

# THE BEETLE FAUNA (INSECTA : COLEOPTERA) OF SOIL IN FOUR SMALL AREAS IN ALLAHABAD (U.P., INDIA)

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(With 1 Text-figure)

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## I—INTRODUCTION

The insect fauna of soil has been studied in its different aspects by Cameron (1913, 1917), Dammermann (1937), Ghilarow (1937), Glasgow (1939), Jacot (1940), King (1939), King and Atkinson (1927), Trehan (1945), and a number of other authors, and much interesting information has thus been accumulated. The information available under Indian conditions, however, is extremely limited.

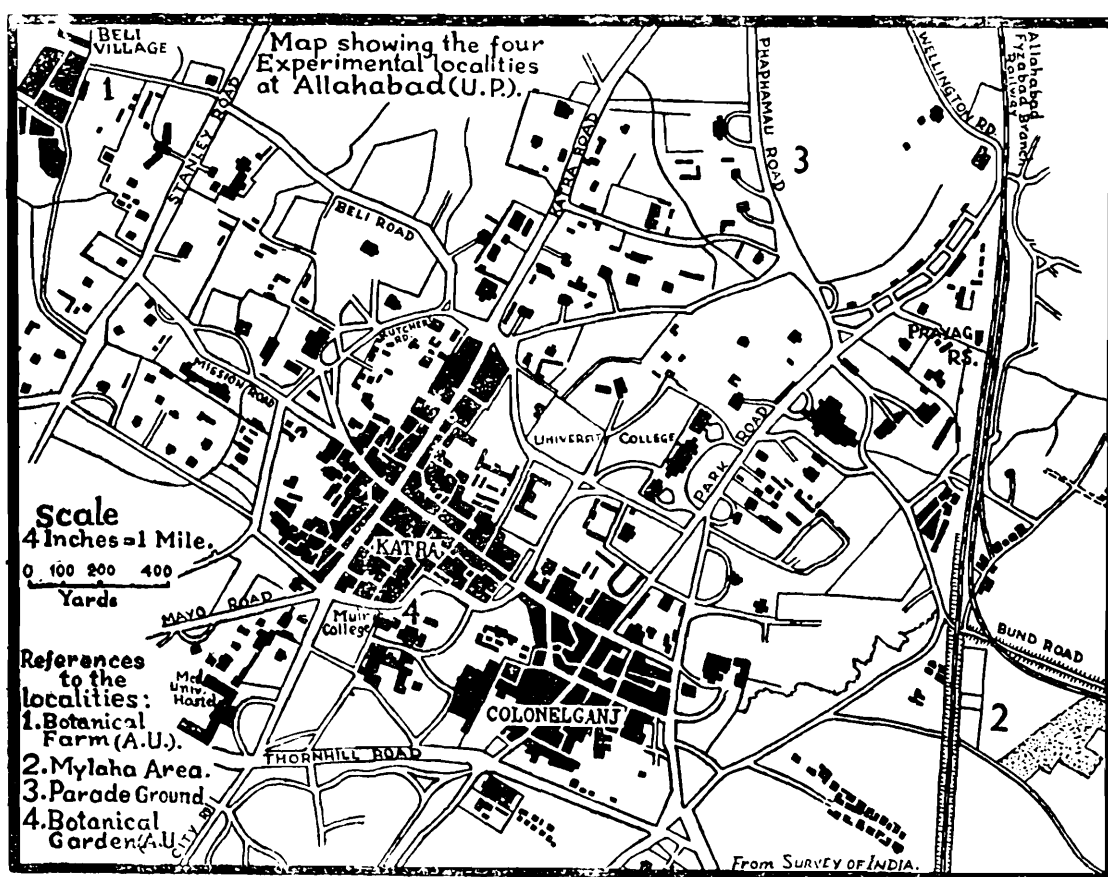
Some years ago (in 1949) I was able to carry out certain observations in four different localities (*vide infra*) in Allahabad (Uttar Pradesh). The observations were made during the *kharif* and part of the *rabi* seasons, *i.e.*, from the beginning of August to end of November, 1949. The localities selected were widely separated from one another and showed different physical conditions particularly in respect to its vegetation, manuring and nature and tillage of the soil. For a preliminary account of these studies, *vide* Kushwaha, 1959.

