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Systematic Studies on Male Genitalia of Coleoptera Species Found on Decomposing Pig (*Sus Scrofa* L.) Carcasses at Ankara Province[Ψ]

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Abstract

In this study, decomposition processes of 12 pig (*Sus scrofa* L.) carcasses were examined and 40 Coleoptera species belonging to Staphylinidae, Histeridae, Dermestidae, Silphidae, Nitidulidae and Cleridae families were collected during one year period at Beytepe Campus, Ankara. According to their presence time on carcass, 22 of these species were accepted to be important. Identification key of these species was composed and male genitalia structures were described. The figures of male genitalia was drawn and discussed.

Key Words: Coleoptera, carcass, male genitalia, decomposition.

INTRODUCTION

Decomposition is a continuous process (Goff, 2000). Anderson (2001) indicated that every stage of decomposition is attractive to different group of sarcosaprophage arthropods, primarily insects. In this process Calliphoridae, known as blow flies, come to carcass within minutes after death and start to oviposit their eggs (Anderson and VanLaerhoven, 1996). After blow flies, species belonging to Coleoptera begin to come around the carcass. These species are found over, around and under the carcass from the second day of decomposition. Within the coming groups species belonging to Staphylinidae, Dermestidae, Cleridae, Nitidulidae, Histeridae, Silphidae and Scarabaeidae families are the most found. Besides them, species of Carabidae is also seen. (Kocarek, 2003). During the decomposition process, different families would be seen on carcass depending in which decomposition stage it was. With this study species belonging to these families were identified, their male genitalia were examined and drawn.

Staphylinidae is a broad family having more than 30.000 identified species (Booth *et al.,* 1990). Adults of Staphylindae are 1-40 mm in length (Booth *et al.,* 1990). They recognized by their typically elongate body and elytra being shortened (Borror *et al.,* 1989). They are saprophagous or predacious on other arthropods, ocurring in a very wide variety of habitats on the ground with a suitably high moisture content, for example in soil, leaf litter, dung, carrion and fungi (Booth *et al.,* 1990). The species attracted to carrion feed on maggots and the larvae of insects (Byrd and Castner, 2001). There are many studies conducted on Staphylinidae. Naomi (1985), Anderson (1997), Assing (2002), Staniec (2005), Solodovnikov (2006) and Herman (2001) are some of these researches. Staphylinidae is not studied much in our country, however Assing (2001, 2003,

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2006) conducted many studies on groups found in our country.

Dermestidae family has as much as 900 species. Adults usually 2-13 mm in length, elliptical to round in shape and usually hairy or scaly. They usually feed only on nectar or pollen, although some, for example *Dermestes* species, feed on the larval food to a lesser extent (Booth *et al.,* 1990). Zhantiev (1976, 2001), Hava (2004), Hava and Kalik (2005) and Gredilha and Lima (2007) could be given as studies on Dermestidae. In our country, Hava and Tezcan (2004), Tezcan *et al.* (2004) are the examples of the studies done.

Cleridae family has as much as 4000 species. Adults are 3-50 mm in length, often metallic or patterned and possess at least some long and erect setae on the body or legs. They can be found under the bark of dead wood, in the tunnels of wood-boring insects, bracket fungi, leaf litter, carrion, also in nests of bees, wasps and termites and in various stored products. Some adults can also be found on flowers where they may feed on pollen (Booth *et al.,* 1990). Schroeder (1999, 2003) could be given as an example of studies. In Turkey, because there is no or few study, that it was not encountered. However in Yüksel's study (1998) *Thanasimus formicarius* (L.) was found in the main and larval galleries of *Ips sexdentatus* (Börner) and *Blastophagus piniperda* (L.) and in Kaygın and Sade's study (2004) it was found that *Korynetes caeruleus* (DeGeer) could be used as a biological control agent on *Anobium punctatum* (Deg.).

Nitidulidae family has approximately 3000 species. Adults are 1-14 mm in length, generally dull-brown or black insects and oblong to hemispherical, and often convex in shape. Many nitidulids are phytophagous, including pollen feeders, others feed on various dead or decaying plant remains, on tree sap or are mycophagous, while a few are carrion feeders (Booth *et al.,* 1990).There are many studies done on Nitidulidae like Kirejtshuk (2005), Kurochkin and Kirejtshuk (2003) and Cline's PhD. Thesis (2005). In Turkey, several species from Nitidulidae family was used in Gençer *et al.* (2005).

Histeridae family has nearly 3000 species. Adults are 1-23 mm in length, heavily sclerotized and have a characteristic form, being usually oval and convex in shape, but are sometimes flattened or cylindrical (Booth *et al.,* 1990). Their body colour is most frequently a shiny jet black, but in some species can be brown, red or metallic green (Byrd ve Castner, 2001). Almost all parts of the body can bear taxonomically important striae and other sculpture (Booth *et al.,* 1990). They usually found in or near decaying organic matter such as dung, fungi and carrion but are apparently predaceous on other small insects living in these materials (Borror *et al*.,1989). Also feeding on mites and other insects, especially the immature stages of Diptera and Coleoptera. They live in a wide variety of bird an mammal nests and sometimes in stored products (Booth *et al.,* 1990). Some species are found in the main and larval galleries of wood-boring insects like *Ips sexdentatus* (Börner), *Orthotomicus erosus* (Wollaston.) and *Ips mannsfeldi* (Wachtl) (Yüksel, 1998) and are potential biological agents (Booth *et al.,* 1990). There are a lot of studies done and many examiners studying on Histeridae. Kryzhanovskii and Reikhardt (1976), Mazur (1997), Yelamos (2002), Penati (2002) and Ohara (2003, 1994, 1989) were studies on Histeridae. Tezcan and Yelamos (2004), Lackner (2004) and Lackner and Hlavac (2002) were some studies done in Turkey.

Silphidae, known as carrion beetles, has more than 1500 species. Adults are typically ranging between 10-35 mm in length,usually medium to large in size (Byrd ve Castner, 2001). Elytra are short and truncate apically exposing few segments in Nicrophorinae and rounded at the apex and almost cover the abdomen in Silphinae (Borror *et al*.,1989). Body usually black and some orange, yellow or red

patterns could be found (Byrd ve Castner, 2001). While most are predaceous, some are feeding on decaying materials and some on vegetation, family name was given depending on few species feeding on carrion. They are typically polyphagous (Demirsoy, 2003). Species from Silphinae occur in various types of decaying animal matter, some in fungi and a few in ant nests. A few are predaceous on maggots and other animals that occur in decaying organic matter (Borror *et al*.,1989). Hava (1995) and Ruzicka (2005) could be given as examples. Hava *et al.* (1998) and Tezcan and Hava (2001) are examples of studies done in Turkey although the family was not studied much.

Looking at the examined six families, male genitalia structures are as followed; Staphylinidae, articulated type, Histeridae and Nitidulidae annulated type, Dermestidae and Silphidae trilobate type and Cleridae vaginate type.

In articulated type, aedeagus usually asymmetrical, basal piece mostly not sclerotized and apparently absent, parameres are connected to penis with a true articulated condyl. In trilobate type, aedeagus symmetrical, basal piece sclerotized and well-developed, parameres connected articularly to basal piece, penis and basal piece are connected with "first connecting membrane" allowing restricted motion and handled as the most primitive type of genitalia in Coleoptera. In vaginate type, basal piece is elongated with parameres and produced a tube or duct in which the penis moves, parameres usually poorly motioned and sometimes penis is too shortened and the most of the copulation is done by tegmen. In annulated type, basal piece forms a weak ring around and connected to penis, even though the parameres reduced sometimes found as coupled projection tightly connected the basal piece (Tuxen, 1970).

MATERIALS AND METHODS

This study was part of a MSc thesis conducted at Hacettepe University Biology Department which was accepted on September 13, 2007 and supported with 06D-02 601 001 numbered project by Hacettepe University Scientific Researches Unit. The study was conducted at two different wooded sites of Hacettepe University's Beytepe Campus in Ankara, Turkey (39°52'17" N; 32°44'8" E) between March 2006-March 2007. The Coleoptera fauna on pig carcasses was determined and male genitalia of species were examined.

Specimens were collected by forceps and hand. Specimens were directly killed by either ethlyacetate jars or put in 70% ethanol. Ethanol killed insects were preserved in 15 cc plastic specimen containers and ethylacetate killed insects were pinned and put in collection for identification and observation. Laboratory examinations were done by using Leica MZ 16A Stereomicroscope and DFC320 imaging system. Photographs were taken by same system and Nikon DSLR D70s digital camera. The photographs of collected 22 species are given in Appendix.

Procedures given in Borror *et. al.* (1989) is followed for the genital examination and drawings of collected specimens. Specimens, which their genitalia was going to be examined, were put in distilled water for one day in a petri dish. Softened specimens then operated with two insect pins to take out the genital organs from the last or two apparent abdominal segments. Genital organs were then put into 15-20% KOH depending on the amount of membranous parts and sclerotization degree for 1-2 days. After the genital organs were cleared they were photographed by Leica MZ 16A Stereomicroscope with DFC320 imaging system. Genitalia drawings were done by the prints of photographs and the help of microscope.

Collected specimens were identified to family and genus level by using several identification keys. For Staphylinidae Smetana and Davies (2000), for Cleridae Kim and Jung (2006), for Histeridae Bousquet (2002), for Nitidulidae Kirejtshuk (http://www.zin.ru/animalia/coleoptera/kirejt4.htm), for Silphidae Hastir and Gaspar (2001) and for Dermestidae Hinton (1945) were used. For the species level identifications specimens were sent to specialists as Jiří Háva from Private Entomological Laboratory & Collection, Czech Republic for Dermestidae and Silphidae, Volker Assing from Germany for Staphylinidae, Fabio Penati from Italy for Histeridae and Alexander Kirejtshuk from Zoological Institute of the Russian Academy of Sciences for Nitidulidae families. Identification of Cleridae species were done by using Kim and Jung's (2006) identification key.

