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Taxonomic study of the main families of Egyptian Coleoptera with forensic Importance

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Abstract: The present work was carried out to create taxonomic study to the members of order Coleoptera with forensic importance. Twenty nine species under twenty one genera and nine families were collected from decaying carcasses (Rabbits & Guinea pigs). Keys, diagnosis, synonyms, photographs and the forensic importance were given to clarify the status of each species.

Keywords: Forensic entomology; Anobiidae; Histeridae; Taxonomy; Egypt.

1. Introduction:

Coleoptera (beetles and weevils) comprise the largest and most varied order of insects on earth, making up about 40% of all insects. There are about166 families and over 350, 000 species of beetles worldwide. Beetles variablein shapes and colors and can range from 0.4 to about 80 millimetres in length. Members of order Coleoptera may consume animal and plant debris, flesh, waste material, fungi, pollen, flowers or fruits. Some types of beetles can harm agricultural crops while others consume harmful insects (http://insects.about.com/od/beetles/p/char_coleoptera.htm).

Coleoptera is one of the most important orders of insects represented on carcasses and its forensic importance has been commonly recognized. The different species of beetles increase in number during advanced stages of decomposition outdoor and are absent or less represented indoor (Goff 1991& Almeida and Mise, 2009).According to the present work the families of Coleoptera of forensic interest are: family Staphylinidae, the most diverse one which represented by 10 species and 7 genera within 5 subfamilies; family Tenebrionidae, the 2nd one in representation which represented by 4 species and 4 genera within unique subfamily; family Dermestidae, the 3rd one which represented by 4 species and 2 genera in 2 subfamilies; followed by family Anobiidae which represented by 3 species and 3 genera within 3 subfamilies; family Histiridae which represented by 4 species under one genus in one subfamily while families Anthicidae, Cleridae, Latridiidae and Nitidulidae appeared the lowest representation, each of them represented by only one species and one genus under one subfamily. Members of these families are associated with carcasses; some of them can feed on cadaveric tissues (necrophagous) while the others can feed on the body of the insects, such as larvae of Diptera or other Coleopterous species (necrophilous).

Throughout this search, we provide a brief taxonomic study for the adults of order Coleoptera of forensic importance that are collected on corpses to facilitate the identification of carrion beetles.

2. Material and Methods

Samples of adult stages collected from, on, in, around and beneath the carcasses by sweep net and forceps. Adult live specimens were killed, some of them placed into a vials which were then put into a freezer (-20^{o}C), while the other specimens were pinned, labeled and identified. Dead samples (if any) were also removed and maintained in a domestic freezer (-20^{o}C). The specimens were examined under LABOMED, CZM4 dissecting, light binocular microscope. The photos were taken by digital camera (Sony Dsc-W610).

3. Results and Discussion

Key to the Families

1- Elytra short, leaving one or more complete abdominal segments exposed (fig. 1)..... 2

- Elytra covering tip of abdomen, or leaving only a part of the last abdominal segment exposed 4

2- Tarsi with more than 3 segments, tibia flattened with spines or teeth (fig. 1)..... **Histridae.**

- Tarsi with apparently 3 or fewer segments, tibia not as above 3

3- Elytra very short, leaving 3 or more abdominal segment exposed (fig.2) ..... **Staphylinidae**.

- Elytra longer, leaving only one or two abdominal segment exposed (fig. 3)..... **Nitidulidae.**

4- Terminal segment of antennae enlarged, forming a club of various sorts (fig. 4) 5

- Antennae not clubbed, but filiform, moniliform, serrate, pectinate or gradually and only very slightly enlarged distally (fig. 5)…… 8

5- All tarsi with apparently 4 or fewer segment …… 6 -Tarsi

5-5-5, 5-5-4 or 5-4-4…… 7

6- Tarsi apparently 3-3-3, 2-3-3 or 2-2-3 …… **Latridiidae.**

- Some or all tarsi apparently 4-segmented, 4th tarsal segment very small and difficult to see (fig. 6) …… **Cleridae.**

7- Front coxae conical and prominent …… **Dermestidae.**

- Front coxae small, usually rounded and not prominent …… **Anobiidae.**

8- Frontal coxal cavities open behind, ant-like in shape (fig. 7) …… **Anthicidae.**

- Frontal coxal cavities closed behind, not as such …… **Tenebrionidae.**

1-Family: Anobiidae Fleming, 1821

(Death Watch Beetles)

Diagnoses:

Small dull colored beetles; body 2-9 mm in length; cylindrical to oval with pubescent. Head deflexed, concealed from dorsal view by the hoodlike pronotum; antennae variable; most species have the last 3 antennal segments enlarged and lengthened; and few have serrate or pectinate antennae. Abdominal segments not exposed from elytra.

Notes:

Some larvae of Anobiids feed on dried animal and plant remains and some other bred in dung. Members of subfamily Ptininae observed on old carcasses with other members of Tenebrionidae eating the dried remains.

Key to subfamilies

1- Antennal insertions present between eyes, close together, separated by a distance relatively as long as the length of scape (fig. 8); coxal plates of metathorax absent; abdominal ventrites 1–3 mostly fused; Spider-like in appearance…..... **Ptininae** Latreille

- Antennal insertions present in front of each eye, far apart, separated by a distance relatively more than 0.5X the total width of the frons (fig. 9); coxal plates of metathorax nearly always present; abdominal ventrites 1–2 mostly fused..... **2**

2-Head strongly deflexed and extended posteriorly (fig. 10); mandibles reaching or nearly reaching metathoracic ventrite… **Xylentininae** Gistel

-Head deflexed but not extended posteriorly (fig. 11); mandibles never reaching metathoracic ventrite…… **Anobiinae** Kirby

1-Subfamily: **Anobiinae** Kirby, 1837

Genus: ***Stegobium*** Motschulsky, 1860

Stegobium paniceum Linnaeus, 1758

(figs. 11 & 12)

Stegobium paniceum Linnaeus, 1758.

Stegobium ferrugineum Herbst, 1783.

Stegobium testaceum Thunberg, 1784.

Stegobium tenuistriatum Say, 1825.

Stegobium obesum Melsheimer, 1846.

Stegobium nanum Kuester, 1849.

Diagnosis:

Body 2.25 - 3.5 mm in length, cylindrical, elongated beetles; brown to reddish brown in color. Head bent downward but not result in a distinct humpbacked appearance; antennae with last 3 segments enlarged forming club. Elytra with longitudinal rows of fine hairs and punctures giving it the striated appearance.

2-Subfamily: **Ptininae** Latreille, 1802

Genus: ***Ptinus*** Linnaeus, 1767

Ptinus variegatus Rossi, 1794

(fig. 8)

Ptinus variegatus Rossi, 1794.

Pinus ornatus Dahl, 1823.

Ptinus duvali Lareynie, 1852.

Ptinus mutandus Marsham, 1886.

Diagnosis:

Body 3-4 mm in length, with pubescence forming bands more or less diffuses on the body. Head and pronotum much narrower than elytra; antennae long, thread-like. Pronotum with scaly yellowish white pubescence especially in the basal part.Elytra with front borders sharp-angled while posterior third oval in shape, with well developed humeral callus. Metathoracic trochanter short, its apex not reaching the elytral margin. Abdominal ventrites being subequal in width to the elytra when viewed ventrally.

