Halme and Niemela, 1993). Seasonal changes in the occurrence of beetle were profoundly noted during the study. Vegetation changes affect the resource availability of members of this group. This is represented by their low diversity as well as species number during summer. Both plant-mediated effects and direct effects of physical contact under crowded conditions have been demonstrated to induce dispersal in other insect groups (Harrison,1980). Therefore, dispersal in coleopteran species too could be triggered by either a reduction in the amount of host material, changes in host quality due to herbivory, or increased contact among adults.

TABLE 3.1. Species abundance in monsoon (M), winter (W) and summer (S) during 2000 from various study sites

FAMILY	SPECIES	SITE 1			SITE 2			SITE 3		
		M	W	S	M	W	S	M	W	S
Cicindellidae	Cicindela cardoni	1	0	1	1	0	0	1	0	0
	Unidentified sp 1	2	1	1	3	1	1	4	2	1
Carabidae	Anthia sexgulata (F.)	2	1	0	1	1	0	2	0	0
	Omphra rafipes (Klug)	3	2	1	2	1	1	1	1	1
	Chlaenius nepalensii (Hope)	2	1	0	0	1	0	1	0	0
	Chlaenius quadricolor	1	1	0	0	0	0	0	0	0
	Chlaenius nilgenensis	2	1	0	1	0	0	0	0	0
	Lesticus desgodinsi	1	0	0	0	0	0	0	0	0
	Brachynus reyi	2	1	1	2	1	1	1	1	1
	Scantes eurytus	1	1	0	0	0	0	0	0	0
	Scantes bengalensis	2	1	1	1	2	1	1	1	1
	Scarites indicus	1	0	0	0	0	0	0	0	0
	Calosoma maderae	1	1	0	1	0	0	0	0	0
Dysticidae	Hydraticus vittatus	1	1	0	1	0	0	1	1	0
	Cybister confussus (Shp.)	1	0	0	0	0	0	1	0	0
	Cybister tripunctatus (Var-Asciatus) (Shp.)	1	0	0	1	0	0	1	1	0
Staphylinidae	Staphylinus sp.	1	0	0	0	0	0	0	0	0
	Unidentified sp 1	2	1	1	1	1	1	1	1	1
	Unidentified sp 2	1	1	1	1	1	1	1	1	1
	unidentified sp 3	1	1	0	1	0	0	1	0	0
Hydrophyllidae	Hydrophilus olivaceus (Fabr)	1	1	0	1	0	0	2	0	0
	Stenolophus rufipes	1	0	0	1	0	0	1	1	0
Scarabaeidae	Anatona stillata (New)	0	0	0	2	1	0	0	0	0
	Adoretus kanaresis	1	2	0	1	0	0	1	1	0
	Adoretus stolioczkae	1	1	0	1	0	0	1	0	0
	Chilotoba acuta (Wied.)	1	0	0	0	0	0	0	0	0
	Rhinyptia indica (Burm)	2	1	0	2	1	0	2	1	0
	Onthophagus pactolus (F.)	1	1	0	0	0	0	0	0	0
	Onthophagus atropolitus	1	1	0	0	0	0	0	0	0
	Onthophagus falusus	1	1	0	1	0	0	1	0	0
	Onthophagus rana	0	0	0	0	0	0	0	0	0
	Onthophagus tragus	1	0	0	1	0	0	0	0	0
	Onthophagus catta	1	1	0	1	0	0	1	0	0
	Cathorsius molossus	3	1	0	2	1	0	2	1	0
	Holotrichia reynaudi	2	1	0	1	1	0	1	0	0
	Heliocopns gigas	3	1	0	1	0	0	2	1	0
	Gymnopleura cyaneus	1	1	0	0	0	0	0	0	0
	Gymnopleura miliaris	4	2	0	0	0	0	2	1	0
	Gymnopleura koenigi	1	1	0	1	0	0	0	0	0
	Anomala bengalensis	2	1	0	1	0	0	1	0	0
	Copris numa	1	1	0	1	0	0	1	0	0
	Drepanocerus exsul	1	0	0	0	0	0	0	0	0
	Disphysema candezei	0	1	0	1	0	0	0	0	0