RESULTS

At the end of the study 40 species from six Coleptera families were identified;

Staphylinidae;

Creophilus maxillosus (Linnaeus, 1758)
Ontholestes murinus (Linnaeus, 1758)
Platydracus flavopunctatus (Latreille, 1804)
Platydracus hypocrita (J. Müller, 1925)
Ocypus mus (Brullé, 1832)
Philonthus laminatus (Creutzer, 1799)
Philonthus politus (Linnaeus 1758)
Philonthus concinnus (Gravenhorst, 1802)
Philonthus corruscus (Gravenhorst, 1802)
Gabrius nigritulus (Gravenhorst, 1802)
Bisnius sordidus (Gravenhorst, 1802)
Aleochara lata Gravenhorst nec Kirby 1832, 1802
Aleochara intricata Mannerheim, 1830
Atheta testaceipes (Heer nec Stephens 1832, 1839)
Paederidus ruficollis (Fabricius, 1781)
Xantholinus Dejean, 1821 sp.

Histeridae;

Margarinotus (Ptomister) brunneus (Fabricius, 1775)
Margarinotus (Paralister) purpurascens (Herbst, 1792)
Saprinus caerulescens (Hoffmann, 1803)
Saprinus subnitescens Bickhardt, 1909
Saprinus vermiculatus Reichardt, 1923
Saprinus prasinus Erichson, 1834
Saprinus immundus (Gyllenhal, 1827)
Saprinus maculatus (Rossi, 1792)
Pachylister inaequalis (Olivier, 1789)
Carcinops pumilio (Erichson, 1834)
Hister quadrinotatus L.G.Scriba, 1790

Dermestidae;

Dermestes frischii Kugelann, 1792
Dermestes undulatus Brahm, 1790
Dermestes intermedius Kalík, 1951
Dermestes olivieri Lepesme, 1939

Silphidae;

Thanatophilus ferrugatus (Solsky, 1874)
Thanatophilus sinuatus (Fabricius, 1775)
Thanatophilus rugosus (Linnaeus, 1758)
Silpha obscura orientalis Brullé, 1832

Nitidulidae;

Nitidula rufipes (Linnaeus, 1767)
Nitidula flavomaculata Rossi, 1790
Nitidula carnaria (Schaller, 1783)

Cleridae;

Necrobia rufipes (De Geer, 1775)
Necrobia violacea (Linnaeus, 1758)

According to their presence time on carcasses, 22 of these species, which were written in bold, were accepted to be important and examined in this study. Idetification key for these species which were found on decomposing carcasses at Beytepe Campus was composed and given in Table 1.

Family Staphylinidae

Creophilus maxillosus (Linnaeus, 1758)

Ventral view: Bulbus round, basal margin recessed medially; median lobe laterally concave, narrowing apically, apex prominent; paramere symmetrical,

narrow and acute at base, widened from proximal through distal, apex slightly recessed medially; five long, stout setae on apical, short setae on lateral (Figure 1a).

Lateral view: Bulbus ellyptical; median lobe sclerotized, equally widened through distal, two pieced and distinctly narrowed through apical, upper lobe acute, lower lobe wide; two heavily sclerotized rod like sclerites in inner sac; paramere heavily sclerotized, base triangular and almost parallel from proximal through apical; long setae on apical (Figure 1b).

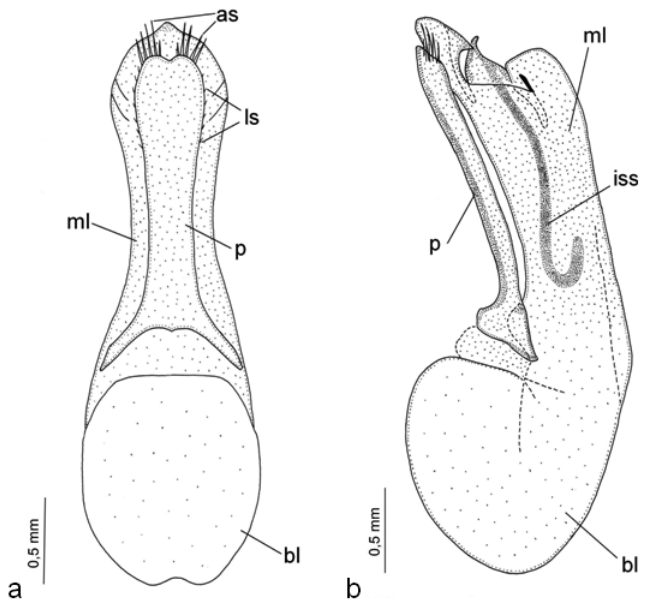

Figure 1. *Creophilus maxillosus* (Linnaeus): Aedeagus. a) Ventral; b) Lateral; as: apical setae bl: bulbus, iss:inner sac sclerite, ls: lateral setae, ml: median lobe, p: paramere.

Ontholestes murinus (Linnaeus, 1758)

Ventral view: Bulbus ellyptical, thin sickle shaped and sclerotized except anterior magrin; median lobe narrow at proximal, parallel through apical, apex semicircle, sclerotized structure on medial lobe between base and distal; paramere asymmetrical, wide and semi-acute at base, slightly concave from proximal through distal, apex straight; three long, stout setae on apical (Figure 2a).

Lateral view: Bulbus ellyptical, posterior margin recessed triangularly on medial; median lobe sclerotized, wide and parallel through medial, distinctly narrowing finger shaped through apical; heavily sclerotized structure in inner sac projecting outward with brush like sclerotized sclerites; paramere sclerotized, wide and curved at base, narrowing finger shaped through apical, acute at apex; long setae on apical (Figure 2b).

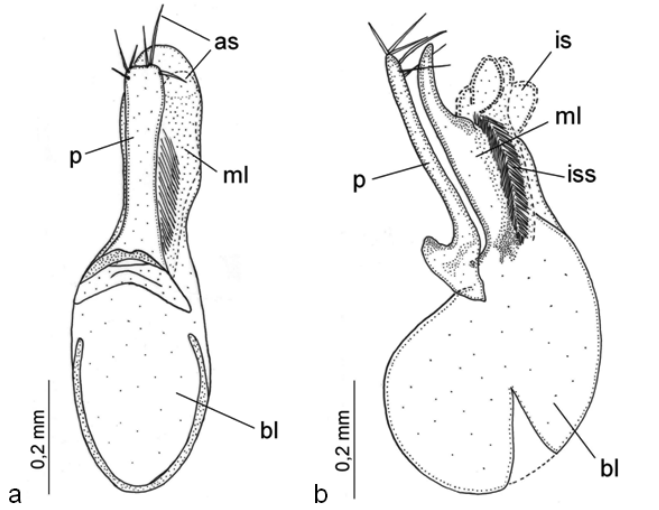

Figure 2. *Ontholestes murinus* (Linnaeus): Aedeagus. a) Ventral; b) Lateral; as: apical setae, bl: bulbus, is: inner sac, iss: inner sac sclerite, ml: median lobe, p: paramere.

Platydracus flavopunctatus (Latreille, 1804)

Ventral view: Bulbus slightly round; median lobe almost equal through distal, barely concave on outer margin, gradually narrowing from distal through apical, apex convex; paramere asymmetrical, wide and acute at base, wide at posterior, narrowest at medial, anterior ellyptical, anterior margin slightly recessed; three short, stout diffuse setae on apical (Figure 3a).

Lateral view: Bulbus ellyptical; median lobe sclerotized, equally widened and two pieced through distal, narrowing asymmetrically through apical,

Table 1. Identification Key of Coleoptera Families, Genera and Species Found on Pig Carcass in Beytepe Campus.