3-Subfamily: **Xylentininae** Gistel, 1856

Genus: ***Lasioderma*** Stephens, 1835 ***Lasioderma serricorne*** (Fabricius, 1792) (figs. 9&10)

Ptinus serricorne Fabricius, 1792.

Ptilinus testaceus Duftschmid, 1825.

Lasioderma testaceum Stephens, 1835.

Xyletinus testaceus Duftschmid, 1835.

Lasioderma castaneum Melsheimer, 1846.

Diagnosis:

Small brown rounded to elongate beetle, body 4 - 4.5 mm in length. Head concealed under pronotum when disturbed, this gives the beetle “humped” appearance. Antennaeserrate with 11 segments. Thorax and elytra smooth with inconspicuous pubescence of yellow-colored bristle; striation hardly visible.

2-Family: Anthicidae Latreille, 1819 (Ant-like Beetles)

Diagnosis:

Ant-like flower beetles; small to medium in size. Dark brown or black in color; body covered with setae. Head constrict forming a nick; antennae slender with 11 segments, usually filiform, serrate or weakly clubbed. Pronotum narrowed posteriorly make the

insects having an ant appearance. Legs slender; tarsal formula 5-5-4.

Note:

Anthicid beetles are scavengers and opportunistic predators of small arthropods. Adults of these beetles are active on the soil surface or are found on flowers or with heaps of dead and decaying vegetables where they are said to feed mainly on dead beetles, though apparently they are omnivorous on a wide range of invertebrates.

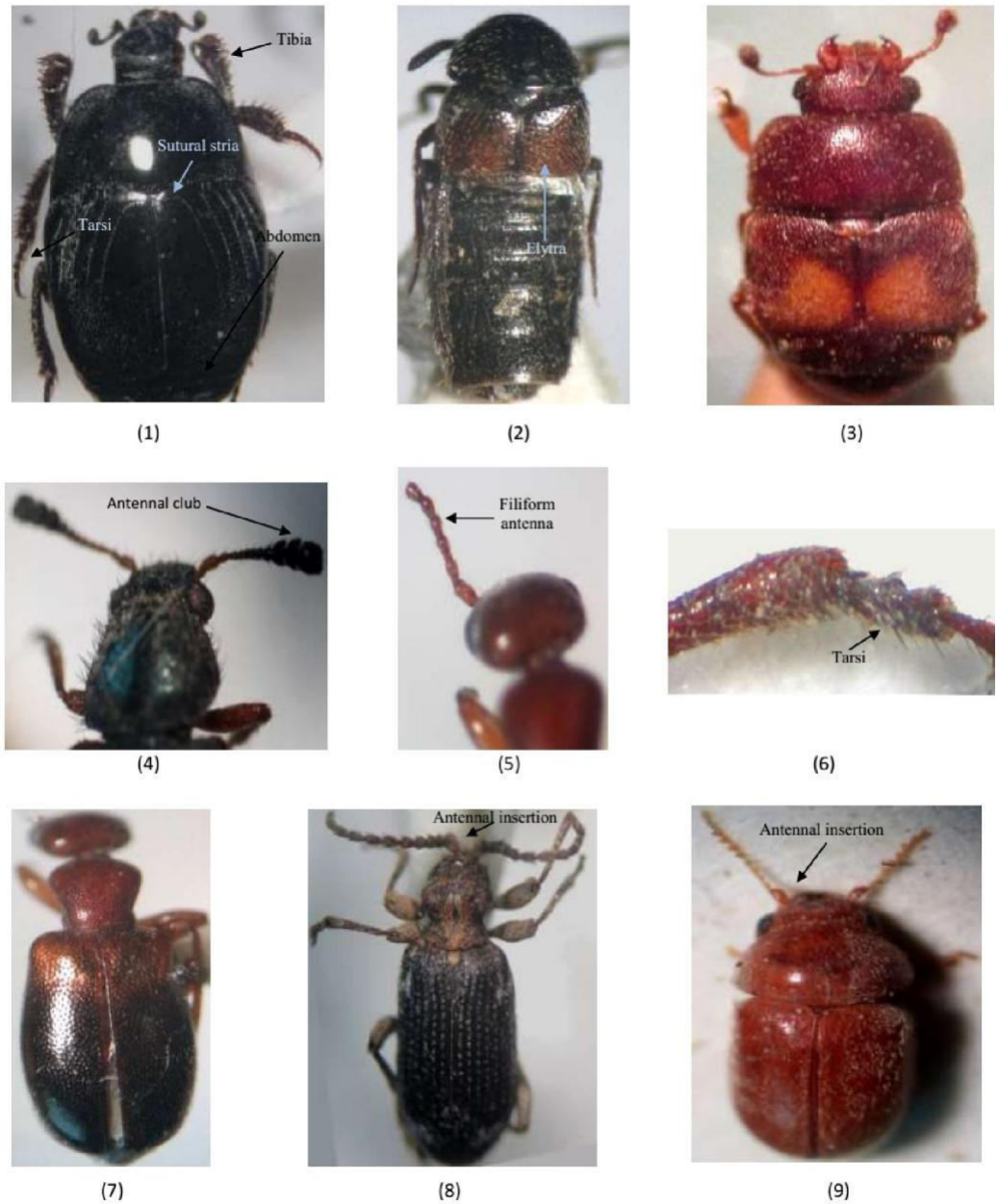

Plate I: 1. ***Saprinus caerulescens*** (Hoffmann, 1803), adult dorsal view; 2. ***Aleochara moesta*** Gravenhorst, 1802, adult dorsal view; 3. ***Carpophilus hemipterus*** (Linnaeus, 1758), adult dorsal view; 4&6. ***Necrobia rufipes*** (De Geer, 1775), 4. Antennal club, 6.Tarsus of fore leg; 5&7.***Anthicus floralis*** (Linnaeus, 1758), 5. Antennae, 7. Adult dorsal view; 8. ***Ptinus variegatus*** Rossi, 1794, adult dorsal view; 9. ***Lasioderma serricorne*** (Fabricius, 1792), adult dorsal view.

Subfamily**: Anthicinae** Latreille, 1819

Genus**: *Anthicus*** (Paykull, 1798)

Anthicus floralis(Linnaeus, 1758) (figs. 5 & 7)

Meloe floralis Linnaeus, 1758.

Notoxus calycinus Panzer, 1795.

Anthicus fuscus Marsham, 1802.

Anthicus basalis Villa, 1838.

Hemantus floralis Casey, 1895.

Diagnosis:

Body 2.9 mm in length, elongated with the dorsal surface covered with sparsely fine, short setae;shining pale to dark brown in color. Antennae filiform with 11 segments, reddish brown in color. Pronotum broad slightly constricted before base. Elytral base with definite shoulders, punctuated but not striated, light in basal fourth, but uniformly dark behind. Legs light brown in color, tarsal formula 5-5-4. Abdomen with 6 visible sternites, last abdominal segment exposed from elytra.

3-Family: Cleridae Latreille, 1802
(Checkered Beetles)

Diagnosis:

Body 3–24 mm. in length; elongated and oval in shape; the entire body covered with bristly hairs; many with ornate body color pattern red, yellow, orange, or blue. Antennae clubbed for most species; others can be serrate or filiform. Pronotum nearly cylindrical narrower than elytra forming a nick; elytra with tiny pits; tarsal formula 5-5-5; one or more of these subsegments in each leg typically lobed, the 4th tarsi normally difficult to distinguish. Two tergites at most exposed from elytra.