The observations were carried out while I was working in the Zoology Department of the University of Allahabad. I am thankful to Prof. H. R. Mehra for laboratory facilities and the late Shri S. C. Verma, Reader, for supervision. The identifications were carried out at the Forest Research Institute, Dehra Dun, and for assistance in this regard

I am indebted to the late Shri G. D. Bhasin, Assistant Systematic Entomologist, and to Shri Balwant Singh for valuable suggestions. My best thanks are due to Dr. M. L. Roonwal, Director, Zoological Survey of India, Calcutta, for critically going through the manuscript and making valuable suggestions for the improvement of the paper.

## II—MATERIAL AND METHODS

Field observations and collections of the soil coleopteran fauna were carried out regularly in all the four localities selected for this study. Besides these, many other coleopteran pests were observed damaging the aerial parts of the plants in these areas, but those have not been included here since they were not observed to exhibit the typical habits of the soil fauna particularly in the adult stage. For collections, the surface soil as well as the sub-surface soil mostly upto 22 cms. (ca. 9



TEXT FIG. 1.—Map showing the four experimental localities at Allahabad, U. P.

inches) depth, which is ordinarily the cultivable soil profile for the agricultural crops in general, were searched extensively and during cultivation the plough was followed closely in search of the specimens. All the families, and under each family all the genera and species, have been arranged alphabetically; the species which could not be identified have not been included. The whole collection was deposited in the Department of Zoology, University of Allahabad.

## III—DESCRIPTION OF THE FOUR EXPERIMENTAL LOCALITIES

1. *Botanical Farm, University of Allahabad.*—The farm is located about a mile north-west of the Muir Central College on the left side of

the road leading to village Beli. The soil was sandy, manured with compost as well as ammonium sulphate and irrigated with well water during the *rabi* season. The major area was under *jowar* (*Sorghum vulgare* Pers.) which followed wheat (*Triticum vulgare* Vill.); the adjoining crops included sugarcane (*Saccharum officinarum* L.), *arhar* (*Cajanus cajan* (Linn.) Millsp.; syn. *C. indicus* Spr.) and some solanaceous vegetables. The area was exposed to wind and sun.

2. *Mylaha Area, Tagore Town.*—The area lies about 2.5 kilometres south-east of the Muir Central College, and is about 65-75 metres south of the Bund Road and adjacent to an old graveyard in the north beyond the railway line running between Allahabad Junction and Prayag. All sorts of city refuse and animal carcasses are dumped in the area. The soil was more or less clayey in nature, with the upper profiles showing considerable deposit of humus. In the absence of drainage facilities, stagnant water got collected round about. The adjacent vegetation included castor (*Ricinus communis* L.), maize (*Zea mays* L.) and some solanaceous vegetables. The area was exposed to the sun, and the railway line running at a considerably high level formed wind-breaks.

3. *Parade Grounds, Chatham Lines.*—The area is about 2 kilometres north-east of the Muir Central College, and lies on the right side of the road leading to New Phaphamau. The land was lying fallow for several years and a portion of it was used for police parades. The soil is very poor in organic matter, and has a hard encrusted surface. It was cultivated with tomato (*Lycopersicum esculentum* Mill.) followed by *bajra* (*Pennisetum typhoides* Staph. & Hubbard) for the first year. During cultivation the plough was followed closely for insect collections. No manure was used and there was no source of water at hand for irrigation. The area was exposed to sun, and the trees of *neem* (*Azadirachta indica* A. Juss.) and *shisham* (*Delbergia sissoo* Roxb.) bordering the adjacent road formed wind-breaks