1.	Elytra exposing few segments 2
1'.	Elytra complete 4
2.	Elytra very short, exposing 7-8 abdomen segments ..... ***Staphylinidae*** 6
2'.	Elytra short, exposing only 1-2 abdomen segments 3
3.	Antennae clubbed ..... ***Nitidulidae*** 14
3'.	Antennae geniculate ..... ***Histeridae*** 16
4.	Antennae slightly broad at terminal end ..... ***Silphidae*** 19
4'.	Antennae clubbed 5
5.	Body brown, elytra covered with white or coloured hairs ..... ***Dermestidae*** 20
5'.	Body metallic blue-green, elytra with scarce black hairs ..... .***Cleridae*** 21
6.	Antennae inserted into vertex between eyes, tarsal formula 5-5-5 ..... ***Aleochara*** 10
6'.	Antenna inserted on vertex or lateral, tarsi variable 7
7.	Pronotum with regular punctures, two rows on medial ..... ***Philonthus*** 11
7'.	Pronotum with dense irregular punctures with dense, short and bristle hairs or not punctured and with few hairs 8
8.	Pronotum apparently without punctures, few hairs on antero-lateral ..... ***Creophilus maxillosus*** (Linnaeus)
8'.	Pronotum with dense punctures and short bristle hairs 9
9.	Anterior edges of pronotum prominent, pronotum and elytra golden with orange and white hairs..... ***Ontholestes murinus*** (Linnaeus)
9'.	Anterior edges of pronotum not prominent, pronotum and elytra with copper hairs..... ***Platydracus flavopunctatus*** (Latreille)
10.	Elytra entirely black, posterior edge slightly concave medially ..... ***Aleochara lata*** Gravenhorst nec Kirby
10'.	Elytra black, with large wide triangular reddish-brown maculae at posterior of each elytron, posterior edge straight ..... ***Aleochara intricata*** Mannerheim
11.	Pronotum without punctures, lateral edges widened gradually from base to distal, the head, pronotum and elytra metallic green or blue ..... ***Philonthus laminatus*** Creutzer
11'.	Pronotum with punctures, lateral edges narrowed gradually from base to distal, the head, pronotum and elytra variable 12
12.	Pronotum with three rows of punctures medially, the head, pronotum and elytra metallic green or copper..... ***Philonthus politus*** Creutzer
12'.	Pronotum with five rows of punctures medially, the head, pronotum and elytra variable 13
13.	Elytra bright black ..... ***Philonthus concinnus*** Gravenhorst
13'.	Elytra bright red ..... ***Philonthus corruscus*** Gravenhorst
14.	Elytra without yellow spot ..... ***Nitidula rufipes*** (Linnaeus)
14'.	Elytra with yellow spots 15
15.	Pronotum with yellowish-orange thick band on lateral edge, elytra with U-shaped light yellow maculae reaching lateral edges on anterior ..... ***Nitidula flavomaculata*** Rossi
15'.	Pronotum with light brown thin line on lateral, elytra with four symmetric yellow maculae on either anterior and posterior halfs ..... ***Nitidula carnaria*** (Schaller)
16.	Antennal cavities present alongside prosternal keel, the funicle curved inward at repose, elytra with four dorsal stria transversially ..... ***Saprinus*** 17
16'.	Antennal cavities, if present, on lateral, the funicle curved outward at repose, elytra with five dorsal striae parallel to elytral stria ..... Genus: ***Margarinotus*** Species: ***Margarinotus brunneus*** (Fabricius)
17.	Elytra metallic green-black, second and third dorsal striae weakly curved at base, humeral stria curved inward over first and second dorsal striae, outer subhumeral stria short, inner subhumeral stria straight, sutural stria begins at proximal medially joining with marginal stria, punctuation is on surface from distal of elytral stria to proximal of lateral edges of elytra ..... ***Saprinus caerulescens*** (Hoffmann)
17'.	Body bright black brown, bordeaux, dorsal-elytral striae and punctuation are not like above 18
18.	Body brown-bordeaux, black, pronotum with marginal stria not distinct and notched at base, elytra dull bordeaux-black, third and fourth striae with distinct punctures, fourth stria hooked at base, humeral stria have same obliquity with dorsal striae and straight, outer subhumeral stria short and straight, inner subhumeral stria have poor obliquity than dorsal striae and straight, sutural stria begins at medial from base to apical joining with marginal stria, punctuation is homogeneous on the medial of each elytron forming a horizontally sinous border at posterior ..... ***Saprinus subnitescens*** Bickhardt
18'.	Body black brown, pronotum with marginal stria not distinct and slightly notched at base, elytra brown black, fourth stria arcuate at base, third stria two pieced, humeral stria slightly concave inwardly, outer subhumeral stria short and straight, inner subhumeral stria weakly convex, stural stria begins at proximal to apical joining with marginal stria, punctuation is homogeneous with small punctures on the posterior of each elyton forming an arched border from distal to lateral ..... ***Saprinus vermiculatus*** Reichardt
19.	Pronotum black, scutellum with yellowish hairs on medial, elytra with three carina and posterior margin is straight, intercarina are irregularly wrinkled ..... ***Thanatophilus rugosus*** (Linnaeus)
19'.	Pronotum with reddish brown band at basal margin and lateral margin to distal, scutellum without yellowish hairs on medial, posterior margin of elytra arcuate, posterior margin and humeral angles of elytra with reddish-brown transversal band, three distinct straight carina on elytra..... ***Thanatophilus ferrugatus*** (Solsky)
20.	Pronotum with yellowish-white hairs forming a thick band on margins except basal margin and few on medial, scutellum with dense yellowish-white hairs on posterior, elytra with irregular yellowish hairs, abdominal sterna are covered with very dense white hairs, hair free sections of every sternum form brown macula on lateral, maculae on first sternum is 3-4 times larger than others, last sternum with a broad, hair free section on anterior, femur of third leg with a broad band of white hairs, male: brown setal tuft on medial of fourth sternum ..... ***Dermestes frischii*** Kugelann
20'.	Pronotum with regular and dense light brown hairs, scutellum with very dense yellowish hairs, basal and humeral margins of elytra with a band of yellowish-orange hairs and the rest with irregular white hairs, abdominal sterna are covered with very dense white hairs, hair free sections of every sternum form brown macula on lateral, maculae on first sternum is 5-6 times larger than others, last sternum with curved bordered on medial by white hairs, femur of third leg with thin a band of white hairs, male: two brown setal tufts on medial of third and fourth sternum ..... ***Dermestes undulatus*** Brahm
21.	Antennae with basal five segments reddish-brown, apical five segments black, lateral margins of pronotum intensely rounded, pronotum and elytra metallic blue-green, punctures of elytra not distinct, legs light brown .....***Necrobia rufipes*** (De Geer)
21'.	Antennae entirely black, lateral margins of pronotum slightly rounded, pronotum and elytra metallic blue-green and purple, punctures of elytra very distinct, legs entirely black ..... ***Necrobia violacea***

apex convex; diversely sclerotized structures in inner sac; paramere sclerotized heavily at base, slightly at other parts, widened ellyptically through proximal, distinctly narrowing finger shaped through apical; diffuse short setae on apical (Figure 3b).

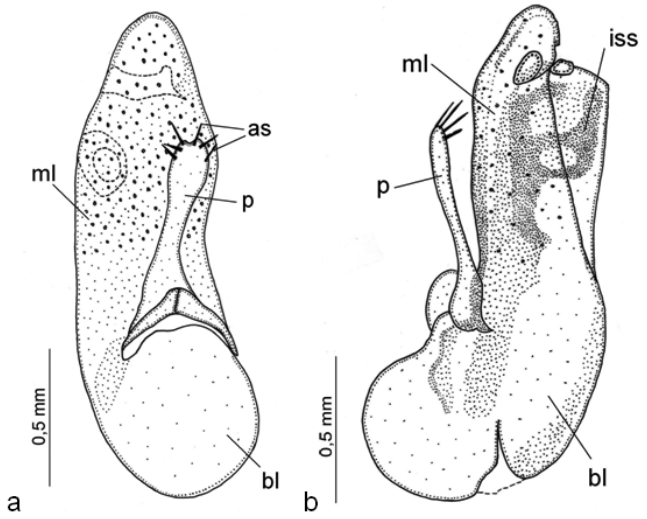

Figure 3. *Platydracus flavopunctatus* (Latreille): Aedeagus a) Ventral; b) Lateral; as: apical setae, bl: bulbus, iss: inner sac sclerite, ml: median lobe, p: paramere.

Philonthus laminatus (Creutzer, 1799)

Ventral view: Bulbus ellyptical; median lobe wide at base, almost parallel from proximal to distal, gradually narrowing from distal through apical, apex widely rounded; paramere symmetrical, wide, short and acute at base, gradually narrowing from base through distal, slightly widened at distal and swollen, narrowing apically; nine-paired opposed and convexly arranged peg setae from swollen part through apex seen as black spots (Figure 4a).

Lateral view: Bulbus semicircular; median lobe sclerotized, inner margin with two larger bulges at proximal and medial and a smaller at distal, gradually narrowing arcuately through apical, inner sac projecting outward at distal part; paramere widened triangularly at base, a short, acute projection at proximal of outer margin, parallel through distal, inner margin distinctly narrowing through apical; peg setae seen as they united between distal-apical part of inner margin, few short hairs in between (Figure 4b).

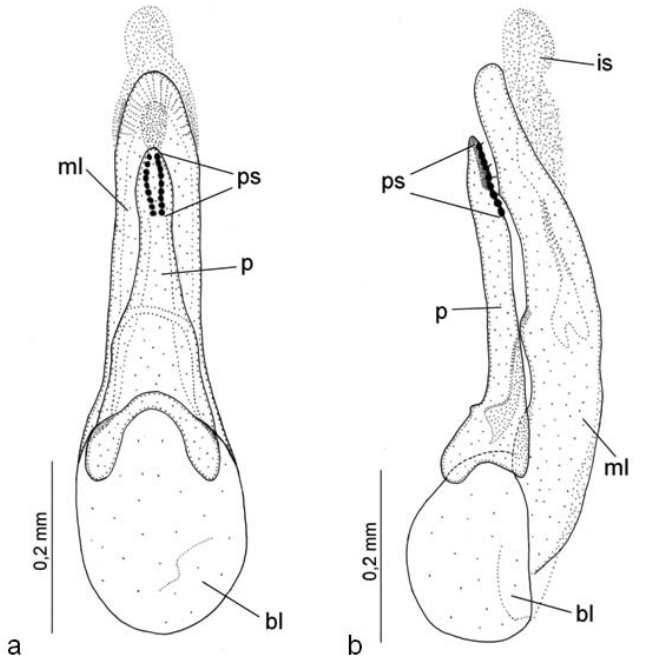

Figure 4. *Philonthus laminatus* (Creutzer): Aedeagus. a) Ventral; b) Lateral; bl: bulbus, is: inner sac, ml: median lobe, p: paramere, ps: peg setae.

Philonthus politus (Linnaeus, 1758)

Ventral view: Bulbus ellyptical; lateral margins of median lobe widened medially, slightly narrowing through distal and strongly through apical, apex semi-acute; paramere symmetrical, distinctly widened at base, sinuous through medio-distal, gradually narrowing apically, apex semi-acute; many irregular peg setae between medio-distal and apical seen as black spots (Figure 5a).

Lateral view: Bulbus semicircular at upper part, narrowing through lower; median lobe sclerotized, widened at base, gradually narrowing apically, inner margin with two small bulges at medio-proximal and medio-distal, inner sac projecting outward with bold and light coloured parts; paramere widened right-

triangularly at base, a short and thud projection at proximal of outer margin, inner margin distinctly widened at medial, gradually narrowing through apical; peg setae forming a heavily sclerotized part from medial through apical part of inner margin (Figure 5b).

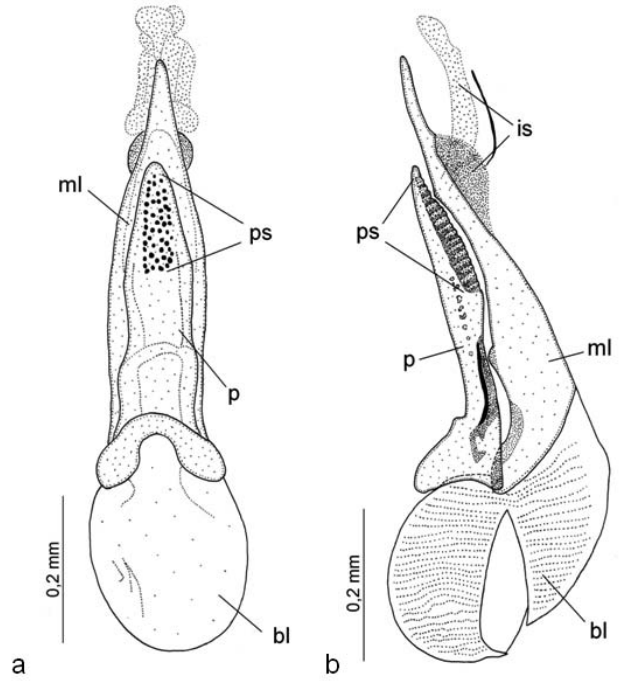

Figure 5. *Philonthus politus* (Linnaeus): Aedeagus a) Ventral; b) Lateral; bl: bulbus, is: inner sac, ml: median lobe, p: paramere, ps: peg setae.