FAMILY	SPECIES	SITE 1			SITE 2			SITE 3		
		M	W	S	M	W	S	M	W	S
	Caccobius himalayanus	1	1	0	1	0	0	1	0	0
	Scarabaeus erichsoni	2	1	1	1	1	1	1	1	1
	Oxecetonia versicolor	0	0	0	3	2	1	0	0	0
	Oxecetonia jucanda	0	0	0	1	0	0	0	0	0
	Oxycetonia albopunctata	0	0	0	1	0	0	0	0	0
	Ochodius spp.	1	1	0	0	0	0	0	0	0
	Bolboceras quadrideus	1	0	0	1	0	0	1	0	0
	Clinteria spilota	1	0	0	1	0	0	0	0	0
	Trox granulatus	2	1	0	0	0	0	0	0	0
	Trox indicus	1	0	0	0	0	0	0	0	0
	Aserica spp.	2	1	0	0	0	0	0	0	0
	Lachnosterna serrata	1	1	1	1	1	1	1	1	1
Buprestidae	Psiloptera spp.	1	1	0	0	0	0	2	1	0
	Psiloptera coerulea	2	0	0	0	0	0	0	0	0
	Sternosera spp.	1	1	0	0	0	0	1	0	0
	Evides elegans	2	0	0	0	0	0	1	0	0
	Sphenoptera curta	1	1	0	0	0	0	1	0	0
	Chrysochora spp.	1	1	1	1	1	1	1	1	1
Elataridae	Lanelater fuscipes	1	1	1	1	1	0	1	0	0
	Melanotus telum.	1	1	0	2	1	0	0	2	0
Lycidae	Plateros spp.	4	2	0	3	1	0	2	0	0
Lampyridae	lamprophorus spp.	2	1	0	4	2	0	2	1	0
Cantharidae	Tylocerus khasianus	1	1	0	1	2	0	2	1	0
	Cylindrothorax audioniui (Haag.)	1	1	0	1	0	0	1	1	0
Bostnchidae	Sinoxylon sudanicum	2	1	1	1	1	0	1	2	1
	Unidentified spp.	1	0	0	1	1	0	1	1	1
Trogostidae	Alendria orientalis (Redten Bucher)	1	1	0	1	0	0	0	0	0
Cucujidae	Oryzaephilus suranamensis	4	2	1	4	2	1	4	2	0
	Laemotmetus insignis	2	1	1	1	1	1	2	1	1
Coccinellidae	Chilomenes sexmaculata	4	2	0	2	1	0	2	0	0
	Coccinella sevenpunctata	2	1	0	1	1	0	1	1	0
	Coccinella repanda	2	1	0	0	0	0	2	0	0
	Coccinella transversalia	2	1	0	1	0	0	0	0	0
Tenebrionidae	Platynotus perforatus (Muls)	2	3	1	2	1	1	3	2	1
	Gonocephalum spp.	1	1	1	2	1	1	3	1	1
	Rytinota impolata	4	2	1	4	3	1	4	7	1
	Mesomorpha billiger	2	1	1	3	1	1	2	1	1
	Opatrodes vicinus	1	2	1	3	2	1	1	1	1
Meloidae	Mylabris pustulata	2	0	0	2	0	0	0	0	0
	Cyanealytta acteon	1	1	0	2	1	0	1	1	0
	Epicauta spp.	1	1	0	1	0	0	2	0	0
Anthicidae	Formicomus spp.	1	1	1	1	1	1	1	1	1
Cerambicidae	Acanthophorus serraticornis (Olive)	2	0	0	0	0	0	0	0	0
	Apomecyna saltrator	1	1	0	1	0	0	1	0	0
	Apomecyna perroteti	1	0	0	1	0	0	1	0	0
	Celosterna scabrator	6	3	0	2	0	0	2	0	0
	Xysrtocera globosa (Olive)	1	0	0	0	0	0	0	0	0

FAMILY	SPECIES	SITE 1			SITE 2			SITE 3		
		M	W	S	M	W	S	M	W	S
	Hypoeschrus strigosics	1	0	0	0	0	0	0	0	0
	Overia brevis	2	1	0	1	0	0	1	0	0
Bruchidae	Bruchus spp.	2	1	0	1	1	0	1	1	1
Chrysomelidae	Oides bipunctata (Fabr.)	2	1	0	2	1	0	2	1	0
	Sindia clanthrata	1	1	0	1	0	0	1	0	0
	Corynodes decemnotatus	1	0	0	0	0	0	1	0	0
	Conchyloctenia nigrovittata	0	0	0	0	0	0	0	0	0
	Clytra spp 1	1	0	0	0	1	0	0	0	0
	Clytra spp 2	1	0	0	0	0	0	0	0	0
	Clytra succincta	2	1	0	1	1	0	1	1	0
	Hispa armiger	1	1	0	1	1	0	1	1	0
	Unidentified sp.2	1	0	0	1	0	0	1	0	0
	Unidentified sp.3	1	0	0	1	0	0	1	0	0
Brenthidae	Prophtalmus tridentatus	2	1	0	0	0	0	0	0	0
Curculionidae	Atactogaster djeani	1	1	0	1	0	0	0	0	0
	Amblyrrhimus poricollis	1	0	0	0	0	0	0	0	0
	Myllocerus pubscens	1	1	0	1	0	0	0	1	0
	Myllocerus pustulatus	2	1	0	1	0	0	1	0	0
	Myllocerous discolor	1	0	0	1	0	0	1	0	0
	Myllocerous sp.1	1	1	1	1	1	1	1	1	1
	Crytozemia dispar	1	1	0	0	0	0	1	0	0
	Lixus trycatalus	1	1	0	1	0	0	1	0	0
	Myllocerous sp.2	2	1	1	2	1	0	2	2	1
	Myllocerous sp.3	11	2	1	1	1	1	3	1	1

TABLE 3.2. Species abundance in monsoon (M), winter (W) and summer (S) during 2001 from various study sites