Notes:

Clerids have a minor significance in forensic entomology. Some species are occasionally found on carrion in the later dry stages of decomposition for example: *Necrobia rufipes* infests dried skins and bones of dead animal carrions predating various species of necrophagous insects.The members of this family found in close relation with dermestids, nitidulids, anobids larvae, ants and mites feeding on the keratin, hair and feathers of the corpse. In some exceptional cases, especially in hot areas, they can be found when the carcass is bloated, i.e. in the early stages of decay, at which time they feed on dipteran larvae and muscle tissue.

Subfamily**: Korynetinae** Laporte, 1836
Genus**:*Necrobia*** Olivier, 1795 ***Necrobia rufipes***(De Geer, 1775) (figs. 4&13)

Clerus rufipes De Geer, 1775.
Necrobiadermestoides Pill et Mitterp., 1783.
Necrobiaglabra Champollion, 1814.
Necrobiamumiarum Hope, 1834.
Necrobia foveicollis Schenkling, 1900.

Diagnosis:

Body 5 mm. in length, elongated, oval in shape, with subparallel sides.Body entirely shining metallic bluish-green.Head slightly punctured; antennae 11 segments with blackish antennal club.Scutellum small and transverse. Elytra long more in length than in width, covered with bristle-like hairs, with 10 longitudinal rows of punctures; sides of thorax and elytra with stiff bristle-like hairs.Legs moderately long, reddish brown or orange in color.

4-Family: Dermestidae Latreille, 1807 (Skin Beetles)

Diagnosis:

Body 2-12 mm. in length; majority oval and convex in shape, sometimes elongated, covered with scales or setae; most species dark in color but some with bright patterns of white, yellow, orange and brown patches. Antennae clubbed, fit into deep grooves. Hind coxae transverse and excavated; hind femora contiguous and fit into recesses of the coxa; tarsal formula 5-5-5.

Notes:

Dermestids typically appear late in the decomposition process, when the corpse begins to dry out, forensic entomologists look for dermestid beetles at crimes scenes when trying to determine the time of death of a cadaver. *Dermestes ater* De Geer, *Dermestes frischii* Kugelann and *Dermestesmaculates* De Geer are the most important dermestid members in forensic entomology. The larvae of *Dermestes ater* are very important in forensic science used in estimation of post mortem interval of dead bodies and used as alternative DNA in toxicological analysis. In the study of mummies, the presence of *D. ater* was used as a non-destructive tool toindicate the cadaver's exposure time prior to mummification. *D. frischii* occurs on carrions and animal skin so its presence on a body can provide valuable chronological information for determining when death occurred. *D. maculates* has the ability to clear skin and hair off bodies cleanly, thus it can be used to clean bones to assist with forensic cases.

Cleaned bones can recommend greatly information, such as age and gender, or indication to trauma, and possibly marks left in the bone by knives or saws.

Key to Subfamilies

1- Median ocellus present on front (fig. 14), pronotum with strong raised ridge near side margin in basal half ……..……**Attageninae** Laporte

- Median ocellus absent on front (fig. 15), pronotum without strong raised ridge near side margin in basal half ….....**Dermestinae** Latreille

1- Subfamily: **Attageninae** Laporte, 1840
Genus: ***Attagenus*** Latreille, 1802 ***Attagenus faciatus*** Thunberg, 1795 (figs. 14 & 16)

Attagenus faciatus Thunberg, 1795.
Anthrenus gloriosae Fabricius 1801.
Attagenus annulifer Castelnau, 1840.
Attagenus cinnamomeus Roth, 1851.
Attagenus unifaciatus Fairmaire, 1860.
Attagenus plebeicus Sharp, 1885.

Diagnoses:

Body5 – 6 mm. in length, ovate and convex, dorsal surface densely clothed with recumbent to erect brown hairs. Head sunken in the pronotum; antennae reddish brown, apical segment of antennal club shorter than the length of two basal segments together. Elytra

black with one transverse band of pale hairs on basal third. Legs stout, reddish brown in color.

2- Subfamily: **Dermestinae** Latreille, 1804

Genus: ***Dermestes*** Linnaeus, 1785

Key to species

1- Apical margin of elytra with numerous small teeth, apex produced into a large tooth (fig.17) ……..…….. ***D.maculatus*** De Geer

- Apical margin of elytra smooth or with minute teeth, but apex not produced into a large tooth …2

2- Abdominal sternites and metasternum with fine, recumbent yellowish-brown or dark brown setae which rarely conceal surface of cuticle; laterally sometimes with patches of brown setae (fig. 18)….. ……..……..***D. ater*** De Geer

- Abdominal sternites and metasternum with dense, recumbent whitish setae which almost conceal surface of cuticle; laterally with patches of black or brown setae (fig.19).……..…..***D. frischii*** Kugelan