Philonthus concinnus (Gravenhorst, 1802)

Ventral view: Bulbus ellyptical; lateral margins of median lobe gradually and distinctly narrowing through apical, slightly concave at medio-proximal and medio-distal, apex acute; paramere symmetrical, narrow and acute at base, gradually narrowing through medial, slightly swollen at medial, strongly narrowing apically, apex acute; 14-16 opposed and regularly arranged peg setae between medial and distal seen as black small circles (Figure 6a).

Lateral view: Bulbus regular-circle shaped at upper part; median lobe sclerotized except some parts, gradually narrowing apically, outer margin widened at medial and distal, apex thud-round; inner sac slightly projecting outward from median lobe; paramere sclerotized except margins, widened triangularly at posterior, thud projection at proximal of outer margin is distinct but smaller than *P. politus*, outer margin straight, prominently turning from distal, inner margin almost parallel to medio-distal except the narrowing on proximal, distinctly narrowing with a concave curve through apical, apex acute; curved part seen as heavily sclerotized because of peg setae (Figure 6b).

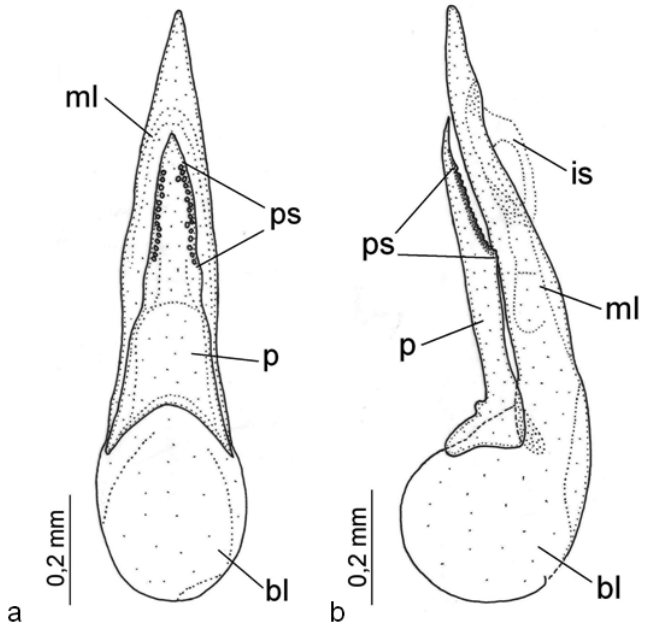

Figure 6. *Philonthus concinnus* (Gravenhorst): Aedeagus a) Ventral; b) Lateral; bl: bulbus, is: inner sac, ml: median lobe, p: paramere, ps: peg setae.

Philonthus corruscus (Gravenhorst, 1802)

Ventral view: Bulbus ellyptical; lateral margins of median lobe narrow, covered by paramere, slightly widening from medial through distal, gradually narrowing through apical, apex semi-acute; paramere symmetrical, base of paramere distinctly widening parallely backwards, narrowing through apical forming two bulges on medio-distal and distal, apex thud-acute; 9-10 opposed and regularly arranged peg setae between distal and apical seen as black spots near lateral margins (Figure 7a).

Lateral view: Bulbus regular circle shaped at upper part; median lobe slightly sclerotized, gradually narrowing apically, apex semi-acute; outer margin slightly projecting at medio-proximal, inner sac slightly projecting outward; paramere widened right-triangularly at posterior, thud projection at proximal of outer margin is widened, inner margin almost parallel to medio-distal except the slight recession on proximal, inner margin distinctly narrowing with a concave curve through apical, apex acute; curved part seen as heavily sclerotized band with peg setae (Figure 7b).

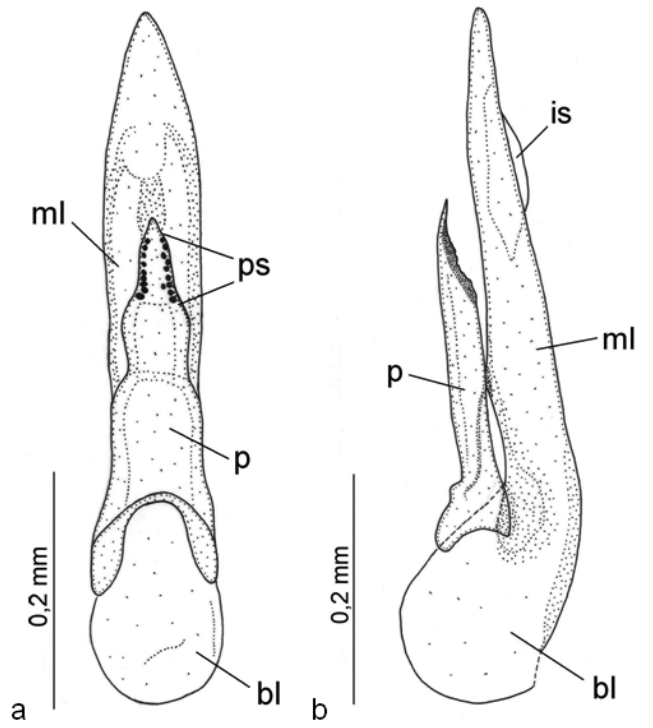

Figure 7. *Philonthus corruscus* (Gravenhorst): Aedeagus a) Ventral; b) Lateral; bl: bulbus, is: inner sac, ml: median lobe, p: paramere, ps: peg setae.

Aleochara lata Gravenhorst nec Kirby 1832, 1802

Ventral view: Bulbus ellyptical; basal orifice bordered on medial; median lobe of tubus gradually and distally narrowed, strongly narrowed through apical, apex acute; inner sac of tubus almost parallel apically, lateral margin slightly projecting distally and curvely narrowed, apical straight; inner sac curved like two sclerotized plates on medial, other convolution of inner sac seen as dense parts (Figure 8a).

Lateral view: Bulbus wide and irregular; median lobe of tubus almost parallel to medio-distal, at this point lower margin widened, distinctly curved and narrowed apically, apex semi-acute; inner sac of tubus seen as swollen on posterior of outer margin, heavily sclerotized from medial through apical and forms tooth-like two structures, part of inner sac surrounding the tooth-like structure at distal like a ring (Figure 8b).

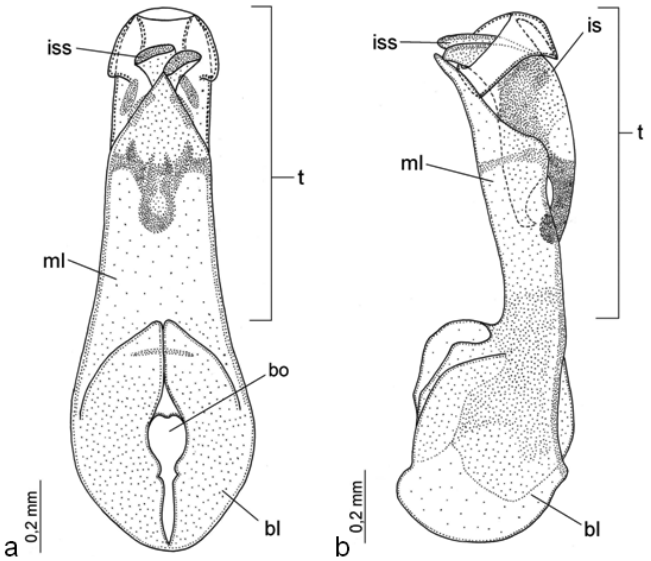

Figure 8. *Aleochara lata* Gravenhorst nec Kirby: Aedeagus a) Ventral; b) Ventral; bl: bulbus, bo: basal orifice, is: inner sac, iss: inner sac sclerite, ml: median lobe, t: tubus.

Aleochara intricata Mannerheim, 1830

Ventral view: Bulbus rather long and ellyptical; median lobe of tubus widened at base, gradually narrowed medio-distally, parallel through distal, sharply narrowed apically, apex semi-acute, strongly sclerotized with a thin border on lateral; inner sac of tubus projecting outwardly as head, sclerites form two large maculae on the base of projection, flagellum in the middle and standing longitudinally in the tubus furcate at posterior (Figure 9a).

Lateral view: Bulbus wide and irregular at base; median lobe of tubus narrow at medio-proximal, lower margin widened at medial, strongly narrowed distally through apical with finger shaped, apical convex, inner margin narrowed from bulbus to distal and heavily sclerotized; inner sac of tubus seen narrowed through apical from the base of outer margin and pass beyond the median lobe, bent over itself, flagellum standing from medial of bulbus to apical of inner sac (Figure 9b).

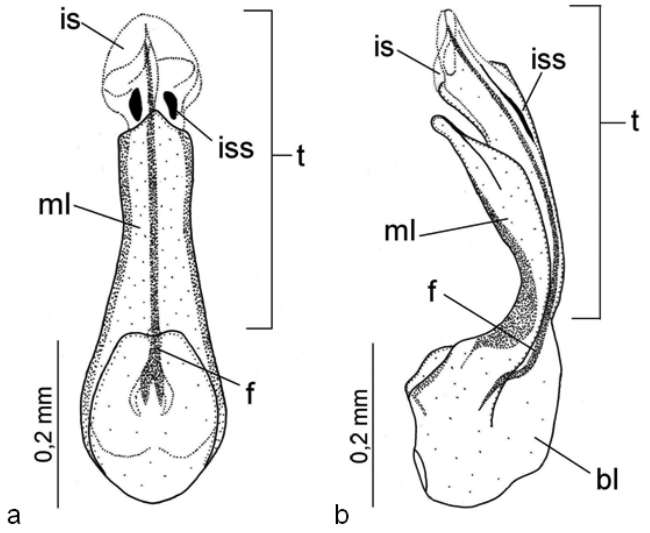

Figure 9. *Aleochara intricata* Mannerheim: Aedeagus a) Ventral; b) Lateral; bl: bulbus, f: flagellum, is: inner sac, iss: inner sac sclerite, ml: median lobe, t: tubus.

Family Histeridae

Margarinotus (Ptomister) brunneus (Fabricius, 1775)

Dorsal view: Basal piece semicircular, slightly sclerotized, wide asymmetric ellyptical opening on ventral side; tegmen slightly concave at medio-proximal, lateral margin arched through apical, two circular structure on apical, collar like opening at the antero-medial of tegmen; posterior apodem and median lobe fused in tegmen, posterior apodem forceps-shaped; spoon-shaped median lobe seen at anterior only because of a pair of mandibul-shaped median aparatus on dorsal; short gonophore on apical of median lobe (Figure 10a).