FAMILY	SPECIES	SITE 1			SITE 2			SITE 3		
		M	W	S	M	W	S	M	W	S
Cicindellidae	Cicindela cardoni	0	0	0	0	0	0	0	0	0
	Unidentified sp 1	3	2	1	3	1	1	2	1	1
Carabidae	Anthia sexgulata (F.)	3	0	0	2	0	0	3	1	0
	Omphra rafipes (Klug)	3	2	1	3	0	0	3	0	0
	Chlaenius nepalensii (Hope)	1	0	0	2	0	0	3	0	0
	Chlaenius quadricolor	1	0	0	0	0	0	1	0	0
	Chlaenius nilgeriensis	1	0	0	0	1	0	0	0	0
	Lesticus desgodinsi	1	1	0	1	0	0	0	0	0
	Brachynus reyi	2	3	0	2	1	0	3	2	0
	Scarites eurytus	1	2	1	1	0	0	0	1	0
	Scarites bengalensis	2	0	0	0	0	0	0	0	0
	Scarites indicus	1	0	0	0	0	0	0	0	0
	Calosoma maderae	3	1	0	1	0	0	1	0	0
Dysticidae	Hydraticus vittatus	2	0	0	2	0	0	2	0	0
	Cybister confussus (Shp)	1	0	0	0	0	0	0	0	0
	Cybister tripunctatus (Var-Asciatus) (Shp)	1	0	0	1	0	0	1	0	0
Staphylinidae	Staphylinus sp	0	0	0	0	0	0	0	0	0
	Unidentified sp 1	2	3	1	3	2	1	3	2	1
	Unidentified sp 2	1	1	1	1	1	1	1	1	1
	Unidentified sp 3	2	1	2	3	1	1	3	1	2
Hydrophyllidae	Hydrophilus olivaceus (Fabr.)	2	1	0	1	0	0	1	0	0
	Stenolophus rufipes	1	0	0	0	0	0	4	0	0
Scarabaeidae	Anatona stillata (New)	0	0	0	20	0	0	0	0	0
	Adoretus kanaresis	2	2	0	1	1	0	3	0	0
	Adoretus stolioczkae	2	1	0	0	0	0	1	0	0
	Chilotoba acuta (Wied)	2	0	0	3	0	0	10	0	0
	Rhinyptia indica (Burm.)	4	2	0	3	2	0	2	0	0
	Onthophagus pactolus (F)	5	2	0	3	1	0	3	0	0
	Onthophagus atropolitus	3	2	0	1	0	0	2	0	0
	Onthophagus falusus	1	0	0	0	0	0	1	0	0
	Onthophagus rana	2	1	0	0	0	0	0	0	0
	Onthophagus tragus	2	0	0	0	0	0	1	0	0
	Onthophagus catta	1	2	0	0	0	0	0	0	0
	Cathorsius molossus	2	1	0	2	0	0	3	0	0
	Holotrichia reynaudi	1	2	0	2	0	0	1	0	0
	Heliocopris gigas	3	2	1	2	1	0	2	1	0
	Gymnopleura cyaneus	2	1	0	1	1	0	1	2	0
	Gymnopleura milians	6	2	0	2	1	0	2	2	0
	Gymnopleura koenigi	3	2	0	2	1	0	1	1	0
	Anomala bengalensis	1	1	0	1	0	0	1	0	0
	Copris numa	2	1	0	1	0	0	1	0	0
	Drepanocerus exsul	1	1	0	1	0	0	1	0	0
	Disphysema candezei	2	1	0	1	0	0	0	0	0
	Caccobius himalayanus	1	0	0	0	0	0	0	0	0

FAMILY	SPECIES	SITE 1			SITE 2			SITE 3		
		M	W	S	M	W	S	M	W	S
	Scarabaeus erichsoni	2	1	1	2	1	0	2	0	0
	Oxecetonia versicolor	0	0	0	100	4	0	0	0	0
	Oxecetonia jucanda	0	0	0	2	1	0	0	0	0
	Oxycetonia albopunctata	1	0	0	1	0	0	0	0	0
	Ochodius spp.	1	1	0	0	0	0	0	0	0
	Bolboceras quadndeus	1	0	1	1	0	0	1	0	0
	Clinteria spilota	3	1	0	2	1	0	1	0	0
	Trox granulatus	0	0	0	0	0	0	0	0	0
	Trox indicus	0	0	0	0	0	0	0	0	0
	Lachnosterna serrata	1	0	0	0	0	0	0	0	0
	Asenca spp	0	0	0	0	0	0	0	0	0
Buprestidae	Psiloptera spp.	2	0	0	0	0	0	2	0	0
	Psiloptera coerulea	2	0	0	0	0	0	1	0	0
	Sternosera spp.	1	0	0	0	0	0	1	0	0
	Evides elegans	4	0	0	0	0	0	0	0	0
	Sphenoptera curta	1	0	0	0	0	0	1	0	0
	Chrysochora spp.	1	0	0	0	0	0	0	0	0
Elataridae	Lanelater fuscipes	2	1	0	2	1	0	1	0	0
	Melanotus telum.	3	2	1	2	1	0	2	0	0
Lycidae	Plateros spp.	6	3	0	1	0	0	0	0	0
Lampyridae	Lamophorus spp	70	20	0	12	4	0	30	13	0
Canthandae	Tylocerus khasianus	1	2	0	2	1	0	1	1	0
	Cylindrothorax audioniui (Haag.)	1	1	0	1	0	0	1	0	0
Bostnchidae	Sinoxylon sudanicum	2	1	0	0	0	0	1	1	0
	Unidentified spp	1	1	0	2	0	0	0	0	0
Trogostidae	Alendna orientalis (Redten Bucher)	0	0	0	0	0	0	0	0	0
Cucujidae	Oryzaephilus suranamensis	4	2	3	5	3	2	1	0	0
	Laemotmetus insignis	2	1	1	1	1	1	1	1	1
Coccinellidae	Chilomenes sexmaculata	7	3	0	1	0	0	0	0	0
	Coccinella sevenpunctata	4	0	0	0	0	0	0	0	0
	Coccinella repanda	5	2	0	2	0	0	2	0	0
	Coccinella transversalia	3	0	0	0	0	0	0	0	0
Tenebnonidae	Platynotus perforatus (Muls.)	4	2	1	3	2	1	3	2	1
	Gonocephalum spp	2	1	0	1	0	0	1	0	0
	Rytinota impolata	5	3	2	4	1	1	40	1	1
	Mesomorpha billiger	1	2	0	2	1	0	0	0	0
	Opatrodes vicinus	1	0	0	1	0	0	1	0	0
Meloidae	Mylabris pustulata	2	0	0	1000	0	0	0	0	0
	Cyanealytta action	4	2	0	2	1	0	5	0	0
	Epicauta spp.	2	0	0	2	0	0	1	0	0
Anthicidae	Formicomus spp.	1	3	1	1	1	1	1	1	1
Cerambicidae	Acanthophorus serraticornis (Olive)	0	0	0	0	0	0	0	0	0
	Apomecyna saltrator	2	0	0	0	0	0	0	0	0
	Apomecyna perroteti	2	0	0	0	0	0	0	0	0
	Celosterna scabrator	6	2	0	4	0	0	4	0	0
	Xysrtocera globosa (Olive)	1	0	0	0	0	0	0	0	0
	Hypoeschrus stngosics	2	1	0	0	0	0	0	0	0

