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Systematic Studies on the Male Genital Organs of some Blister Beetles (Coleoptera: Meloidae) of Ankara Province (Turkey)

Ankara İli (Türkiye) Bazı Yakı Böceklerinin (Coleoptera: Meloidae) Erkek Genital Organları Üzerinde Sistematiik Çalışmalar

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ABSTRACT

The focus of this study is to make important contributions to Meloidae taxonomy. Specimens belonging to thirty-two species of the family Meloidae (Coleoptera) were collected from Ankara province in 2018-2019. Male genital structures of these species were examined. Photographs and drawings of the male genital organ structures of all these species (32 species), and descriptions of some of them, which were found to be missing in the current literature, were given. The taxonomic key has been constructed for these species from the present literature and examined materials. Also, male genital organs of all species were compared to the literature. Photographs and drawings of the male genital organs of *Alosimus luteus* (Waltl, 1838), *A. marginicollis* (Haag-Rutenberg, 1880) and *Euzonitis rubida* (Ménétriés, 1832) were given for the first time with this study.

Key Words

Ankara, Meloidae, Systematic evaluations, Turkey.

Öz

Bu çalışmanın odak noktası Meloidae taksonomisine önemli katkılarda bulunmaktır. Meloidae (Coleoptera) familyasına ait otuz iki türe ait örnekler, 2018-2019 yıllarında Ankara ilinden toplanmıştır. Bu türlerin erkek genital yapıları incelenmiştir. Bu türlerin tamamının (32 tür) erkek genital organ yapılarının fotoğrafları ve çizimleri ile güncel literatürde eksik bulunan bazı türlerin tanımlamaları verilmiştir. Bu türler için mevcut literatürden ve incelenen materyallerden taksonomik anahtar oluşturulmuştur. Ayrıca tüm türlerin erkek genital organları güncel literatürle karşılaştırılmıştır. *Alosimus luteus* (Waltl, 1838), *A. marginicollis* (Haag-Rutenberg, 1880) ve *Euzonitis rubida* (Ménétriés, 1832) erkek genital organlarının fotoğrafları ve çizimleri ilk kez bu çalışmada verilmiştir.

Anahtar Kelimeler

Ankara, Meloidae, Sistematiik değerlendirmeler, Türkiye.

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INTRODUCTION

The family Meloidae (Coleoptera) has about 3000 species belonging to 120 genera [1]. This family, known as blister beetles, is cosmopolitan (except New Zealand, Antarctica and most Polynesian islands) [2]. This family has the tenebrionoid type of male genitalia, and parameres partly or entirely fused but articulated with phallobase. Aedeagus is elongate and generally with two dorsal hooks, or uncommonly one, and with usually one ventral endophallic hook. Nemognathinae lacks both aedeagal dorsal hooks and endophallic hooks. Parameres distinct, fused only basally in Eleticinae, Meloinae and Tetraonycinae; completely fused in most Nemognathinae except in certain genera [2]. The focus of this study is to make important contributions to Meloidae taxonomy by examining with the drawing and describing of male genital organs of specimens collected from Ankara.

MATERIALS and METHODS

Specimens were collected from Ankara for 69 days (May-October 2018 (33 days) and April-October 2019 (36 days)) with field studies. The male genital organs were dissected and compared with the drawings in the current literature for confirmation of species diagnosis. The male genitals were prepared by using standard methods. These were examined by separating, photos of them were taken and drawings were made from ventral and lateral views. Morphological structures of male genital organs for differential diagnosis are also given briefly in tables. Photographs of male genitalia and small-sized specimens were taken with the Euro-mex SB-1903 Stereoblue microscope. Large specimens were taken with the Nikon Coolpix P900. The taxonomic key has been prepared considering the examined materials and related literature [3-14]. The differential diagnosis characters in male genital organs are placed on the keys. Detailed differences are given in the tables.

RESULTS and DISCUSSION

In this study, 32 species belonging to 2 subfamilies, 5 tribe and 11 genera from Ankara were systematically examined. Photographs and drawings of the male genital organ structures of all these species, and descriptions of some of them, which were found to be missing in the current literature, were given. Photographs and drawings of the male genital organs of *Alosimus luteus*,

A. marginicollis and *Euzonitis rubida* species were given for the first time in this study. Also, *Alosimus armeniacus*, *A. chalybaeus*, *Lydus turcicus*, *Hycleus polymorphus*, *Mylabris (Eumylabris) cincta*, *M. (E.) crocata*, *M. (E.) fabricii*, *M. (Micrabris) laevicollis*, *M. (Micrabris) concolor*, *Meloe (Eurymeloe) glazunovi*, *Euzonitis sexmaculata*, *Zonitis (s.str.) flava* and *Z. (s.str.) immaculata* male genital organ structures were photographed and drawn for the first time in detail (evaluation of aedeagus and tegmen separately, and spiculum gastrale).