4. *Botanical Garden, University of Allahabad.* The garden is situated in the Muir Central College behind the Zoology and Botany Departments, with the Muir Road bounding it in a semi-circle and running north-east to south-west. The soil surface was covered considerably with organic matter. The area was partially shaded by trees of peach (*Prunus persica* Bth. & Hook. f.), *ashok* (*Saraca indica* L.), *simal* (*Salmalia malabarica* (DC.) Schott. D Fndl.; syn. *Bambax malabarica* DC.), *anjir* (*Ficus carica* L.), etc., on all the sides. Irrigation was by tap water.

#### IV—THE COLEOPTERAN FAUNA OF THE SOIL IN FOUR DIFFERENT LOCALITIES

##### (a) LIST OF SOIL COLEOPTERA FROM THE BOTANICAL FARM

##### Family 1. CARABIDAE (Ground beetles)

*Omophron* sp.: A single individual of *Omophron* sp. was collected, on 25th August 1949, from root region of *Jowar* (*Sorghum vulgare*) plant when the soil was not very moist, though these insects are semiaquatic in their habit.

*Siagona fabricii* Andrewes : A single specimen of *Siagona fabricii*, Andr. was found hidden on 25th August 1949 in soil crevices ; it was noticed to be a most active runner.

#### Family 2. CICINDELIDAE (Tiger beetles)

*Cicindela erudita* Wiedemann, *Cicindela sexpunctata* Linnaeus *Cicindela vigintiguttata* Herbst, and *Cicindela* sp. All the above species were collected between 4th August to 14th September 1949, but were most abundant in the 3rd and 4th weeks of August. They were mostly collected from surface on humid days and also by arranging light traps. All are predacious, swift runners with small but agile flights.

#### Family 3. MELOIDAE (Oil beetles, blister beetles)

*Cyaneolytta* sp. : Collected abundantly from 9th August to 3rd September 1949 on the surface, walking sluggishly and also observed on small plants of *jowar* (*Sorghum vulgare*), though no significant damage to the crop was observed. They are generally diurnal and herbivorous.

#### Family 4. SCARABAEIDAE (Dung-beetles, chafers, etc.)

*Alissonotum* sp. (Subfam. Dynastinae) : Collected from 6th September to 3rd October 1949, being abundantly observed in the 2nd week of September mostly about 5 cms. below soil amongst rootage of some wild creepers.

*Apogonia hopei* Ritsema (Subfam. Melolonthinae) : Collected from 28th August to 2nd October 1949, being observed more abundantly in the 1st and 2nd weeks of September, hardly 3 or 4 cms. below surface.

*Apogonia* sp. (Subfam. Melolonthinae) : Observed in abundance in the 3rd and 4th weeks of September and mostly collected under clods of earth or other such shelters on the surface.

*Bolbocerus inaequale* Westwood (Subfam. Geotrupinae) : Commonly observed throughout August and September, but more abundantly collected from 15th September onwards for a week or so on surface ; is a general feeder on dung or on truffle.

*Catharsius pithecius* Fabricius (Subfam. Coprinae) : Collected from 6th August to 27th August 1949, being observed more abundantly in 3rd week of August and collected about 7—12 cms. below the ground surface. The area inhabited by these beetles was indicated at the surface by ample loose, porous, pulverised soil with numerous large and small holes

*Chiron cylindrus* Fabricius (syn. *Chiron digitatus* Cast.) (Subfam. Chironinae) : Collected from 2nd September to 14th November 1949, but abundantly observed in the 1st and 2nd weeks of September and mostly collected from surface ; the larvae as well as adults feed on dung.

*Copris* sp. (Subfam. Coprinae) : Collected from 2nd August to 4th October 1949, being abundantly observed in the last week of August and the 1st and 2nd weeks of September. Collected just below soil amongst *C. pithecius*- (vide supra) under loose porous soil.