FAMILY	SPECIES	SITE 1			SITE 2			SITE 3		
		M	W	S	M	W	S	M	W	S
	Overia brevis	0	4	0	0	0	0	0	0	0
Bruchidae	Bruchus spp.	3	2	1	0	1	0	1	0	0
Chrysomelidae	Oides bipunctata (Fabr)	5	2	0	4	0	0	3	0	0
	Sindia clanthrata	2	1	0	1	0	0	1	0	0
	Corynodes decemnotatus	2	0	0	3	0	0	1	0	0
	Conchyloctenia nigrovittata	0	0	0	2	0	0	0	0	0
	Clytra spp 1	2	0	0	1	1	0	1	0	0
	Clytra spp 2	1	0	0	1	0	0	0	1	0
	Clytra succincta	3	2	0	2	0	0	1	0	0
	Hispa armiger	1	0	0	0	0	0	0	0	0
	Unidentified sp.2	1	0	0	0	0	0	0	0	0
	Unidentified sp 3	1	0	0	0	0	0	0	0	0
Brenthidae	Prophtalmus tridentatus	0	0	0	0	0	0	0	0	0
Curculionidae	Atactogaster djeani	2	1	0	0	1	0	2	0	0
	Amblyrrhimus poricollis	1	0	0	0	0	0	0	0	0
	Myllocerus pubscens	3	1	0	1	0	0	2	0	0
	Myllocerus pustulatus	2	1	0	1	1	0	2	0	0
	Myllocerous discolor	2	1	0	1	0	0	2	1	0
	Myllocerous sp. 1	1	0	0	0	0	0	1	0	0
	Myllocerous sp 2	3	2	0	3	1	0	2	1	0
	Myllocerous sp. 3	2	1	0	1	1	0	0	0	0
	Crytozemia dispar	1	0	0	0	0	0	1	0	0
	Lixus trycatalus	0	0	0	1	0	0	1	0	0

TABLE 3.3 Seasonal diversity of coleopterans at various study sites of Gir PA during 2000 and 2001.

Monsoon:

Study site	Species richness		Species diversity		Equitability	
	2000	2001	2000	2001	2000	2001
Site 1	107	100	4.48	3.9	0.947	0.824
Site 2	80	61	4.26	1.11	0.900	0.235
Site 3	74	69	4.19	3.46	0.885	0.730

Winter:

Study site	Species richness		Species diversity		Equitability	
	2000	2001	2000	2001	2000	2001
Site 1	80	61	4.33	3.78	0.914	0.799
Site 2	42	34	3.68	3.39	0.777	0.717
Site 3	42	21	3.58	2.58	0.756	0.534

Summer:

Study site	Species richness		Species diversity		Equitability	
	2000	2001	2000	2001	2000	2001
Site 1	23	16	3.14	2.69	0.662	0.568
Site 2	20	09	2.99	2.16	0.633	0.457
Site 3	22	08	3.09	2.04	0.653	0.431

TABLE 3.4 Coleopteran community similarity (C_j) between sites

Monsoon 2000

Study sites	Site 1	Site 2	Site 3
Site 1	---	0.67	0.69
Site 2	---	---	0.71
Site 3	---	---	---

Monsoon 2001

Study sites	Site 1	Site 2	Site 3
Site 1	---	0.60	0.64
Site 2	---	---	0.41
Site 3	---	---	---

Winter 2000

Study sites	Site 1	Site 2	Site 3
Site 1	---	0.44	0.47
Site 2	---	---	0.68
Site 3	---	---	---

Winter 2001

Study sites	Site 1	Site 2	Site 3
Site 1	---	0.46	0.30
Site 2	---	---	0.41
Site 3	---	---	---

Summer 2000

Study sites	Site 1	Site 2	Site 3
Site 1	---	0.79	0.73
Site 2	---	---	0.75
Site 3	---	---	---

Summer 2001

Study sites	Site 1	Site 2	Site 3
Site 1	---	0.56	0.50
Site 2	---	---	0.89
Site 3	---	---	---

TABLE 3.5 Number of coleopteran species shared between sites

Monsoon 2000

Study sites	Site 1 (107)*	Site 2 (80)	Site 3 (74)
Site 1	—	75	74
Site 2	—	---	64
Site 3	—	---	---

Monsoon 2001

Study sites	Site 1 (100)	Site 2 (61)	Site 3 (69)
Site 1	---	64	66
Site 2	---	---	55
Site 3	---	---	---

Winter 2000

Study sites	Site 1 (80)	Site 2 (42)	Site 3 (42)
Site 1	—	37	39
Site 2	—	—	34
Site 3	—	—	—

Winter 2001

Study sites	Site 1 (61)	Site 2 (34)	Site 3 (21)
Site 1	---	30	19
Site 2	---	---	16
Site 3	---	---	---