Lateral view: Basal piece triangular, lateral margins slightly sclerotized; tegmen fused ventrally and D-shaped; posterior apodem and median lobe fused, sinuous and narrow at base, widest at medio-distal; median aparatus reverse T-shaped (Figure 10b).

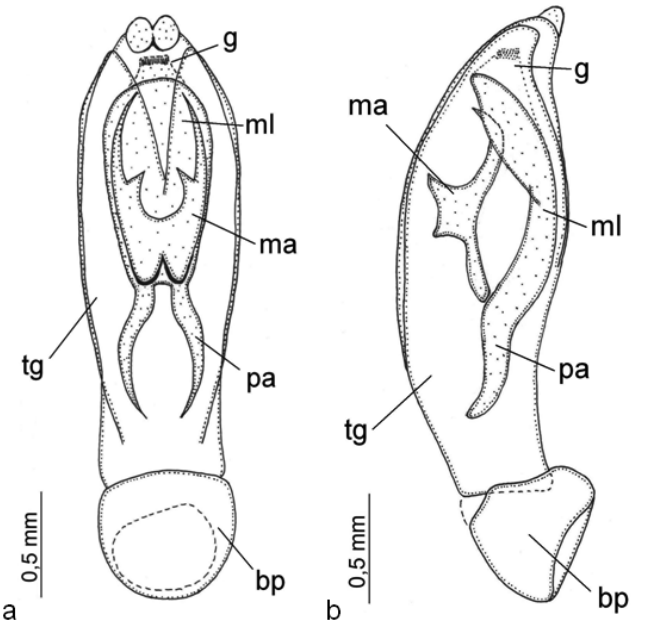

Figure 10: *Margarinotus (Ptomister) brunneus* (Fabricius): Aedeagus a) Dorsal; b) Lateral; bp: basal piece, g: gonophore, ma: median aparatus, ml: median lobe, pa: posterior apodem, tg: tegmen.

Saprinus caerulescens (Hoffmann, 1803)

Dorsal view: Basal piece slightly sclerotized and C-shaped, posterior edges pointed; tegmen sclerotized being the lateral margins stronger, lateral margins slightly concave from base thtough medial, slightly convex from medio-distal through distal, expanded a little, almost straight at apical; median lobe seen as a knife extruded from medio-distal of tegmen (Figure 11a).

Lateral view: Basal piece slightly scerotized and trapezoid-shaped; tegmen arched through distal, strongly narrowing through apical, apex semi-acute, gradually narrowing from medial through apical, inner sac slightly extruded from medio-distal of outer margin (Figure 11b).

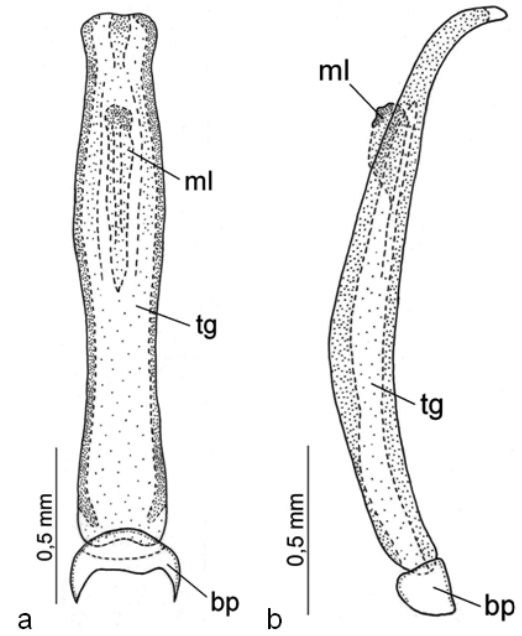

Figure 11: *Saprinus caerulescens* (Hoffmann): Aedeagus a) Dorsal; b) Lateral; bp: basal piece, ml: median lobe, tg: tegmen.

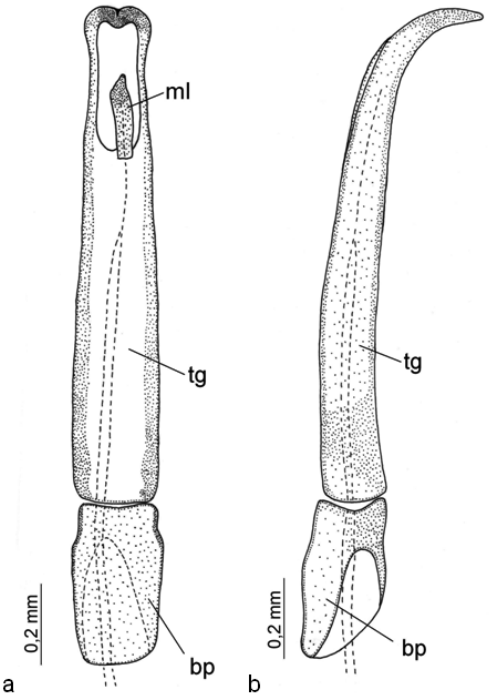

Figure 12: *Saprinus subnitescens* Bickhardt: Aedeagus a) Dorsal; b) Lateral; bp: basal piece, ml: median lobe, tg: tegmen.

Saprinus subnitescens Bickhardt, 1909

Dorsal view: Basal piece rectangular, strongly scerotized being the lateral margins highly sclerotized, narrowing between distal and apical; tegmen slightly narrowing from proximal through distal, expanded distally, apical margin slightly recessed medially; median lobe seen as a thin, pointed band on medio-distal of tegmen (Figure 12a).

Lateral view: Basal piece hollow and asymmetric, trapezoid-shaped; tegmen slightly narrowed from proximal through medio-distal, highly narrowed through apical, strongly bended, apex semi-acute (Figure 12b).

Saprinus vermiculatus Reichardt, 1923

Dorsal view: Basal piece two pieced; tegmen almost parallel through apical, apical slightly concave medially; median lobe seen as a knife on medial (Figure 13a).

Lateral view: Lower part of basal piece asymmetric and wide, upper part is narrow and symmetric; tegmen slightgly curved through medio-distal and narrowed, distinctly curved through apical, apical narrow and pointed; median lobe rectangular (Figure 13b).

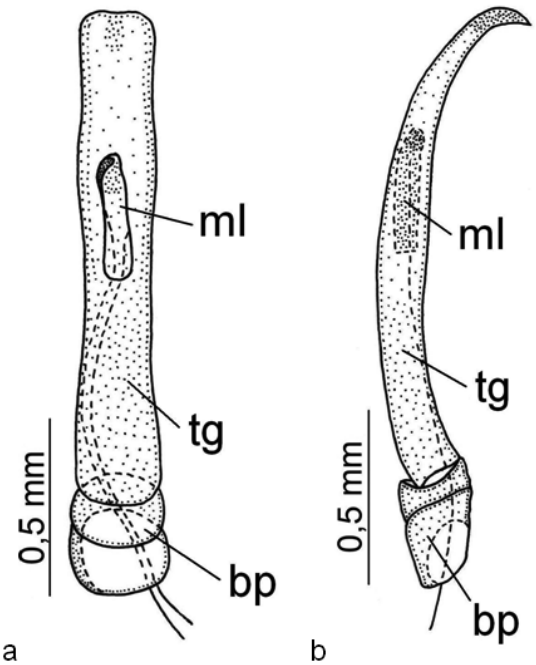

Figure 13: *Saprinus vermiculatus* Reichardt: Aedeagus a) Dorsal; b) Lateral; bp: basal piece, ml: median lobe, tg: tegmen.

Family Dermestidae

Dermestes frischii Kugelann, 1792

Dorsal view: Sclerotized parameres fused basally and pointed, wide U-shaped between base and proximal, parallel through medio-proximal, expanded over and then narrowed through medio-distal, while narrowing apically expanded outwardly, apical semi-acute; outer margin with long, dense hairs on apical, inner margin with short, few hairs from medio-proximal through apical; highly sclerotized median lobe fork-shaped at posterior, passing parameres on proximal, parallel through apical, slightly bulged at apical, apex convex (Figure 14a).

Lateral view: Base of sclerotized paramere nail-shaped and pointed, parallel through proximal, while strongly expanding to outer margin on medio-proximal, form a distinct sharp tooth-like structure, narrowed through apical, apex semi-acute with long and dense setae between distal and apical; median lobe wide at base, inner margin prominent to paramere's proximal, slightly narrowing at proximal, equally widened through apical and bent, apex slightly narrow and straight (Figure 14b).

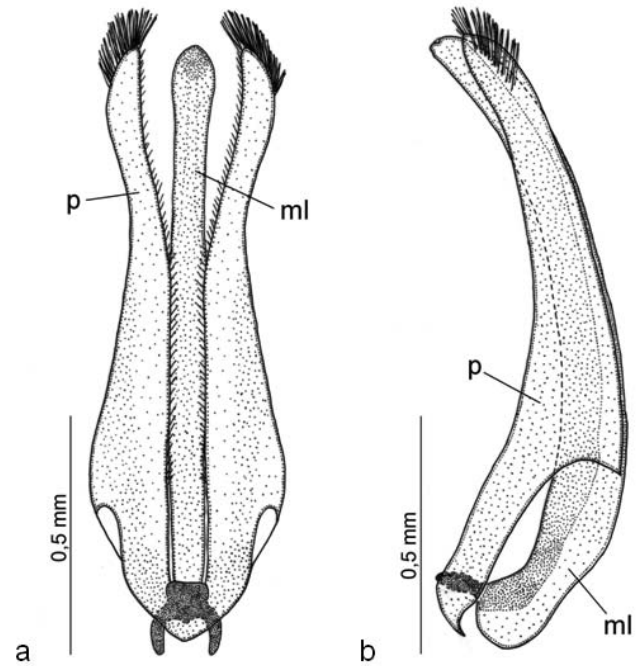

Figure 14: *Dermestes frischii* Kugelann: Aedeagus a) Dorsal; b) Lateral; mb: median lobe, p: paramere.

Dermestes undulatus Brahm, 1790

Dorsal view: Sclerotized parameres fused basally and pointed, narrow V-shaped between base and proximal, parallel through medio-proximal, expanded over and concave through medio-distal, while widening apically expanded outwardly, apical wide, convex; hairs between distal and apical are more dense than *D. frischii*, inner margin with short, dense hairs; median lobe fork-shaped at posterior, fork-shaped posterior part more slender and pointed than *D. frischii*, gradually narrowing from proximal through apical, apex straight, median lobe with a sclerotized line on medial (Figure 15a).