*Holotrichia seticollis* Moser (Subfam. Melolonthinae) : Collected from 28th August to 7th October 1949, being abundantly observed in the

1st and 2nd weeks of September, and mostly collected around the root region of *Jowar* plants, etc.; larvae are generally underground root feeders.

*Onitis* sp. (Subfam. Coprinae) : Collected from 29th July to 17th September 1949, about 9—12 cms. below soil surface. More abundantly observed in the beginning of August.

*Onthophagus gazella* Fabricius (Syn. *Onthophagus catta* Fabricius) (Subfam. Coprinae) : Commonly observed during August and September 1949, but occurring more abundantly in August ; collected about 10—12 cms. below soil. Search of their underground habitations revealed neither any dung nor any other visible organic matter which forms their usual food, though some species are known as carrion feeders and still others known as feeders on decomposed vegetable matter.

*Onthophagus* sp. Subfam. Coprinae) : Collected from 19th August to 25th September 1949, being more abundant in the 2nd and 3rd weeks of September. Observed mostly in upper profiles, hardly 4—6 cms. below ground.

*Oxycetonia versicolor* Fabricius (Subfam. Cetoniinae) : Only a few individuals were collected, from 7th August to 18th August 1949, under rubbish heaps of trash lying within the fields.

*Serica* sp. (Subfam. (Melolonthinae) : Collected from 3rd August to 14th September 1949, at about 7—9 cms. depth, in soil around the root region of the *jowar* plants, but also collected from the root region of *anar* (*Punica granatum* L.) plant on the Bund Road.

#### Family 5. STAPHYLINIDAE (Rove beetle)

*Paederus* sp. : Commonly observed during August and September but more abundant in the last three weeks of August. Mostly noticed running on ground under trash or in between overlapping leaf bases of crop-plants, particularly sugarcane. Have a characteristic, mobile abdomen moving up and down.

#### Family 6. TENEBRIONIDAE (Darkling ground beetles)

*Adesmia orientalis* Haag : Collected from 1st September to 8th October 1949, but observed only in meagre numbers ; hardly about 3 or 4 cm. below the loose soil. General scavengers ; light-seeking as well as light shunning species.

### (b) LIST OF SOIL COLEOPTERA FROM THE MYLAHA AREA IN TAGORE TOWN

#### Family 1. CARABIDAE (Ground beetles)

*Brachynus eucosmus* Andrewes : Collected from 7th August to 21st September 1949, near surface under trash or similar shelters.

*Brachynus* sp. : Collected from 27th August to 8th September 1949 in meagre numbers, mostly from surface under clods and also under a big stone.

*Callistomimus chalcocephalus* Wiedemann : Only 4 specimens were collected, on 10th and 13th November 1949, from surface ; noticed running actively from shelter to shelter.

*Chlaenius chlorodius* Dejean : Collected from 3rd to 24th August 1949, in meagre numbers and invariably found under clods on surface.

*Chlaenius duvauceli* Dejean : About a dozen specimens collected from 14th August to 29th August 1949, under clods and also under a small plank of wood lying in the filed.

*Chlaenius pretiosus* Chaudoir : Collected from 7th August to 3rd September 1949, just below surface about 4—5 cms. below soil.

*Melaenus piger* Fabricius : A single individual was caught on 17th August under a clod of earth.

*Siagona* sp. : Only 3 specimens were collected on 21st August 1949, from cracks at the base of stem of *lissora* plant (*Cordia dichotoma* Forst f., syn. *Cordia myxa* Roxb. non Linn.; and *Cordia obliqua* Willd.), at about 10—12 cms. depth from the soil surface.

#### Family 2. CURCULIONIDAE (Weevils)

*Lixus truncatulus* Fabricius : A single individual was collected, on 21st August from exposed surface.