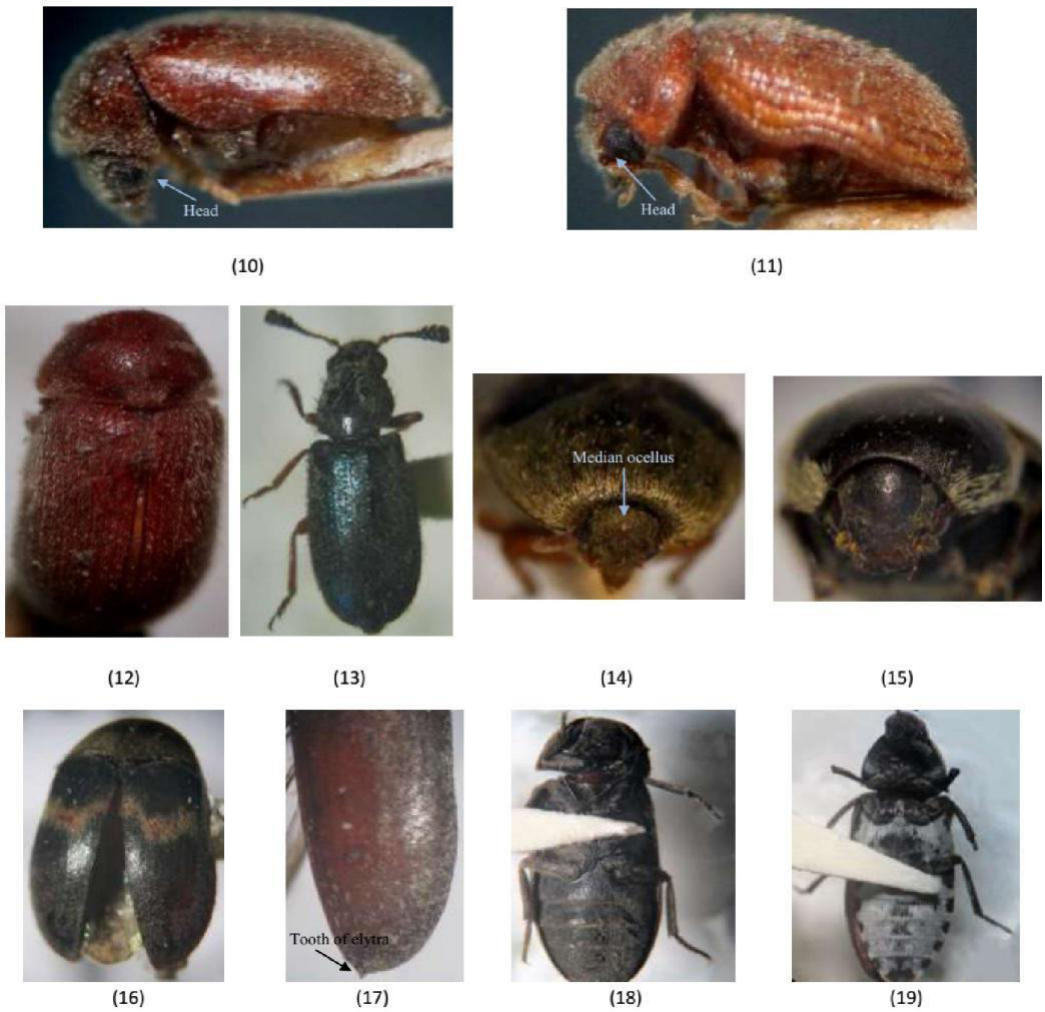

Plate II: 10. ***Lasioderma sericorne*** (Fabricius, 1792), adult lateral view; 11&12. ***Stegobium paniceum*** Linnaeus, 1758, adult, 11. lateral view, 12. dorsal view; 13. ***Necrobia rufipes*** (De Geer, 1775), adult dorsal view; 14&16. ***Attagenus faciatus*** Thunberg, 1795, 14. Head dorsal view; 16. Adult dorsal view; 15&19. ***Dermestes frischii*** Kugelann, 1792, 15. head dorsal view, 19. adult lateral view; 17. Elytra wing of ***Dermestes maculatus*** De Geer, 1774; 18.***Dermestes ater*** De Geer, 1774, adult lateral view.

1- ***Dermestes ater*** De Geer, 1774 (figs. 18&20)

Dermestes ater De Geer, 1774.

Dermestes cadaverinus Fabricius, 1775.

Dermestes domesticus Germar, 1824.

Dermestes ater De Geer, 1939.

Diagnoses:

Body about 7-9 mm. in length, the whole body covered with yellowish-grey hairs. Pronotum sometimes with a few scarcely discernible spots of golden setae, ventral side mainly with light golden setae. Elytral setae unicolors, varying between light golden brown and dark brown.

2-***Dermestesfrischii*** Kugelann, 1792

(figs. 15,19&21)

Dermestes frischii kugelann, 1729.
Dermestes poliinctus Hope, 1834.
Dermestes sibericus Frichson, 1846.
Dermestes uniformis Rey, 1889.
Dermestes frischii heyrovskyi Obenberger, 1922.

Diagnosis:

Body about 6-10 mm. in length, stout insects. Head with golden hairs and groups of white hairs forming patches, a small tuft of silvery hairs present on the inner border of the eye. Prothorax ornate with a golden-white pubescence on its front part and on its sides. Elytra covered with fine, flat, black bristles irregularly mixed with yellowish-white hairs, with a few golden hairs at base. Metasternum and abdomen white with a few patches of black hairs at sides, underside of 5th segment of abdomen with a patch of black hair on apex and one at each side.

3- ***Dermestesmaculatus*** De Geer, 1774
(figs. 17,22&23)

Dermestes maculates Degeer, 1774.
Dermestes vulpinus Fabricis, 1781.
Dermestes elongatus Hope, 1834.
Dermestes senex Germar, 1842.
Dermestes sudanicus Gredler, 1877.

Diagnosis:

Body range from 5.5-10 mm. in length.Dorsal face brown, more or less reddish, legs and antennae lighter brown. Head and scutellum with pubescence on the top. Pronotum huge, bristles dense and thick on the sides of the thorax and form a wide golden stripe.Elytra dark brown or black, with hairs mostly black, yellow, or white. Abdomenal sternites white with black spots at the sides, and a large black patch on the last segment.

5-Family: Histeridae Gyllenahl, 1808
(Clown Beetles)

Diagnosis:

Body length ranging from 0.5 to 25 mm, many species ovate to oblong and convex, others clynderical or dorsoventrally flattened in shape. Black or dark reddish brown in color with metallic shine in some species. Head usually retracted under prothorax, particularly in subfamily Saprininae,antennae elbowed with clubbed ends. Pronotum punctuate and punctuation become coarser laterally and basely than in disc. Legs short roubust, protibia dentate along lateral edge. Elytra exposing the last abdominal terga in the majority of species.Abdomen with five visible sterna.

Notes:

Most histerids are dung, carrion, and decaying vegetable matter inhabitants, feeding on eggs and larvae of associated Dipteran flies. Hister beetles have proved useful during forensic investigations to help in time of death estimation.

Subfamily**: Saprininae** Lacordaire, 1854
Genus: ***Saprinus*** Erichson, 1834

Key to species

1-Sutural stria not connected with 4th dorsal one (fig. 1), frontal stria of head complete……..... ***S. caerulescens*** Hoffmann

- Sutural stria connected with 4th dorsal one (fig. 24), frontal stria absent at middle or interrupted ……..2 2-

Fore tibia with nine strong teeth …… ***S. furvus*** Erichson -

Fore tibia with teeth divided into two groups (fig. 25)…..……..……3

3- Fore tibia with 10 teeth in two groups, 1st one with seven strong teeth near tarsus and 2nd one with three small teeth near leg base…..***S. chalcites*** Illiger

- Fore tibia with 13 teeth in two groups, 1st one with seven strong teeth near tarsus and 2nd one with six small teeth near leg base…. ***S. semistaiatus*** Scriba

1- ***Saprinus caerulescens*** (Hoffmann, 1803)
(fig. 1)

Hister caerulescens Hoffmann,
1803. *Hister caspius* Dejean, 1837.
Hister cyaneus Rossi, 1792.
Hister semipunctatus Fabricius, 1792.
Saprinus semipunctatus var. *chobauti* Auzat, 1926.

Diagnosis:

Body 5.5 - 8.4 mm in length, metallic brown beetle. Pronotum covered with fine punctuation that appears smooth and becoming coarser toward sides; lateral sides of pronotum with pubescences. First tibia with 10 teeth. Elytra with four stria, first one usually irregular and crossed with a number of lines, fourth dorsal stria short extending to middle of elytra, elytra smooth except at the apical fourth near suture and apical half near sides are punctuated.

2-***Saprinus chalcites***(Illiger,
1807) (fig. 24)

Histerchalcites Illiger, 1807. *Histeraffinis* Paykull, 1811. *Saprinus certus* Lewis, 1888.
*Saprinusaerosus*Normand and Thérond, 1952.
Saprinus aerosus melanocephalus Normand and Thérond, 1952.

Diagnosis:

Body 2.1 – 3.5 mm. in length, reddish brown metallic beetle. Frontal stria at head opened.Sutural stria of elytra complete connected with apical one at apex and with fourth dorsal stria in arc at base, first dorsal stria the longest one extending to middle of elytra.

3- ***Saprinus furvus*** Erichson,
1834 (fig. 27)

Saprinus furvus Erichson, 1834.
Saprinus fulvus Marseul, 1855.
Saprinus furvus var. *cabanesi* Thérond, 1931.
Histermassilienus Cristofori & Jan, 1832.