Lateral view: Base of sclerotized paramere sinuous, parallel through proximal, while expanding to outer margin on after proximal, form a stub tooth like structure, narrowed through apical, apex semi-acute with dense setae between medio-distal and apical; median lobe straight at base, basal angle of inner margin prominent to paramere, arched and gradually narrowing through medial, almost parallel through apical, apex slightly convex (Figure 15b).

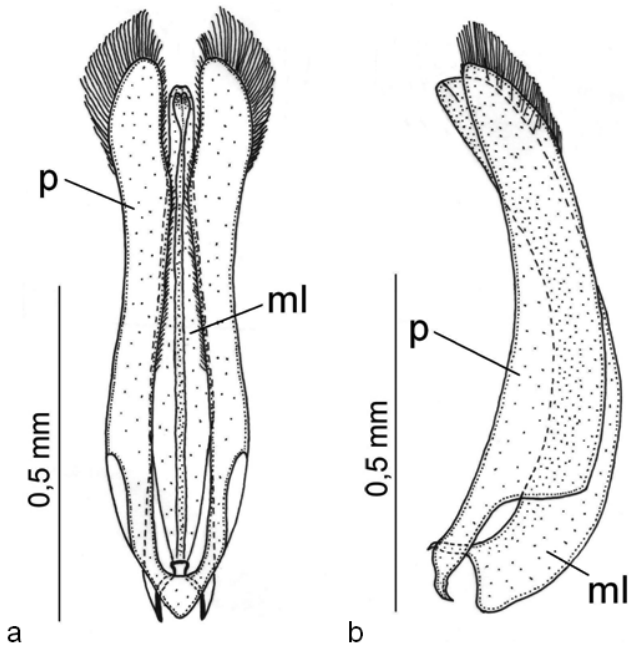

Figure 15: *Dermestes undulatus* Brahm: Aedeagus a) Dorsal; b) Lateral; mb: median lobe, p: paramere.

Family Silphidae

Thanatophilus rugosus (Linnaeus, 1758)

Dorsal view: Basal piece semicircular, outer margins highly sclerotized; parameres slightly expanded on proximal and more expanded on medio-proximal, slightly narrowed and arched apically, apex narrow and bulged; lateral margins of median lobe arched through medial and slightly arched through distal, equilateral triangle shaped between distal and apical, apex semi-acute; different parts of inner sac variedly sclerotized (Figure 16a).

Lateral view: Basal piece wide; median lobe narrow at proximal, strongly expanded from proximal and slightly narrowed through distal, while inner margin slightly arched through apical, outer margin sharply narrowed through apical, apex sharp; paramere narrow at base, strongly expanded at outer margin of proximal forming a tooth like structure, while slightly narrowing through distal, strongly narrowed through apical, apex straight (Figure 16b).

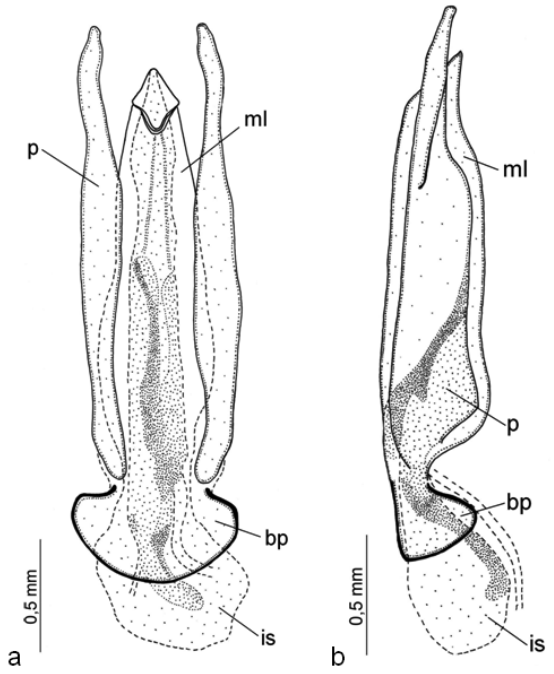

Figure 16. *Thanatophilus rugosus* (Linnaeus): Aedeagus a) Dorsal; b) Lateral; bp: basal piece, is: inner sac, ml: median lobe, p: paramere.

Thanatophilus ferrugatus (Solsky, 1874)

Dorsal view: Basal piece tablet shaped and angled; parameres curved basally, almost parallel through medial, widest at medio-distal, distinctly narrowed and almost equally widened, S-shaped through apical, apex semi-acute; lateral margins of median lobe arched through apical, lateral margin collar-shaped inwardly between medio-proximal and distal; very long and brush like hairs on medial of inner sac (Figure 17a).

Lateral view: Basal piece wide, triangular shaped; median lobe narrow at proximal, expanding from proximal, widest at medio-proximal and slightly narrowed through distal, distinctly narrowed through apical, apex spine-shaped; paramer arched through medio-distal, while slightly narrowing, equally widened and sinuous through apical, apex convex (Figure 17b).

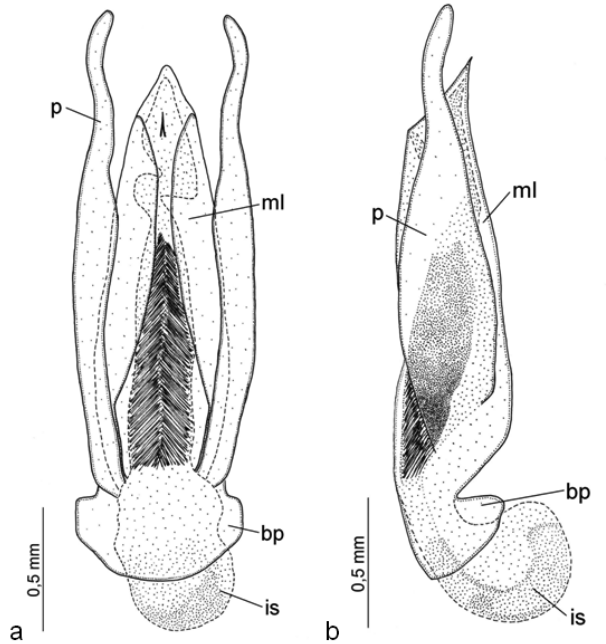

Figure 17. *Thanatophilus ferrugatus* (Solsky): Aedeagus a) Dorsal; b) Lateral; bp: basal piece, is: inner sac, ml: median lobe, p: paramere.

Family Nitidulidae

Nitidula rufipes (Linnaeus, 1767)

Dorsal view: Tegmen extended and ellyptical, with thin connection on medio-proximal, other lateral

margins sclerotized from base to distal, broadly sclerotized through apical, apical margin convex with short, dense hairs; aedegal apophysis narrow and slender, wide at base, slightly curved at posterior half; median lobe ellyptical, entirely contoured with highly sclerotized band, collar like folding on lateral margin from proximal through medial of apical margin, apical margin two pieced and sharp teeth shaped on medial, two arched and sclerotized transverse structure in the middle from medial through distal; a couple of chromosome shaped sclerotized plate in inner sac (Figure 18a).

Lateral view: Tegmen sinuous, slightly widening through medio-proximal, almost parallel through medio-proximal while distinctly curving to the left convexly then distinctly narrowing apically, distal part with short hairs on both inner and outer margin; aedegal apophysis curved, more wavy on posterior half; median lobe beneath the tegmen, only the part between medio-distal and apical visible and narrowing, visible part transversly standing to tegmen; plate in inner sac ellyptical through distal, then refined and widened while curving downwardly (Figure 18b).

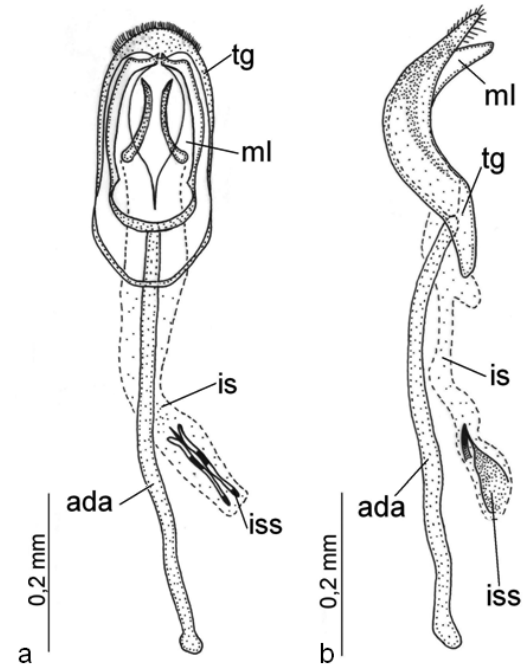

Figure 18. *Nitidula rufipes* (Linnaeus): Aedeagus a) Dorsal; b) Lateral; ada: aedegal apophysis, is: inner sac, iss: inner sac sclerite, ml: median lobe, tg: tegmen.

Nitidula flavomaculata Rossi, 1790

Dorsal view: Tegmen extended and ellyptical, anterior part wide at posterior, with thin connection on medio-proximal, other lateral margins sclerotized from base to distal, broadly and slightly sclerotized through apical, apical margin convex with short hairs; aedegal apophysis slender, wide at base and straight; median lobe contoured with highly sclerotized and U-shaped thin band, lateral margins distinctly arched through apical, apical margin broad V-shaped, anterior angles sharp, anterior part with a couple of horn-like projection; square shaped sclerotized plate in inner sac (Figure 19a).

Lateral view: Tegmen sinuous, almost parallel through proximal, while curving to the left concavely then widened, gradually narrowing through apical, apex semi-acute, distal part with short hairs on both inner and outer margin; aedegal apophysis slightly curved and wavy on anterior half; median lobe arched and almost parallel with tegmen, slightly narrowed through medial, almost parallel through apical and strongly curved to the right, apical margin straight and transverse; plate in inner sac boat shaped (Figure 19b).