*Tanymecus indicus* Faust : Collected from the beginning of August to the end of November 1949, but very abundant in August and September, in field as well as in houses, and is commonly seen attracted towards light at night. In field it was found under fallen leaves and trash.

#### Family 3. HISTERIDAE (Hister beetles, Steel beetles)

*Hister (Pachylister) chinensis* Quensel, and *Hister* sp. : Some individuals of these were collected from the subsurface, at about 3—6 cms. depth, from 9th August to 12th September 1949. Generally found in concealment and are nocturnal.

#### Family 4. SCARABAEIDAE (Dung-beetles, chafers, etc.)

*Chiron cylindrus* Fabricius (syn. *Chiron digitatus* Cast.) (Subfam. Chironinae) : Collected from the beginning of September to the middle of November 1949, but more abundant during September. Collected invariably at the base of plants.

*Hybosorus* sp. (Subfam. Hybosorinae.) : Only the larvae and pupae were collected lying mostly side by side, at about 10—12 cms. depth, from 2 to 23rd November 1949. Both the immature stages were successfully reared to adults.

#### Family 5. TENEBRIONIDAE (Darkling ground beetles)

*Adavius* sp. : Commonly collected throughout November 1949, at the base of plants in cracks.

*Cossyphus depressus* Fabricius : Collected from 4th September to 25th October 1949, being observed abundantly in the narrow spaces at the base of plants in the 2nd and 3rd weeks of September.

*Gonocephalum strangulatum* Fairmaire, and *Gonocephalum* sp. : Both these were collected from 6th August to 16th September 1949, but were more abundant in the 3rd week of August. Found hidden in narrow, shallow cracks in the soil, particularly at the base of the plants.

*Pachypterus infimus* Fairmaire : Collected amongst *C. depressus* Fabr. (*vide supra*).

*Sclerum reitteri* Gebien (syn. *Scleron reitteri* Gebien) : Collected from 1st to 29th November 1949, just below surface or on surface.

(c) LIST OF SOIL COLEOPTERA FROM THE PARADE GROUNDS IN  
CHATHAM LINES

Family 1. CARABIDAE (GROUND beetles)

*Amara* sp. : Collected from furrows behind the plough, abundantly from 3rd to 17th November 1949.

*Oxycentrus parallelus* Chaudoir : Collected from furrows behind the plough, from 2nd to 13th August 1949.

*Platymetopus flavilabris* Fabricius : Collected from furrows behind the plough, abundantly from 3rd to 17th November 1949.

*Scarites indus* Olivier : Collected from 1st August to 12th October 1949, but observed more abundantly in August ; about 12—15 cms. below soil.

*P. flavilabris* Fabr. and *S. indus* Oliv. were observed to be the most common representatives of this family in this area. Also, the last three species recorded above in this family were observed to be very active runners.

Family 2. CURCULIONIDAE (Weevils)

*Tanymecus indicus* Faust : Collected from the beginning of August to the end of November 1949, mostly from surface, but more abundant in August and September.

Family 3. SCARABAEIDAE (Dung-beetles, chafers, etc.)

*Chiron cylindrus* Fabricius (syn. *Chiron digitatus* Cast.) (Subfam. Chironinae) : Collected from 2nd September to 14th November 1949, on surface and upto 8 cms. depth. More abundant in the 1st and 2nd weeks of September.

*Onthophagus* sp. (Subfam. Coprinae) : Mostly collected in this area from the middle of October to the middle of November 1949 ; just below surface.

Family 4. TENEBRIONIDAE (Darkling ground beetles)

*Rhytinota* sp. : Only one specimen was collected, about 9 cms. below soil, on 15th September 1949.

(d) LIST OF SOIL COLEOPTERA FROM THE BOTANICAL GARDEN

Family 1. CARABIDAE (Ground beetles)

*Calosoma maderae* Fabricius var. *indicum* Hope : A single specimen was collected on 4th August 1949, about 13 cms. below soil under a flower pot growing fern where the soil was sufficiently moist.