Diagnosis:

Body 4.7- 5.5 mm. in length, metallic brown beetle. Frontal stria absent at middle.Sutural stria of elytra complete and united with apical stria near apex and with fourth dorsal stria in arc near base, first and fourth dorsal stria equal in length and shorter than second and third. Elytra completely punctuated except fourth interval smooth near base.

4-***Saprinus semistaiatus*** (Scriba, 1790)
(fig. 25&26)
Hister semistaiatus Scriba, 1790.
Hister Incrrassatus Faldermann, 1832.
Hister krynickii krynicki, 1832.
Saprinus sparsipunctatus Motschulsky, 1849.
Saprinus punctatostraiatus Marseul, 1862.
Saprinus asphaltinus Hochhut, 1872.

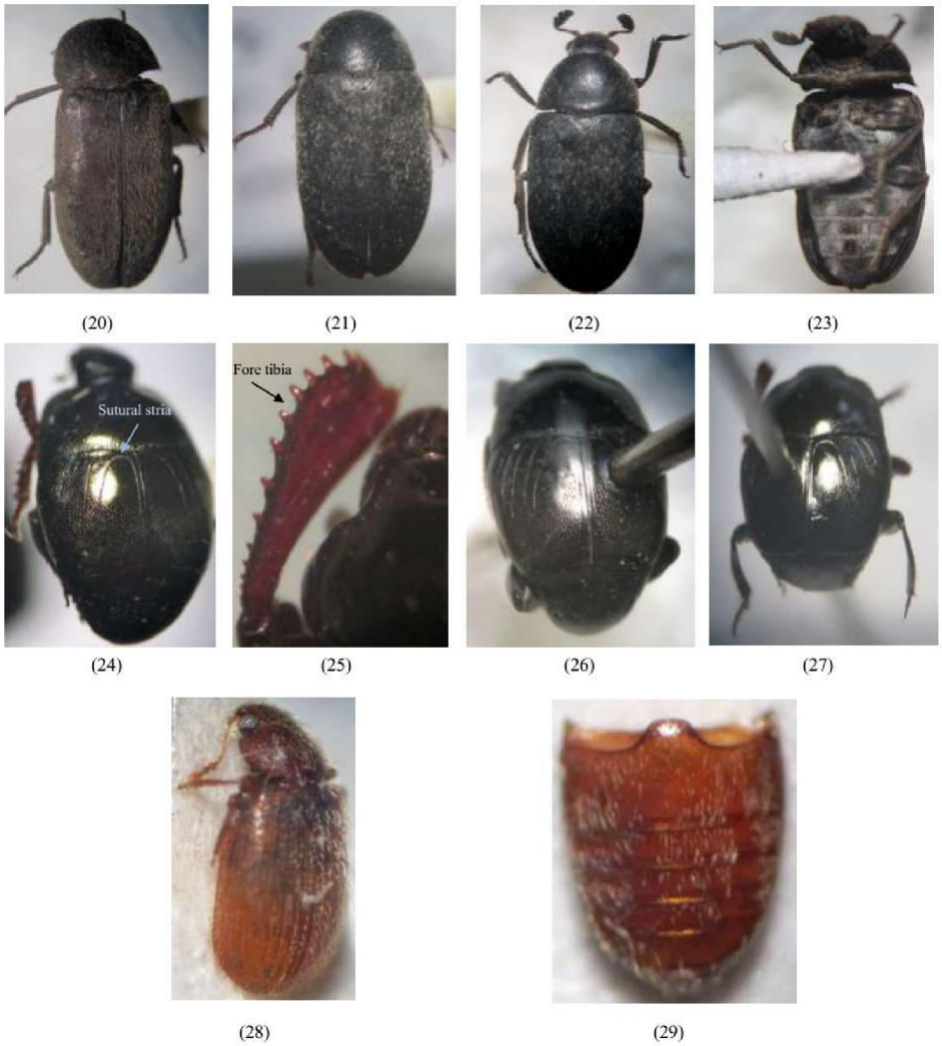

Plate III: 20. ***Dermestes ater*** De Geer, 1774, adult dorsal view; 21. ***Dermestes frischii*** Kugelann, 1792, adult dorsal view; 22&23. ***Dermestes maculatus*** De Geer, 1774, adult, 22. Dorsal view, 23. Lateral view; 24.***Saprinus chalcites*** (Illiger, 1807), adult dorsal view; 25&26. ***Saprinus semistaiatus*** (Scriba, 1790), 25. Fore tibia, 26. Adult dorsal view; 27. ***Saprinus furvus*** Erichson, 1834, Adult dorsal view; 28&29***. Corticaria sp.***, 28. Adult dorsal view, 29. Abdomen lateral view.

Diagnosis:

Body 4.2 – 5.7 mm. in length, metallic black beetle. Frontal stria of head interrupted at middle. Sutural stria of elytra not complete, absent at elytral base; first, second and third elytral stria equal in length; basal part of eltyra smooth; first interval shgreened; apical two thirds of elytra punctuated.

6-Family: Latridiidae Erichson, 1842

(Minute Brown Scavenger Beetles)

Diagnosis:

Body 3 mm or less in length; elongate-oval in shape; pale brown to nearly black beetles. Antennae 10-11 segments with last two or three segments forming club. Prothorax wider than head and narrower than elytra;scutellum small and triangular;elytra

grooved with basal angles rounded.Tarsal formula 3-3-3.

Note:

Latiriidid beetles are not predaceous insects may be found in shed fur and feather for feeding.

Subfamily**: Corticariinae** Curtis, 1829

Genus*: Corticaria* Marsham, 1802

Corticariasp.

(figs. 28&29)

Diagnosis:

Body 1.3-2.8 mm. in length, with long, heavy hairs throughout.Antennae 11 segments with 3-segmented club. Most species of the genus have a prebasal, almost round pit on the pronotum.Elytra rather elongate. First metatarsomere scarcely produced ventrally and not extending to apex of second one. Abdomen with 5 visible sterna.

7-Family: Nitidulidae Latreille, 1802

(Sap-feeding Beetles)

Diagnosis:

Small to medium in size, body nearly ranges from 0.9-15 mm in length; its shape varied greatly; dorsal side pubescent. Most species brown to dark black in color, sometimes with red or yellow marks. Head appeared from dorsal side; antennae 11 segments with 3-segmented club. Elytra usually truncate. Legs short, stout, tarsal formula 5-5-5 or rarely 4-4-4. Usually abdominal segments from 1-3 exposed from elytra; 1st and 5th abdominal segments longer than others.

Note:

Some taxa such as *Carpophilus* feed on carrions at advanced stages of decay.

Genus**:*Carpophilus*** Stephens, 1830

Carpophilus hemipterus (Linnaeus, 1758)

(fig. 3)

Dermestes hemipteru Linnaeus,1758.

Silpha bimaculata Linnaeus1767.

Nitidula flexuosa Herbst,1790.

Cateretes pictus Heer,1841.

Carpophilus brevicornis Germain 1856.

Carpophilus aterrimus Macleay, 1873.

Diagnosis:

Body about 3 mm. in length, ovate to sub parallel shape, reddishbrown in color. Head narrower than pronotum. Antennae pale brown with dark club. Pronotum broad more in width than in length. Scutellum triangular and very short. Elytra short, with light brownspots on humeral and apical parts. Mesosternum heavily punctuate. Legs short, light brown in color.