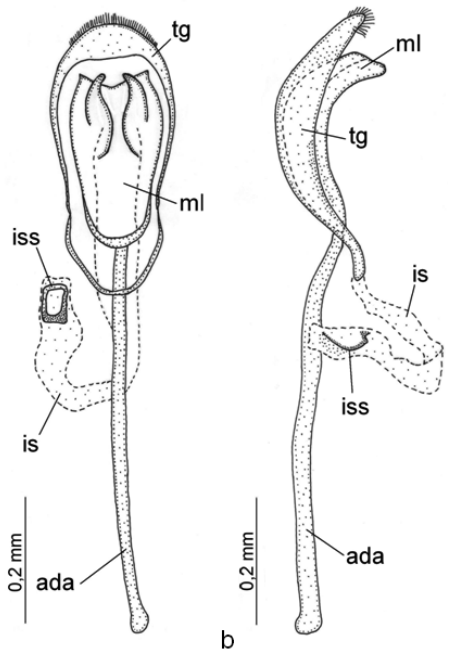

Figure 19. *Nitidula flavomaculata* Rossi: Aedeagus a) Dorsal; b) Lateral; ada: aedegal apophysis, is: inner sac, iss: inner sac sclerite, ml: median lobe, tg: tegmen.

Nitidula carnaria (Schaller, 1783)

Dorsal view: Tegmen ellyptical, no thin connection on medio-proximal, other lateral margins sclerotized through distal, strongly sclerotized between distal and apical with sclerotized maculae, apical margin wide and straight with short hairs; aedegal apophysis narrow and slender, wide at base; median lobe ellyptical and sinuous through apical, anterior margin slightly prominent, the middle of anterior part with a very thin and slightly arched sclerotized structure; three pieced sclerotized plate in inner sac (Figure 20a).

Lateral view: Tegmen narrow and straight through proximal, slightly curving to the left concavely and widened through medio-distal, gradually narrowing through apical, apex broad and sharp, distal part with short hairs on both inner and outer margin but this part is smaller than other two species; aedegal apophysis almost parallel and arched; median lobe banana shaped, narrow part on anterior is visible; inner sac long, with an arm-shaped and prominent plate in the middle (Figure 20b).

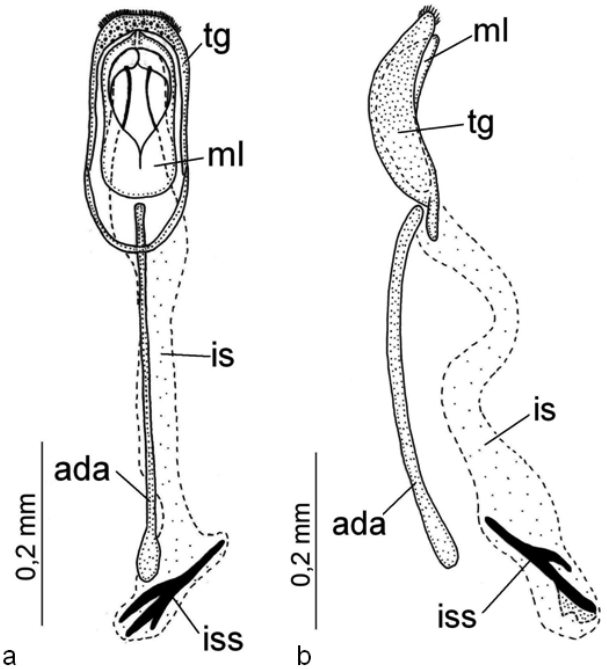

Figure 20. *Nitidula carnaria* (Schaller): Aedeagus a) Dorsal; b) Lateral; ada: aedegal apophysis, is: inner sac, iss: inner sac sclerite, ml: median lobe, tg: tegmen.

Family Cleridae

Necrobia rufipes (De Geer, 1775)

Dorsal view: Tegmen gradually narrowing triangle shaped, distal margins straight, apical margin straight and wide, triangularly recessed from base through proximal; phallus almost two times as long as tegmen; median lobe very slightly sclerotized and almost parallel, very distinctly narrowing through apical with finger shaped; phallobasic apodem slender, narrow based and shorter than phallus (Figure 21a).

Lateral view: Tegmen triangular shaped at posterior, widest at proximal, very slightly curving to the right and narrowed through distal, apical margin narrow and straight; median lobe parallel to tegmen, narrower and distinctly narrowing finger shaped from distal through apical; phallus slender, long, slightly arched at posterior, semi-acute at base; phallobasic apodem slender and narrow based (Figure 21b).

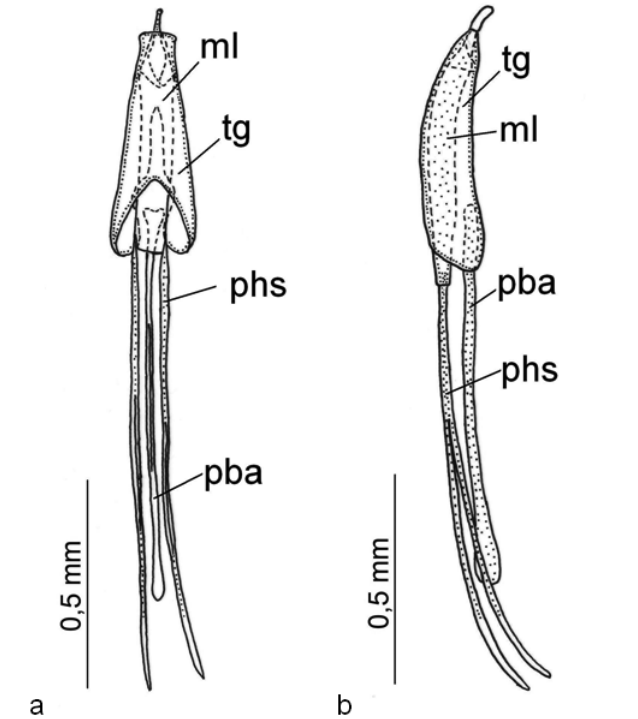

Figure 21: *Necrobia rufipes* (De Geer): Aedeagus a) Dorsal; b) Lateral; ml: median lobe, tg: tegmen, pba: phallobasic apodem, phs: phallus.

Necrobia violacea (Linnaeus, 1758)

Dorsal view: Tegmen gradually narrowing triangular-shaped through apical, lateral margins narrowing through medio-proximal and almost parallel through apical, apical angles recessed like rounded V-shape, recessed like semicircle from base through proximal; phallus almost two times as long as tegmen, more slender than *N. rufipes*; median lobe very slightly sclerotized, gradually narrowing from base through distal, slightly widened at distal and then narrowed through apical with equilateral triangle shaped; phallobasic apodem slender, slightly widened at base and shorter than phallobasic apodem (Figure 22a).

Lateral view: Tegmen slightly widened through proximal, distinctly curving to the right and slightly narrowed at proximal, apical margin broad and straight; median lobe narrow, slender and slightly arched, narrow at base, almost equally widened from medio-proximal through distal; phallus very slender and highly sclerotized, very sharp at base; phallobasic apodem very narrow, widened at posterior (Figure 22b).

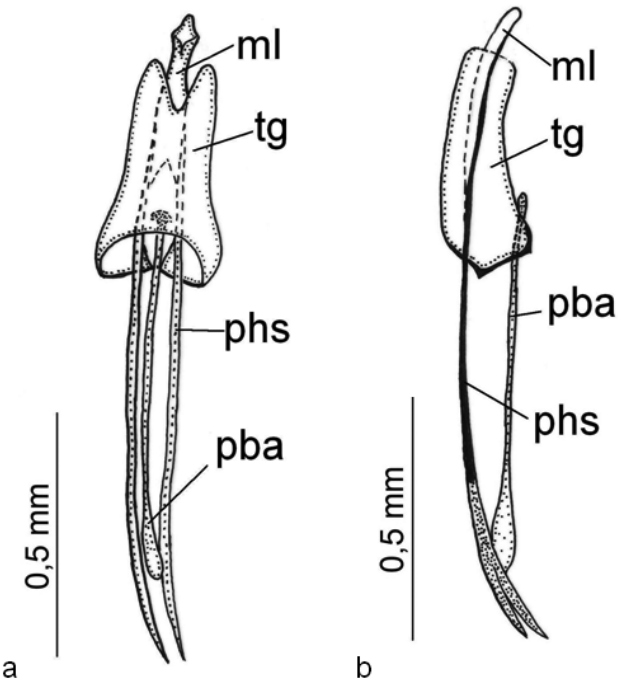

Figure 22. *Necrobia violacea* (Linnaeus): Aedeagus a) Dorsal; b) Lateral; ml: median lobe, tg: tegmen, pba: phallobasic apodem, phs: phallus.

DISCUSSION

With this study, systematic examination of species found on pig carcasses was aimed. This study was not a systematic study at all and comprehensive examination of 22 species belonging to six Coleoptera families would not be possible however, these species were examined systematically, especially the male genitalia. Results were discussed by means of possibilities and obtained literature.

In this examination, nine species from Staphylinidae belonging to two subfamilies and five genera were discussed. This species are *Philonthus laminatus, P. politus, P. corruscus, P. concinnus, Creophilus maxillosus, Platydracus flavomaculatus*, *Ontholestes murinus*, *Aleochara lata* and *A. intricata.*

Philonthus genus is identified by the characteristics of four basal tarsomeres of tarsus of both sexes more or less widened and bearing varied weak setae in addition to normally found unchanged marginal setae on ventral surface of each tarsomere (Netwon *et al*., 2000). From the examined *Philonthus* species, bulbus being wide, ellyptical or circular, median lobe being sclerotized and strong, the structure of paramere being plane shaped and having peg setae on parameres are apparently the characteristics of genus. Coffait (1974) studied the genus *Philonthus*, examined 24 species' male genitalia and drawn schematical figures. These species were also having the previously reputed common genus characters. These characters were also seen on species which were studied by Pietrykowska-Tudruj and Staniec (2006), Chani-Posse (2004), Navarrete-Heredia (2003), Moore (1968), Gusarov (1995), Staniec and Pietrykowska-Tudruj (2007). However, since there were no enough literature for closely related genera, it could not be determined that which of these characteres

were descriptive characteres of this genus. Examined species are differentiate by these characteres; apical margin of median lobe is widened in *P. laminatus* and variedly narrowed on other three species. The structure of paramere (lateral view) and the tooth-like projection being large or small differentiate among species. Also the anterior part of paramere being narrow or wide and apex being acute or thud, the base of paramere (dorsal view) being wide-thud or narrow-acute and the number and distribution of peg setae were apparenty the charaters that could be useful for identification.