*Chlaenius malachinus* Motschulsky : Collected from 15th August to 11th September 1949.

*Chlaenius nitidicollis* Dejean : Collected from 27th October to 30th November 1949.

*Chlaenius rayotus* Bates : Collected from 19th August to 4th October 1949, but abundant in the last week of August and the 1st week of September.

*Chlaenius trinotatus* Laferte, *Chlaenius xanthospilus* Wiedemann, and *Pheropsophus catoirei* Dejean : All these three species were collected amongst *C. rayotus* (*vide supra*) to which these species were observed to closely correspond in duration of occurrence as well as intensity.

*Rhopalopalpus janthinus* Redtenbacher (syn. *Rhopalistes janthinu* Redt.) : Except the species of *Calosama*, all the above Carabidae were collected from the surface of heaps of garden refuse including mainly the dry tree leaves dumped just behind the Entomology Laboratory under the shade of trees and a temporary shed. The heaps had sufficient moisture inside. *R. janthinus* Redt. was observed to be an active predator on small Blattids. *P. catoirei* Dej. is armed with a defensive apparatus for the discharge of a volatile, caustic fluid.

#### Family 2. SCARABAEIDAE (Dung-beetles, chafers, etc.)

*Adoretus* sp. (Subfam. Rutelinae) : Only three adults were collected from the root region of *gurhal* (*Hibiscus rosa sinensis* Linn.) plant on 9th September 1949. They are generally nocturnal defoliators in the beetle stage, mainly feeding at night ; and are injurious to rootlets of plants in the larval stage. Several common Indian species of this genus have been reported to feed upon roses (*Rosa* sp.), cannas (*Canna* sp.), vines (*Vitis vinifera* L.), mangoes (*Mangifera indica* L.) and other cultivated plants.

*Chiron cylindrus* Fabricius (syn. *Chiron digitatus* Cast.) (Subfam. Chironinae) : Collected from surface under refuge, mostly in the 1st and 2nd weeks of September (*vide supra*).

*Gymnopleurus parvus* Macleay (Subfam. Coprinae) : A few individuals were collected from 5th to 19th September 1949, invariably under refuge, though slightly buried at subsurface.

*Hybosorus* sp. (Subfam. Hybosorinae) : A few individuals were collected from 3rd to 20th September 1949, from surface under refuge.

#### Family 3. TENEBRIONIDAE (Darkling ground beetles)

*Gonocephalum depressum* Fabricius, and *Gonocephalum* sp. : Collected from 18th October to 21st November 1949, but observed more abundantly in the 1st and 2nd weeks of November. Commonly found under refuge on surface ; and noticed slowly coming out to cleaned areas, particularly in the forenoons, from their hidden places. Many of them were coming to the cemented floor of the laboratory. *G. depressum* Fabr. was also noticed in great numbers under *anjir* (*Ficus carica* L.) tree among five cockchafer grubs which were cannibalistic in habit.



## V—SUMMARY

1. The Coleopteran fauna of soil was studied at Allahabad from August to November, 1949, in four limited areas with variable physical conditions of vegetation, manuring and tillage of soil.

2. Altogether 68 species were collected, of which 57 could be indentified. They belong to 40 genera of 8 families, viz., Carabidae, Cicindelidae, Curculionidae, Histeridae, Meloidae, Scarabaeidae, Staphylinidae, and Tenebrionidae. The Elaterids could not be satisfactorily identified. Family Scarabaeidae is represented by 8 subfamilies, viz., Cetoniinae, Chironinae, Coprinae, Dynastinae, Geotrupinae, Hybosorinae, Melolonthinae and Rutelinae.

3. A total of 22 species, belonging to 18 genera of 6 families, are recorded from the Botanical Farm ; 20 species, belonging to 15 genera of 5 families, from the Mylaha Area ; 14 species, belonging to 9 genera of 3 families, from the Botanical Garden ; and 8 species, belonging to 8 genera of 4 families, from Parade Grounds.