8-Family: Staphylinidae Latreille, 1802

(Rove Beetles)

Diagnosis:

Body elongated, with parallel sides; it ranges from less than 1 mm to 40 mm; colors range from yellow to reddish-brown to brown to black. Antennae usually 11 segments but in some genera 3, 9, or 10 segments; filiformwith moderate clubbing in some genera. Pronotum variable in shape. Elytra short and truncate about the same length of pronotum; winglessness forms in species present. Tarsal formula variable, 2-2-2, 3-3-3, 4-4-4 or 5-5-5. Five or 6 abdominal segments exposed dorsally from elytra.

Notes:

Staphylinidae occupy almost all moist environments including dung and carrion. They are mainly predators of fly larvae and other invertebrates such as *Creophilus maxillosus* (Linnaeus), both larvae and adults of this species are predators feed on the organic remains of carrion as well as dipterous larvae. They invade the carcasses at the first signs of decay after the succession of dipterous larvae colonization and continue throughout the later stages of decomposition.

Some others are parasites such as some species of genus *Aleochara* Gravenhorstfor example: *Aleocharamoesta* Gravenhorst which lives at the expense of other Dipterans like *Muscina stabulans* Fallen; although the adult of *Aleochara tristis* Gravenhorstis a predator on fly eggs while its larvae are an ectoparasite on scathophagous and necrophagous dipterous pupae.

Key to subfamilies

1- Antennae inserted behind the anterior margin of the eye (fig. 30)…..**Aleocharinae**

- Antennae inserted in front of the anterior margin of the eye (fig. 31)…..2

2- Second sternite of abdomen complete, abdomen with 7 visible abdominal sternites ……**Oxytelinae**

- Second sternite of abdomen absent or rudimentary, abdomen with 6 visible abdominal sternites…….**……**3

3- Last segment of maxillary palpus less than one-half as long as penultimate, usually little longer than width of penultimate……**Paederinae**

- Last segment of maxillary palpus at least one-half as long as penultimate…..……4

4- Lateral marginal lines of pronotum separate throughout……**Xanthopyginae**

- Lateral marginal lines of pronotum united behind anterior angles……**Staphylininae**

1- Subfamily**: Aleocharinae** Fleming, 1821

Key to genera

1- Tarsal formula 5-5-5, body shape of most species more or less broad, stout and roubst, fusiform or cylenderical , only few species are rather selender and narrow……**……*Aleochara*** Gravenhorst

- Tarsal formula 4-5-5, body selender and subparallel…..……..***Atheta*** Thomson

1- Genus**:** ***Aleochara*** Gravenhorst, 1802

Key to species

1- Head and thorax less shining, with distinct ground sculptures……..…..***Al. moesta*** Gravenhorst

- Head and thorax shining, without ground-sculptures…..... ***Al. tristis*** Gravenhorst

1- ***Aleochara moesta*** Gravenhorst, 1802

(fig. 2)

Aleocharamoesta Gravenhorst, 1802.

Aleochara crassiuscula Sahlberg, 1831.

Aleocharaconvexiuscula Kol.,1846.

Diagnosis:

Body 3.5- 4.5 mm in length, moderately shining black in color. Antennae black with the first two segments reddish; head and thorax with distinct ground-sculptures and fine close punctuation. Elytra reddish-yellow, sides and scutellum more or less darkened with a brownish tinge. Legs reddish in color. Abdomen with fine dense punctures, including the terminal segments, and with shortpubescence throughout.

2- ***Aleochara tristis*** Gravenhorst, 1806

(figs. 30&32)

Aleochara tristis Gravenhorst, 1806.

Staphylinus bipunctata Olivier, 1795.

Aleochara nigripes Miller, 1853.

Baryodma nigripennis Mulsant & Rey, 1874.

Diagnosis:

Body 3.7–6.4 mm in length, shining black in color, covered with a moderately close, stiff, yellowish, semi-erect pubescence.Head narrower than pronotum, rarely with fine punctuation. Antennae reddish black,1st – 3rd antennal segments elongate, and 4th – 10th transverse;penultimate segments about twice as broad as long. Pronotum transverse with rounded sides; finely, moderately closely punctured, more closely and less finely towards the base. Elytrawith little closely coarsely punctuation and with well-defined triangular reddish-yellow spot on the posterior margin, latero-posterior margin round.Legs reddish black, hind tarsi distinctly shorter than tibiae. Abdomen coarsely closely punctured, especially at the bases of the segments; posterior margin emarginated; penultimate segments with more fine and more sparing punctuation.

2- Genus**:*****Atheta*** Thomson, 1858

Atheta sp.

(fig. 33)

Diagnosis:

Body 1.0–5.0 mm in length, slender, subparallel, black, brown or bicolored. Pronotum with several macrosetae, pronotal hypomeron visible laterally for at least two-thirds of pronotal length. Elytra yellowish-brown. Mesocoxae approximately adjacent. Mesosternal process slenderand long, its length one-third to middle of mesocoxae; metasternal process short, obtusely subtriangular, approximately equal to metasternal process, tarsal formula 4-5-5. Segmental margins of abdomen smooth.

2- Subfamily**: Oxytelinae**Fleming, 1821

Genus**:** ***Platystithus*** Mannerheim, 1830

Key to species

1- Pronotum and elytra without longitudinal sculpture; male sternite 7 slightly protruding in middle of posterior margin, not bearing teeth; female clypeus with anterior margin truncate, without denticles at end …….. ***Pl. nitens*** Sahlberg

-Pronotum and elytra with distinct longitudinal sculpture; male sternite 7 strongly protruding in middle posterior margin, bearing 2 teeth; female anterior margin of clypeus slightly emarginated, with tiny denticles at end……..***Pl. cornutus*** Gravenhorst

1- ***Platystethus cornutus*** Gravenhorst, 1802

(fig. 34)

Platystethuscornutus Gravenhorst, 1802.

Platystethusscybalarius Runde, 1835.

Platystethusmaxillosus Peyron, 1858.

Platystethusoperosus Sharp, 1874.

Platystethuscornutus ssp. *stramineus* Zheng, 2004.

Diagnosis:

Body 2.5-3.5 mm in length, shiny black, dark brown to reddish brown; mouthparts, antennae, legs lighter. Head, pronotum, elytra and abdomen densly punctuated and with distinct longitudinal microsculpture. Pronotum rounded from the posterior margin, slightly wider than head, pronotum with median longitudinal deep groove through the whole length. Elytra with posterior margin truncate, elytral suture partly overlapped, disc of elytra with yellowish brown patch. Sternite 8 of male divided to 3 parts by 2 curved sutures , middle part truncate from posterior margin, and lateral parts connected at anterior margin; each lateral part with two teeth one strong and one weak.

2- ***Platystethus nitens*** Sahlberg, 1832

(fig. 35)

Platystethus nitens Sahlberg, 1832.

Platystethus aegyptiacus Motschulsky, 1857.

Platystethus angustipennis Scriba, 1868.

Platystethus punctatus Fiori, 1915.

Platystethus laevigatus Fiori, 1915.