Summer 2000

Study sites	Site 1 (23)	Site 2 (20)	Site 3 (22)
Site 1	—	19	19
Site 2	—	—	18
Site 3	—	—	—

Summer 2001

Study sites	Site 1 (16)	Site 2 (09)	Site 3 (08)
Site 1	---	09	08
Site 2	---	---	08
Site 3	---	---	---

* Total Number of species in that site

FIGURE 3.1 *Acanthophorus serraticornis* (F) 0.4 X

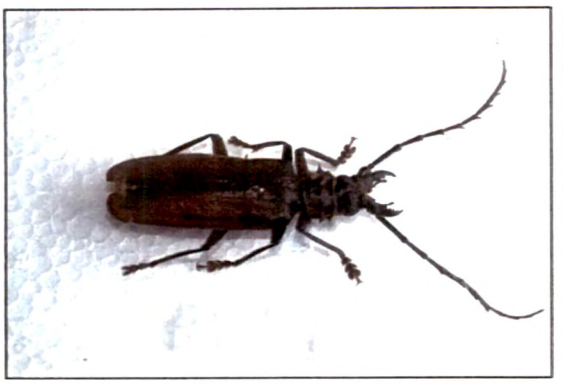


FIGURE 3.2 *Acanthophorus serraticornis* (M) 0.4 X

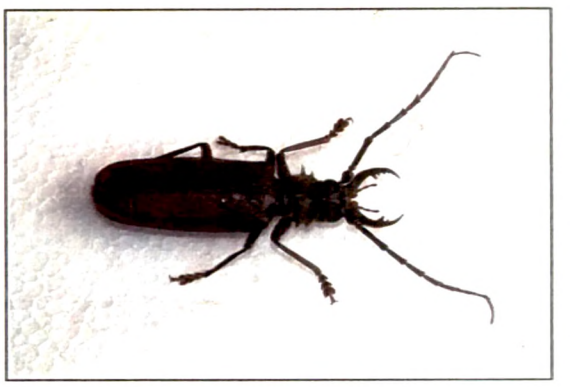


FIGURE 3.3 *Celosterna scabrator* 0.2X

FIGURE 3.4 *Sternocera spp* 0.5X

FIGURE 3.5 *Evides elegans* 1.2X

FIGURE 3.6 *Sindia clathrata* 0.8X

FIGURE 3.7 *Anthia sexguttata* 0.5X

FIGURE 3.8 *Chlaenius quadricolor* 1.2X

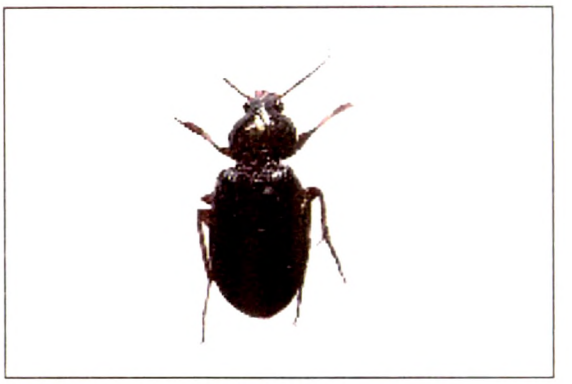


FIGURE 3.9 *Chlaenius nepalensii* 1.1X

FIGURE 3.10 *Chlaenius nilgiriensis* 1.2X

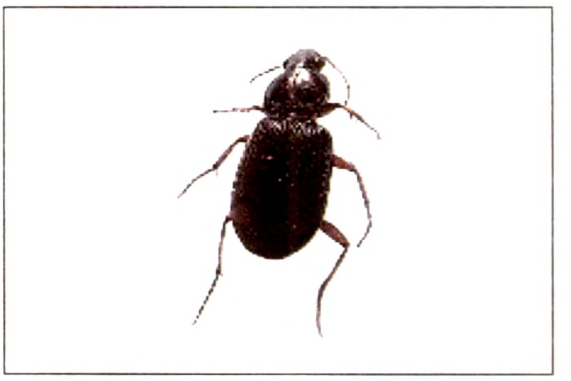