4. Cicindelids and Carabids predominated in the Botanical Farm ; Carabids and Tenebrionids in the Mylaha ; and Carabids in the Botanical Garden and the Parade Grounds.

5. The families Carabidae, Scarabaeidae and Tenebrionidae were represented more or less in all the four areas. The Cicindelids and the Meloids were recorded only from the Botanical Farm, and the Histerids only from the Mylaha. Further, the Curculionids were absent from the Botanical Garden, whereas the Staphylinids were absent both from the Mylaha and the Botanical Garden.

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## VII—APPENDIX

## LIST OF THE COLEOPTERAN FAUNA COLLECTED AT ALLAHABAD

## Family 1. CARABIDAE

*Amara* sp.

*Brachynus eucosmus* Andrewes

*Brachynus* sp.

*Collistomimus chalcocephalus* Wiedemann

*Calosoma maderae* Fabricius var. *indicus* Hope

*Chlaenius chlorodius* Dejean

*Chlaenius duvauceli* Dejean

*Chlaenius malachinus* Motschulsky

*Chlaenius nitidicollis* Dejean

*Chlaenius pretiosus* Chaudoir

*Chlaenius rayotus* Bates

*Chlaenius trinotatus* Laferte

*Chlaenius xanthospilus* Wiedemann

*Melaenus piger* Fabricius

*Omophron* sp.

*Oxycentrus parallelus* Chaudoir

*Pheropsophus catoirei* Dejean

*Platymetopus flavilabris* Fabricius

*Rhopalopalpus janthinus* Redtenbacher (syn. *Rhopalistes janthinus* Redt.)

*Scarites indus* Olivier

*Siagona fabricii* Andrewes

*Siagona* sp.

## Family 2. CICINDELIDAE

*Cicindela erudita* Wiedemann

*Cicindela sexpunctata* Linnaeus

*Cicindela vigintiguttata* Herbst

*Cicindela* sp.

## Family 3. CURCULIONIDAE

*Lixus truncatulus* Fabricius*Tanymecus indicus* Faust

## Family 4. HISTERIDAE

*Hister (Pachylister) chinensis* Quensel*Hister* sp.

## Family 5. MELOIDAE

*Cyaneolytta* sp.

## Family 6. SCARABAEIDAE

## Sub-family (i) CETONIINAE

*Oxycetonia versicolor* Fabricius

## Sub-family (ii) CHIRONINAE

*Chiron cylindrus* Fabricius (syn. *C. digitatus* Cast.)

## Sub-family (iii) COPRINAE

*Catharsius pithecius* Fabricius*Copris* sp.*Gymnopleurus parvus* Macleay*Onittis* sp.*Onthophagus gazellu* Fabricius (syn. *O. catta* Fabr.)*Onthophagus* sp.

## Sub-family (iv) DYNASTINAE

*Alissonotum* sp.

## Sub-family (v) GEOTRUPINAE

*Bolbocerus inaequale* Westwood

## Sub-family (vi) HYBOSORINAE

*Hybosorus* sp.

## Sub-family (vii) MELOLONTHINAE

*Apogonia hopei* Ritsema*Apogonia* sp.*Holotrichia seticollis* Moser*Serica* sp.

## Sub-family (viii) RUTELINAE

*Adoretus* sp.

## Family 7. STAPHYLINIDAE

*Paederus* sp.

## Family 8. ENEERIONIDAE

*Adavius* sp.

*Adesmia orientalis* Haag

*Cossyphus depressus* Fabricius

*Gonocephalum depressum* Fabricius

*Gonocephalum strangulatum* Fairmaire

*Gonocephalum* sp.

*Pachypterus infimus* Fairmaire

*Rhytinota* sp.

*Sclerum reitteri* Gebien (syn. *Scleron reitteri* Gebien)