Aleochara genus was deviated from other genera by the anntenna inserted on vertex behind the eyes and being 11-segmented (Ashe, 2000). In the studies of Klimaszewski and Crosby (1997) and Klimaszewski *et al*. (2003), few species were examined. Consequently, it is not enough to decide on genus characters from the obtained results. From the Gusarov's (2003) study, in which 20 other genera apart from *Aleochara* were examined, the structure of tubus and inner sac sclerites were seen as genus characters as they were also seen on other genera, but it is thought that more examination needs to be done on the genitalia of this genus. From the examined male genitalia of *A. lata*, median lobe (lateral view) being distincly narrowed on anterior part and semi-acute on apical, sclerotized plate in the inner sac of tubus being large, having basal orifice on medial from ventral view, and the median lobe being gradually narrowed and pointed at apical determined as the differences from *A. intricata* that median lobe (lateral view) being gradually narrowed and convex at apical, sclerotized plate in the inner sac of tubus being small, not having basal orifice on medial from ventral view and the median lobe being distinctly narrowed and thud at apical. From Gack and Peschke (2005), Peschke (1978) and Klimaszewski (1984) indicated that males of *Aleochara* having a flagellum and Klimaszewski (1984) and Welch (1997) indicated that the lenght of the flagellum is short in most of the species. Also in Gack and Peschke's (2005) study, in which they examined *A. tristis*, it was stated that the lenght of flagellum could be as two times as the entire lenght of male. Within the examined species, only *A. intricata* has flagellum; from lateral view it's extruding from the apex of inner sac and from ventral view standing at the base of bulbus, fork-shaped at posterior. In *A. lata* it was thought that it could not be determined because of the shortness of flagellum.

The genus *Creophilus* differentiate from other genera by the central part of pronotal disc being apparently impunctate, superior and inferior marginal lines of pronotal hypomeron being well seperated throughout and superior line fading out behind anterior pronotal angle (Netwon *et al*., 2000). In our study only *C. maxillosus* from *Creophilus* genus is examined and since there was possibility for comparing, the descriptive characters of this species is not known. However, the structures of bulbus, median lobe and paramere would be useful for distinguishing the species as in other genera of staphylinids. Also *Ontholestes murinus* and *Platydracus flavopunctatus* was examined as the only species from these genera and same conditions are valid for these species. From the literature, *Ontholestes* is differentiating by anterior angle of pronotum being prominent, acute and mesosternum having the complete midlongitudinal carina and *Platydracus* is differentiating by the anterior angle of pronotum not prominent and mesosternum not having the complete midlongitudinal carina from other genera (Netwon *et al*., 2000).

In the study four species from two subfamilies and two genera were examined from Histeridae. This species are *Margarinotus brunneus, Saprinus caerulescens, S. subnitescens and S. vermiculatus*.

Saprinus genus differetiate by the antennal cavities present alongside prosternal keel and the funicle in repose curving inward from *Margarinotus* with the funicle in repose curving outward (Kovarik and Caterino, 2000). Among the examined four species, the male genitalia structure of *Margarinotus brunneus* resembles *Saprinus* species but having some basic differences. *Margarinotus brunneus* is differentiating from *Saprinus* species by having a broader tegmen of aedeagus and bearing very distinct structures named median aparatus and posterior apodem. As with the previous examples of single species from a genus, these are poor characteres and no determination could be done with this limited knowledge. Yelamos (2002) studied on some *Margarinotus* species and our species, *M. brunneus*, was one of them. Our results show a parallellism with this study both with the structures of basal piece and tegmen and the sclerotized structures in the tegmen.

In *Saprinus* genus it would be seen that the tegmen is long and very narrowed to *Margarinotus brunneus* (Figures 11a, 12a, 13a). The structure and sclerotization of tegmen and basal piece, especially the apical part of tegmen being acute or not and it's curvature from lateral view could be used for identifiying the species. Also it is thought that reduced median lobe in innner sac could be useful for identification. In Yelamos's (2002) study our examined *Saprinus* species were also took a part but little differences are present because of the drawings being schematic. Beside these differences results are consentient with this study.

From Dermestidae *Dermestes frischii* and *D. undulatus* species were identified belonging to genus *Dermestes* which differs by the black and white hairs covering abdomen (Hava, 2004) and not having median ocellus (Hinton, 1945). Adams (1980) indicated that the structure and lenght of median lobe and the structure of parameres are the important systematic characters. These characters were important for us as Adams (1980) but it could not be determined in our study that which character or characters would be used for genus identification. *D. frischii* differs by the median lobe being long and slender, widened at distal and semi-acute at posterior ends, parameres being wide at posterior and distinctly narrowed at distal and long hairs only on apical from *D. undulatus* which the median lobe is variedly narrowing and widening, narrowed at distal and narrow acute at posterior ends, parameres having equal width at posterior and distal and long, more dense hairs between distal and apical. The photographs of these species' male genitalia are present at the Andreas Herrmann's homepage on internet (www.derme-stidae.com). While parameral structures are consistent, both species' distal of median lobe shown as distinguished and differs from our results.

Morphological identification characters of *Thanatophilus* genus from Silphidae could not be obtained from our literature. However according to Peck (2000), this genus differs from *Silpha* by the antennal club being more robust and antennomere 2 shorter than 3, 8 shorter than 9 in Nearctic region. *Thanatophilus ferrugatus* and *T. rugosus* species were identified in this study. From the examined male genitalia of *T. rugosus* that basal piece (dorsal view) being recessed with arched at the connection point with parameres and margins more sclerotized, median lobe being generally shuttle shaped and strongly narrowing at apical and inner sac being membranous except the part between the base of median lobe through medio-distal is slightly sclerotized determined as the differences from *T. ferrugatus* that basal piece (dorsal view) being recessed with L-shaped at the connection point with parameres and margins equally sclerotized, median lobe being generally shuttle shaped and lateral margins bent like envelope on center from proximal through distal and inner sac being membranous

except the part between the base of median lobe through medio-distal is highly sclerotized.

From Cleridae *Necrobia rufipes* and *N. violacea* species were identified belonging to genus *Necrobia* which differs by the body mostly being uni-coloured, three apical antennal segments forming a broad club and elytra having dense and regularly punctured (Kim and Jung, 2006). The genitalia of this species greatly differ from other examined families. Phallus and phallobasic apodem being very long, almost as two times as longer or more than tegmen, tegmen embracing the median lobe as it gains a distinct structural shape are the first aqcuired impressions from our results.

N. rufipes differs by tegmen (dorsal view) with a large and triangular recess at posterior, apical margin being wide and straight and distal of median lobe being narrowed as finger shaped from *N. violacea* with tegmen (dorsal view) with a semicircular recess at posterior, apical margin having a V-shaped recess and distal of median lobe being narrowed triangularly. Kim and Jung (2006) given the schematic drawing of only a part of aedeagus of *N. rufipes* and because of that it's not consentient with our results.

Nitidula flavomaculata, *N. rufipes* and *N. carnaria* species were identified from *Nitidula* genus of Nitidulidae which differs by the antennal cavities being on the ventral side of head, not extended through eyes, not having a little recess on the disc of pronotum (Bosquet, 1990) and having distinct, short hairs on margins of elytra and pronotum (Connel, 1987). All three species having ellyptical tegmen, aedegal apophysis being long and slender, median lobe being shorter than tegmen and having diffrerent shaped sclerotized plates in inner sac seen as common characters, however as previous, it could not be possible to say anything about the genus.

N. flavomaculata differs from other two species by tegmen (dorsal view) being broader on anterior, median lobe having two horn-like projections in the middle, having a rectangular shaped sclerite in inner sac and tegmen (lateral view) being narrow and long at posterior, median lobe being curved on anterior. *N. rufipes* differs by tegmen (dorsal view) being broader on posterior, median lobe having two transverse and arched sclerotized structure in the middle, having a couple of chromosome shaped sclerotized plate in inner sac and tegmen (lateral view) being broad and long at posterior, median lobe being arched on anterior from *N. carnaria* which tegmen (dorsal view) being equally widened both on posterior and anterior, median lobe having a slightly curved and thin sclerotized structure in the middle, having three pieced sclerotized plate in inner sac and tegmen (lateral view) being narrow and short at posterior and median lobe being arched on anterior.

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Appendix


I A)
I B)
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II B)
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IV B)
V A)
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VI A)
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X A)
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XI A)
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XII B)

Appendix (continued)

I -*Creophilus maxillosus* (Linnaeus, 1758), A) Dorsal, B) Lateral
II -*Ontholestes murinus* (Linnaeus, 1758), A) Dorsal, B) Lateral
III -*Platydracus flavopunctatus* (Latreille, 1804), A) Dorsal, B) Lateral
IV -*Philonthus laminatus* (Creutzer, 1799), A) Dorsal, B) Lateral
V -*Philonthus politus* (Linnaeus, 1758), A) Dorsal, B) Lateral
VI - *Philonthus concinnus* (Gravenhorst, 1802), A) Dorsal, B) Lateral
VII -*Philonthus corruscus* (Gravenhorst, 1802), A) Dorsal, B) Lateral
VIII-*Aleochara lata* (Gravenhorst nec Kirby 1832, 1802), A) Dorsal, B) Lateral
IX -*Aleochara intricata* (Mannerheim, 1830), A) Dorsal, B) Lateral
X -*Margarinotus (Ptomister) brunneus* (Fabricius, 1775), A) Dorsal, B) Lateral
XI -*Saprinus caerulescens* (Hoffmann, 1803), A) Dorsal, B) Lateral
XII -*Saprinus subnitescens* (Bickhardt, 1909), A) Dorsal, B) Lateral
XIII -*Saprinus vermiculatus* (Reichardt, 1923), A) Dorsal, B) Lateral
XIV - *Dermestes frischii* (Kugelann, 1792), A) Dorsal, B) Ventral
XV - *Dermestes undulatus* (Brahm, 1790), A) Dorsal, B) Ventral
XVI -*Thanatophilus rugosus* (Linnaeus, 1758), A) Dorsal, B) Lateral
XVII - *Thanatophilus ferrugatus* (Solsky, 1874), A) Dorsal, B) Lateral
XVIII - *Nitidula rufipes* (Linnaeus, 1767), A) Dorsal, B) Lateral
XIX - *Nitidula flavomaculata* (Rossi, 1790), A) Dorsal, B) Lateral
XX - *Nitidula carnaria* (Schaller, 1783), A) Dorsal, B) Lateral
XXI - *Necrobia rufipes* (De Geer, 1775), A) Dorsal, B) Lateral
XXII - *Necrobia violacea* (Linnaeus, 1758). A) Dorsal, B) Lateral