FIGURE 3.11 *Scarites bengalensis* 2.3X

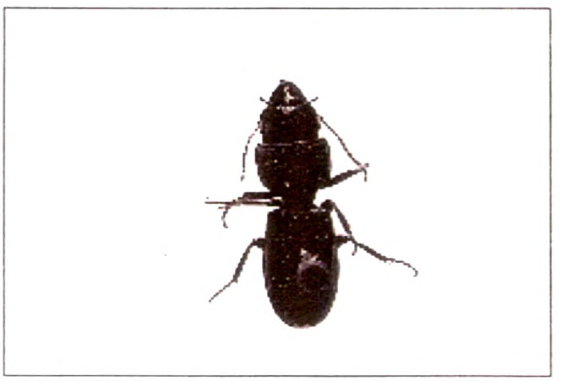


FIGURE 3.12 *Scarites indicus* 1.7X

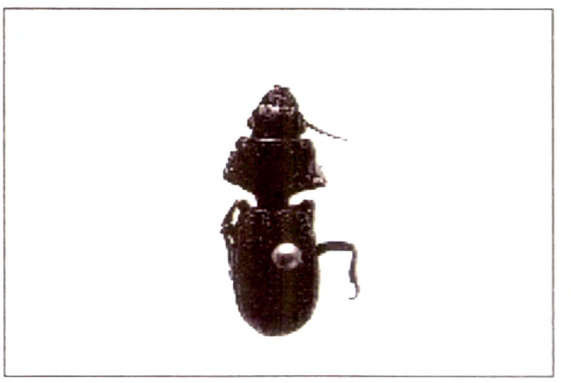


FIGURE 3.13 *Brachinus reyi* 1.3X

FIGURE 3.14 *Omphra rufipes* 1.2X

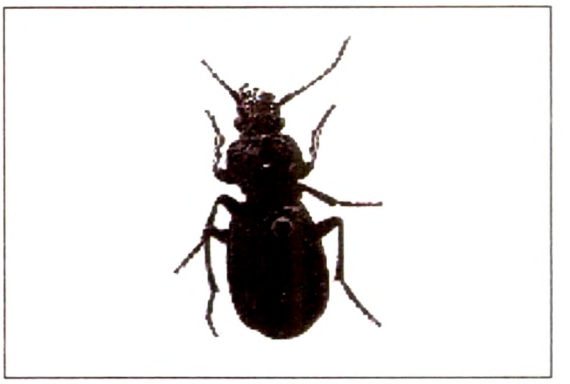


FIGURE 3.15 *Calosoma maderae* 1X

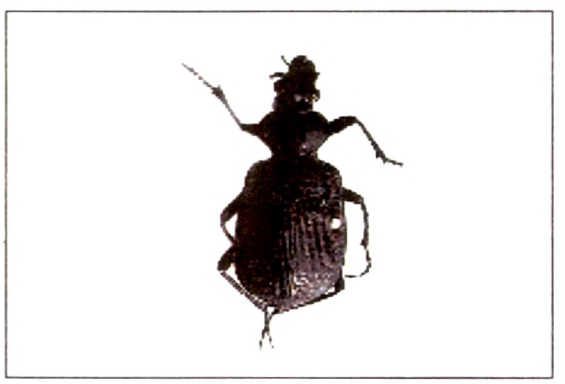


FIGURE 3.16 *Plateros spp.* 2.2X

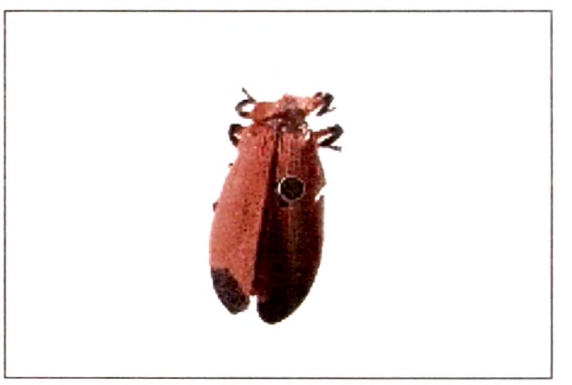


FIGURE 3.17 *Cybister tripunctatus* 1.8X

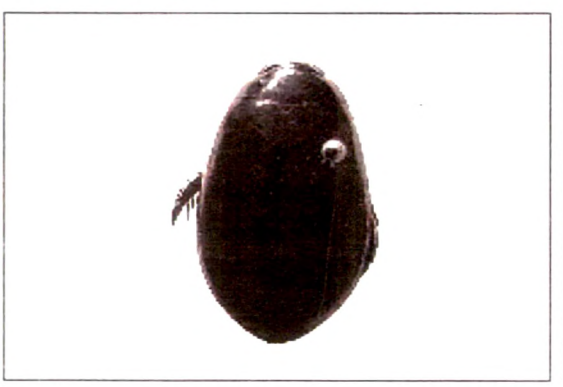


FIGURE 3.18 *Alendria orientalis* 2X

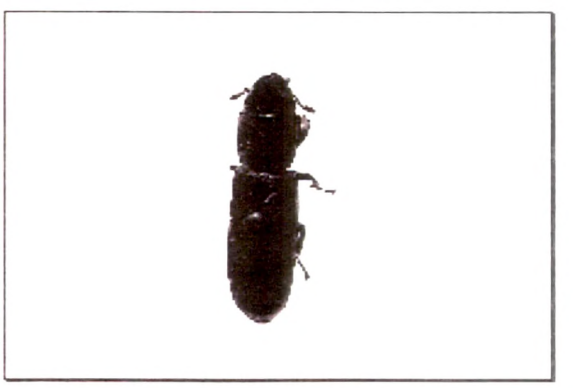


FIGURE 3.19 *Corynodes decemnotatus* 2.5X

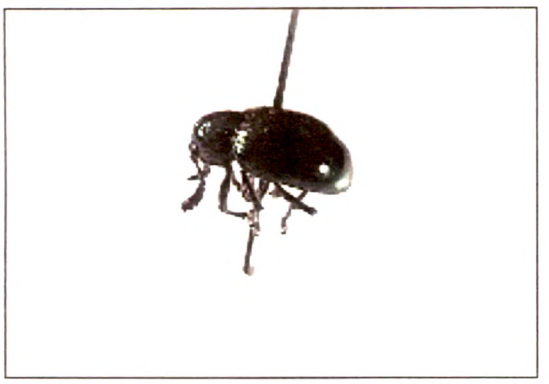


FIGURE 3.20 *Clytra succinata* 2X

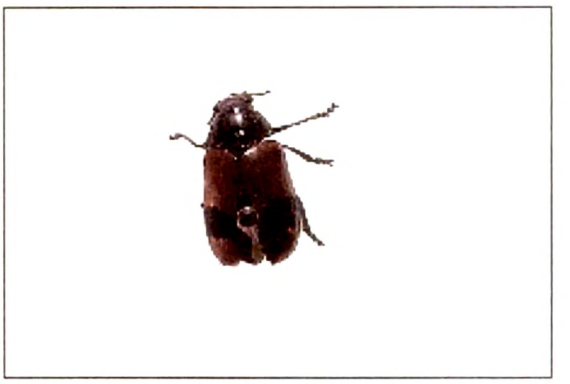


FIGURE 3.21 *Rytinota impolita* 1.1X

FIGURE 3.22 *Platynotus perforatus* 0.8X