Diagnosis:

Body 1.7-3 mm in length, shiny brown in color, mouthparts, antennae, elytra and legs light brown. Head, pronotum and elytra smooth or with light punctuation and without microsculptures. Mesial side of eye with 3 longitudinal grooves in males. Clypeus in male with two weak spines and in female with teeth at ends of anterior margin. Pronotum with median longitudinal groove through the whole length. Elytra with posterior margin truncate. Posterior margin of

sternum 7 in male straight, sternum 8 with 2 teeth on the median plate.

3- Subfamily: **Paederinae** Fleming, 1821
Genus: ***Scopaeus*** Erichson, 1839
Scopaeus debilis Hochhuth, 1851
(fig. 36)
Scopaeus debilis Hochhuth, 1851:50.
Scopaeus boops Scheerpelz, 1931: 411.
Scopaeus (Scopaeus) debilis Coiffatt, 1952:7.

Diagnosis:

Body 2.5-3 mm. in length, small, flattened and dark brown in color with the distal half of the elytra and the appendages lighter brown. Head parallel-sided, its back edge more or less straight forming distinct hind angles. Pronotum narrower than head and elytra, with rounded edges. Tibial tips oblique; hind tarsus stocky; the first tarsal segment longer than the second; the last segment somewhat longer than the first.

4- Subfamily: **Staphylininae** Latreille, 1802

Key to genera

1- Last segment of labial palpus not or very little narrower than penultimate, subfusiform or articulate (fig. 37)……..……..***Philonthus*** Stephens

- Last segment of labial palpus narrower than penultimate, cylindrical (fig.38)……..***Gabronthus*** Tottenham

1- Genus: ***Gabronthus*** Tottenham, 1955
Gabronthus maritimus Motschulsky, 1858
(figs. 38&39)
Gabrius maritimus Motschulsky, 1858.
Philonthus libanicus Saulcy, 1864.
Philonthusmimulus Rottenberg, 1870. *Gabrius pubens* Mulsant & Rey, 1878. *Philonthus meridioafricanus* Scheerpeltz, 1974.

Diagnosis:

Body 5.5 mm.in length, dark brown to black in color. Head longer than wide, usually somewhat quadrate, with small eyes. Pronotumas wide as haed, with several rows of punctures each consisting of five ones, pronotal collar present. Elytra dark brown in color with interior edges light, punctuated with fine punctures and with fine, short setae. First four segments of protarsus at least slightly dilated and with at least a few setae ventrally.

2- Genus: ***Philonthus*** Stephens, 1829

Key to species

1- Temples one-third longer than eyes (fig. 40), head with 4 punctures in transverse row opposite anterior fourth of eyes…***Ph. Sordidus*** Gravenhorst

- Temples as long as eyes(fig. 41), head with 4 corase steferous punctures between eyes
……..……..***Ph. quisquiliarius*** Gyllenhall

1- ***Philonthus quisquiliarius*** (Gyllenhall, 1810)
(figs. 37, 41&42)
Stahpylinuss quisquiliarius Gyllenhal, 1810.
Philonthus phaeopus Stephens, 1832.
Philonthus rubrosuturatus Bernhauer, 1902.
Philonthus opacinus Scheerpeltz, 1933.
Philonthus chopardi Cameron, 1950.
Philonthus peregrinoides Scheerpeltz, 1974.

Diagnosis:

Body 7 – 7.5 mm. in length, black in color; maxillary, labial palpi, mandibles and 1st antennal segment, base of 2nd, 3rd antennal ones and legs yellow-brown, remaining antennal segments black. Head wider than long with 2 long and several short black bristles; temples area with many variably large punctures. 4th – 6th antennal segments longer than wide. Pronotum slightly shinny dark-brown, as long as wide, with many dorsal rows of punctures, each row with 5 relatively equidistant punctures, each sublateral row with 2 punctures. Elytra combined wider than long, punctures of elytra conspicuously larger than eye-facets. Abdomen slightly narrowed towards apex, abdominal tergites punctuated but finer than that on elytra.

2- ***Philonthus sordidus*** (Gravenhorst, 1802)
(figs. 40&43)
Staphylinus sordidus Gravenhorst, 1802.
Philonthus sordidus Gravenhorst, 1802.
Philonthus sordidus Woll,1854.

Diagnosis:

Body4.5 - 5 mm. in length, shiny black in color. Pronotum with 4 rough punctures in sub-median longitudinal row. Elytra brown or reddish black in color, with deep punctures which nearly twice as wide as eye facets. Anterior tarsi not dilated, posteriorone with basal segment shorter than length of the three following segments and about as long as fifth. Abdomenal tergites with irregular shaped punctures, caudal part of each abdominal tergite usually reddish or brownish black.

5- Subfamily: **Xanthopyginae**
Genus:***Creophilus***Leach, 1819
Creophilusmaxillosus(Linnaeus, 1758)
(figs. 31&44)
Staphylinus maxillosus Linnaeus 1758.
Creophilus maxillosus Kano, 1933.
Staphylinus maxillosus Kuwayama, 1967.

Diagnosis:

Body 12–18mm. in length, stout build beetle,shiny black in color. Head slightly as wide as pronotum, with gray pubescence present on the posterior angles;antennae thick, beaded, composed of 11 segments; eyes large. Pronotum narrower than elytra with rounded base, anterior angles of pronotum with yellow-gray setae.Elytra, 2nd, 3rdsometime 4th abdominal segments with gray setae forming wide variable bands encircling the body.Legs entirely black, tarsal formula 5-5-5.

9- Family: **Tenebrionidae** Latreille, 1802
(Darkling Beetles)

Plate IV: 30&32. ***Aleochara tristis*** Gravenhorst, 1806, 30. head top view, 32. Adult dorsal view; 31. ***Creophilus maxillosus*** (Linnaeus, 1758), head dorsal view; 33. ***Atheta sp.*** Adult dorsal view; 34. ***Platystethus cornutus*** Gravenhorst, 1802, adult dorsal view; 35. ***Platystethus nitens*** Sahlberg, 1832, adult dorsal view; 36. ***Scopaeus debilis*** Hochhuth, 1851, adult dorsal view; 37. ***Philonthus quisquiliarius*** (Gyllenhall, 1810), head dorsal view; 38&39. ***Gabronthus maritimus*** Motschulsky, 1858, 38. Head dorsal view, 39. Adult dorsal view.

Diagnosis:

Variable in shape and in size; from 1 mm to 35 mm in length;majority dark but sometimes beautifully colored or metallic; body glabrous or pubescent, covered with diverse types of hairs, setae and sensilla. Head visible from dorsal side;antennae 11 segments seldom 10 or 9 segments, varied in shape, filiform, moniliform, or weakly clubbed, inserted underside of head, so that the basal third of the first joint hidden; eyes notched by a frontal ridge. Elytra varied greatly in shape.Tarsal formula 5-5-4. Abdomen with 5 visible sternites,the first one not divided by coxae.

Notes:

Tenebrionids varied extremely in food habitsfeeding on a wide variety of materials. Adults and larvae are primarily scavengers and detritivores.

Subfamily**: Pimeliinae**Latreille, 1802

Key Genera

1- Scutellum absent or not visible, no construction between pronotum and elytra (fig. 45)…..…. ***Zophosis*** Latreille

- Scutellum present or clearly visible (fig. 46) ...**2**

2- Body strongly setosed and finely granulated, antennae long mostly reach to basis of pronotum, eye rarely carinated (fig. 47) ….***Trachyderma*** Latreille

- Body bald and finely punctuated, antennae short, eye carinated (fig. 46).....…….…….**3**

3**-** Elytra with punctuated striae, fore-tibia narrow at apex and without teeth….(fig. 48) ……..…….***Mesostena*** Eschscholtz

- Elytra with scattered fine punctuation, fore-tibia wide at apex with sharply angular external apex (fig. 46) …..……..……..***Scelosides*** Solier

1- Genus**:** ***Mesostena*** Eschscholtz, 1831

Mesostena puncticollis Solier, 1835

(fig. 48)

Mesostena puncticollis Solier, 1835.

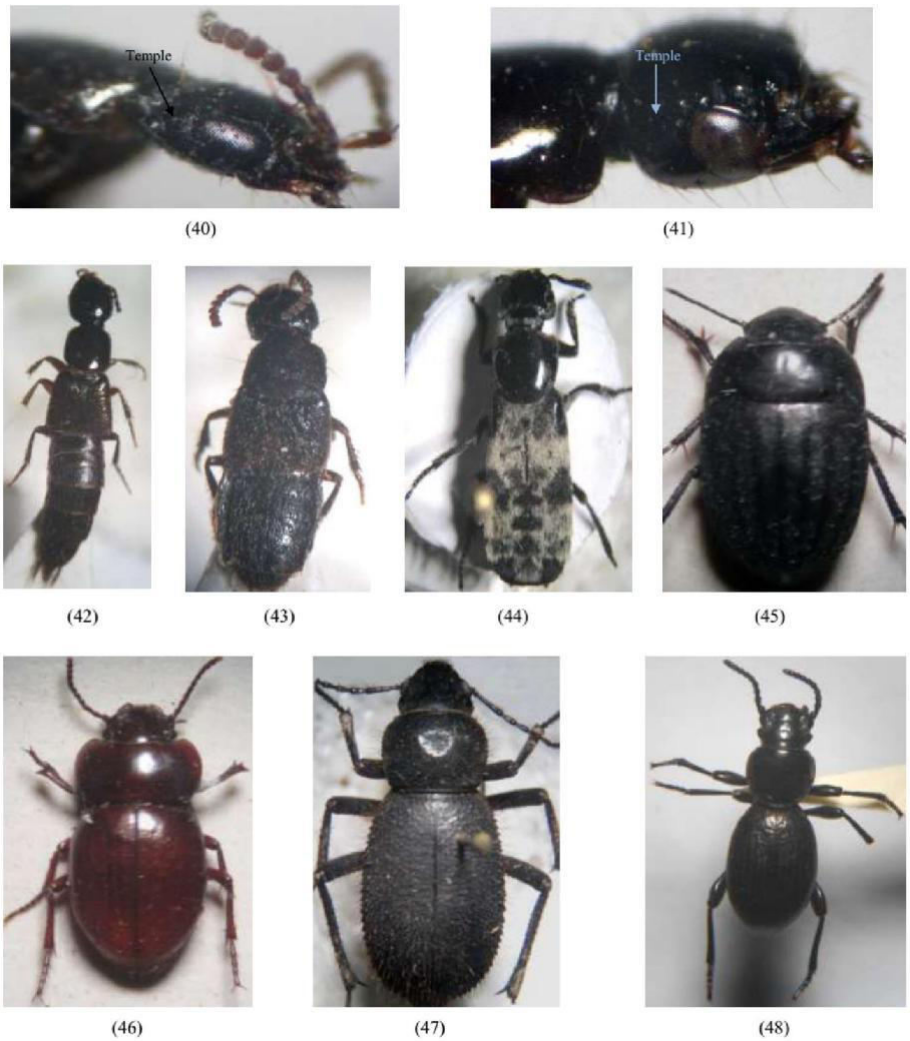

Plate V: 40&43. ***Philonthus sordidus*** (Gravenhorst, 1802), 40. Head lateral view, 43. Adult dorsal view; 41&42. ***Philonthus quisquiliarius*** (Gyllenhall, 1810), 41. Head lateral view, 42. Adult dorsal view; 44.***Creophilus maxillosus*** (Linnaeus, 1758), adult dorsal view; 45. ***Zophosis abbreviata*** Solier, 1834, adult dorsal view; 46. ***Scelosides castaneus*** Eschscholtz, 1831, adult dorsal view; 47. ***Trachyderma hispida*** (Forskål, 1775), adult dorsal view; 48. ***Mesostena puncticollis*** Solier, 1835, adult dorsal view.

Diagnosis:

Body 9.5-10.5 mm. in length, shiny black oblong insect. Head narrower than pronotum with small eyes, posterior eye margin acuminate angle forward; 2nd antennal segment little longer or as long as third. Pronotum strongly punctuated, oblong to slightly cordiform in shape. Elytra oblong to oval with 10 elongate punctuated striae.Anterior tibia rounded exteriorly. Abdomen slightly marginate specially at base.

2- Genus: ***Scelosides*** Solier, 1835

Scelosides castaneus Eschscholtz, 1831

(fig. 46)

Scelosides castaneus Eschscholtz, 1831.

Diagnosis:

Body 6.5 – 9 mm in length,parallel elongate in shape, castaneous in color. Head broad, sunken in the pronotum, with small eyes. Pronotum wider than length, with anterior angles widely produced over the level of anterior margin, at base only behind the shoulders with a redumentary margin, humeral angles strongly toothed, produced and wide onwards the level of scutellum. Elytra with confused punctuation. Anterior tibiae sharply angular and toothed at external

apex; 1st segment of meso and meta tarsi as long as claws segment.

3- Genus: ***Trachyderma*** Latreille, 1829

Trachyderma hispida (Forskål, 1775)

(fig. 47)

Tenebrio hispida Forskål 1775.

Ocnera hispida latreillei Solier, 1836.

Ocnera hispida Alfieri, 1976.

Diagnosis:

Body 17-24 mm. in length, black oblong insect covered with loose long hairs. Head slightly rectangular with reddish hairs and separated tubercles; antennae long surpassing pronotum, 3rd antennal segment very long. Pronotum convex, anterior and posterior margins straight, with rounded angles, pronotal disc covered with rounded tubercles.Elytra elongated wider than base of pronotum, with scattered not spiny tubercles and dense sculptures. Legs thick, tuberculated, and hairy; external margin of fore tibiae dentate at apex only. Abdomen with fine tubercles and short hairs.

4- Genus: ***Zophosis***Latreille, 1807 ***Zophosis abbreviate***Solier, 1834

(fig. 45)

Zophosis abbreviata Solier, 1834.

Zophosis abbreviata var. *semilineata* Deyrolle. 1867.

Zophosis seminitida Chatanany, 1917.

Diagnosis:

Body 9 – 9.5 mm. in length, slightly ovate convex shiny black beetle. Head broad, sunken in the pronotum, moderately punctuated; eyes evenly large; antennae moderately selender surpassing the pronotal base; 10th antennal segment about as wide as long. Pronotum with lateral margins slightly divergent toward base, pronotal base bisinuate, pronotal disc covered with fine dense punctures, sides with larger punctures.Elytra with 3 broad, smoothed and scattered punctures, median suture slightly raised posteriorly. Legs with clavate femora, 1st tarsal segment of protarsus twice as long as second, 2nd and 3rd segments of protarsus longer than wide, claws equal. Abdominal sternite 5 truncate apically.

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