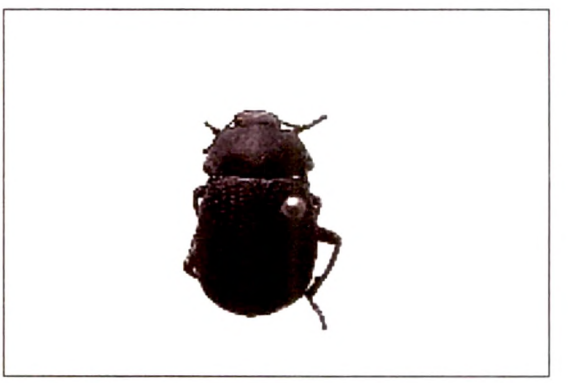


FIGURE 3.23 *Lanelater fuscipes* 1.1X

FIGURE 3.24 *Mylabris pustulata* 1.3X

FIGURE 3.25 *Cyaneolytta acteon* 3X

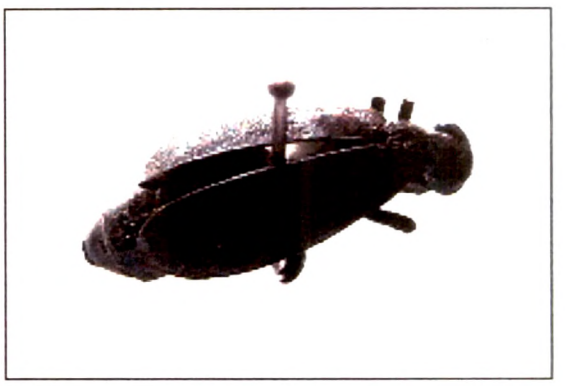


FIGURE 3.26 *Tylocerus khasianus* 1.9X

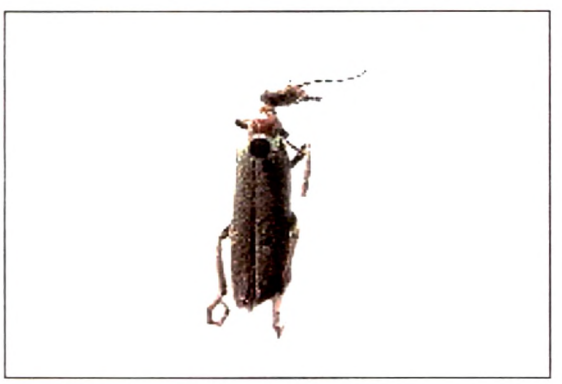


FIGURE 3.27 *Cylindrothorax audioniui* 1.5X

FIGURE 3.28 *Coccinella transversalis* 2.8X

FIGURE 3.29 *Coccinella sevenpunctata* 3.2X

FIGURE 3.30 *Scarabaeus erichsoni* 1.1X

FIGURE 3.31 *Heliocopris gigas* 1X

FIGURE 3.32 *Gymnopleurus cyaneus* 1.1X

FIGURE 3.33 *Gymnopleurus miliaris* 1.5X

FIGURE 3.34 *Oxycetonia jucunda* 2X

FIGURE 3.35 *Oxycetonia versicolor* 2.2X

FIGURE 3.36 *Oxycetonia alvopunctata* 2.7X

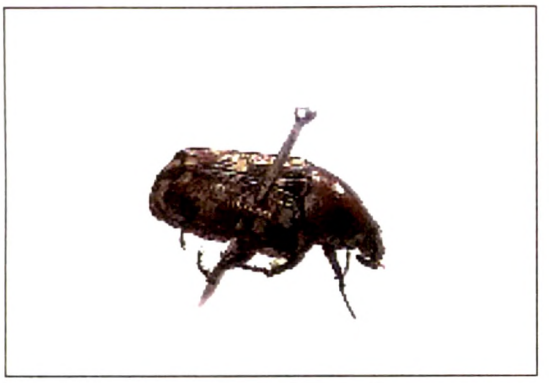


FIGURE 3.37 *Trox indicus* 2.2X

FIGURE 3.38 *Trox granulatus* 2.1X

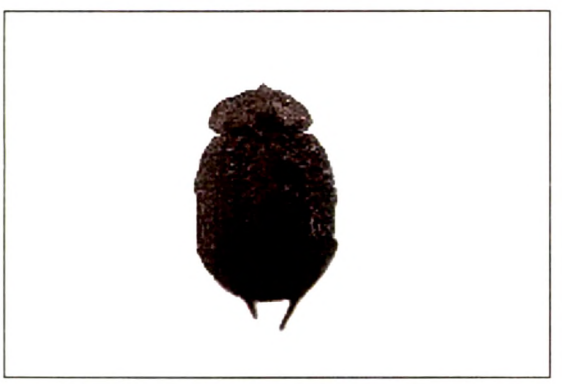


FIGURE 3.39 *Onthophagus tragus* 3.1X

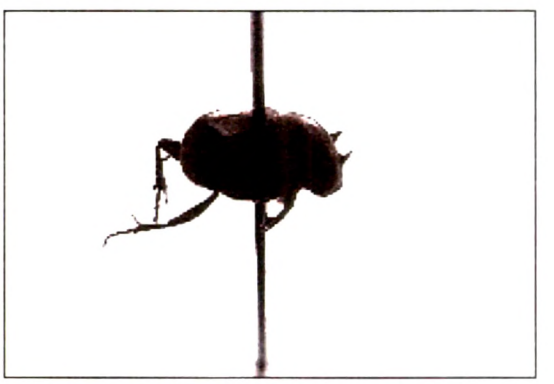


FIGURE 3.40 *Onthophagus rana* 3.8X

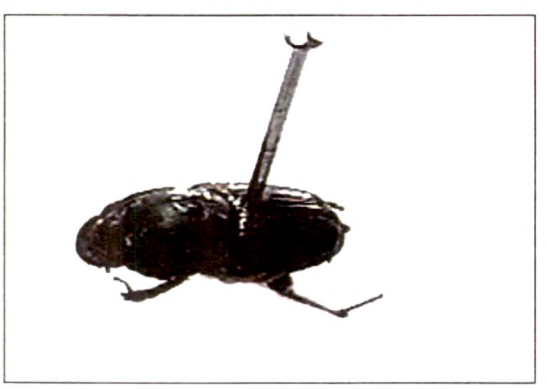


FIGURE 3.41 *Rhinyptia indica* 2X

FIGURE 3.42 *Copris numa* 1.8X

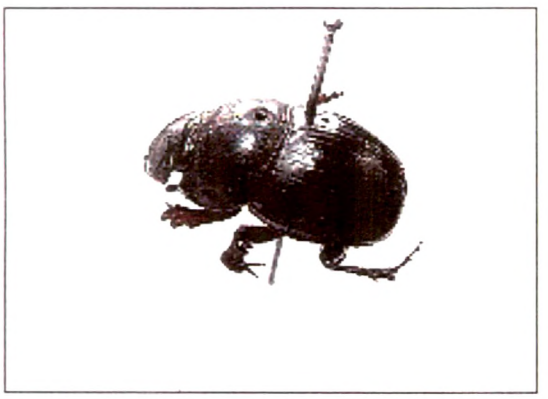


FIGURE 3.43 *Anomala bengalensis* 1.5X

FIGURE 3.44 *Ochodius spp.* 2X

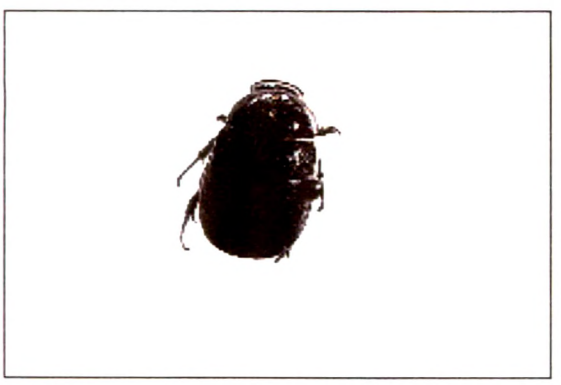


FIGURE 3.45 *Adoretus stoliczkae* 3.4X

FIGURE 3.46 *Adoretus kanarensis* 3.6X

FIGURE 3.47 *Lamprophorus spp.*.(Dorsal) 6.5X

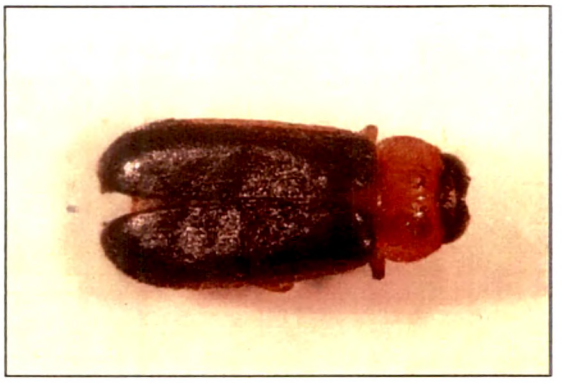


FIGURE 3.48 *Lamprophorus spp.*.(Ventral) 6.5X

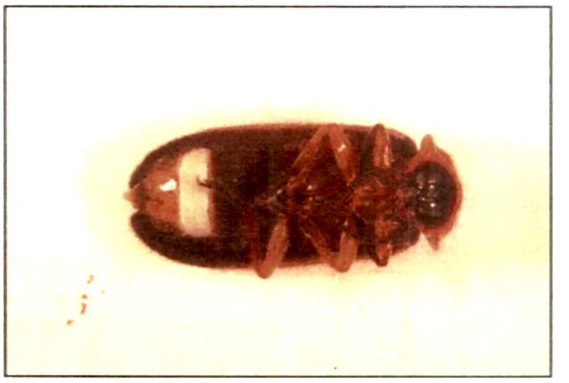


FIGURE 3.49 *Hispa armiger* 8.7X

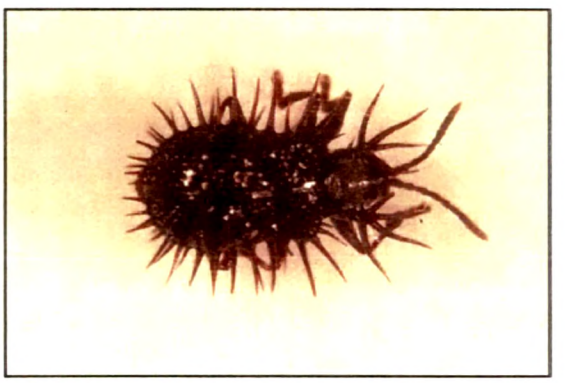


FIGURE 3.50 Mating Pair of *Anthia spp.*

FIGURE 3.51 Mating Pair of *Mylabris pustalata*