Key to the species

1. Antennae elongate and usually filiform; maxillary galeae rather modified and in usually elongate and forming a suction tube; outer angle of anterior tibiae of female blunt and short; the dorsal blade of tarsal claws with a double row of teeth along lower margin; aedeagus semi-membranous, without hook, endophallus only slightly sclerotized, never hooked; parameres usually completely fusing.....**2**

1'. Antennae variously shaped, usually not filiform; maxillary galeae usually not modified or elongate (except for *Cerocomia*); outer angle of anterior tibiae of female pointed and elongate (except for *Meloe*); the dorsal blade of tarsal claws smooth in lower margin (except for Lyttini, and *Eumylabris* subgenus belonging to *Mylabris*); aedeagus strongly sclerotized, with 2-1 hooks, endophallus well sclerotized and also hooked; parameres not completely fusing.....**6**

2. Galeae quite elongate, longer than maxillary palpi (Figure 31 in Bologna and Pinto [9]); gonoforceps cylindrical in lateral view (Figure 3)***Nemognatha chrysomelina***

2'. Galeae slightly elongate, shorter than maxillary palpi; gonoforceps conical in lateral view **3**

3. Outer hind tibial spur much longer, wider apically than inner spur **4**

3'. Outer hind tibial spur about as long as an inner spur, variable in width **5**

4. Head and pronotum black; pronotum spotless; antenna completely black; gonoforceps completely fused in ventral view; aedeagus pointed at the apex (Figure 1) ***Euzonitis rubida***

- 4'.** Head and pronotum yellow-ocher; pronotum with two black slightly spots on the lateral; antenna brown, only first segment black; gonoforceps slightly separated in ventral view; aedeagus not pointed at the apex (Figure 2) ***Euzonitis sexmaculata***
- 5.** Prosternum short, not elongated between posteriorly anterior coxa; pronotum narrowing roundly the antero-laterally in viewed dorsally (Figure 156 in Bologna [8]); outer hind tibial spur wider than the inner (Figure 86 in Bologna and Pinto [9]); gonoforceps pointed at the apex in ventral view (Figure 4) ***Zonitis* (s.str.) *flava***
- 5'.** Prosternum long, clearly posteriorly elongated and pointed between the anterior coxa; pronotum narrowing suddenly antero-laterally in viewed dorsally (Figure 156 in Bologna [8]); outer hind tibial spurs almost equal width (Figure 87 in Bologna and Pinto [9]); gonoforceps blunt at the apex in ventral view (Figure 5) ***Zonitis* (s.str.) *immaculata***
- 6.** Elytra short and basally imbricate, not completely covering abdomen; metathoracic wings absent; metasternum short; the endophallic hook of the aedeagus is too small, not visible clearly in the lateral view **7**
- 6'.** Elytra normally developed and basally non-imbricate, covering abdomen; metathoracic wings developed; metasternum elongate; the endophallic hook of aedeagus is not small, clearly visible in the lateral view (except *Actenodia confluens*) **8**
- 7.** Elytral humeral depression very pronounced ***Meloe (Eurymeloe) glazunovi***
- 7'.** Elytral humeral depression less pronounced ***Meloe (Eurymeloe) mediterraneus***
- 8.** Antenna inserted in front of frontal suture, far from eyes, the segments strongly modified in male; aedeagus with two endophallic hooks **9**
- 8'.** Antenna behind frontal suture, near eyes, the segments moderately or not modified in male; aedeagus with one endophallic hook **12**
- 9.** (Male) Frontal calli scarcely developed and raised over the head, with a frontal area well visible between them; antennae and maxillary palpi scarcely modified; protibiae not modified or only slightly swollen dorsally; the apex of aedeagus rounded **10**
- 9'.** (Male) Frontal calli only slightly raised over the head and not very close to each other, frontal area clearly visible between them; antennae and maxillary palpi strongly modified; protibiae with a high dorsal keel, variously shaped and not directed outwards; the apex of aedeagus pointed **11**
- 10.** Maxillary palpomere II and III weakly enlarged; antennae only slightly modified within the *Cerocoma* subgenus (Figures 2-V and 3-V in Turco and Bologna [12]); apical lobes of parameres distinctly swollen (Figure 6) ***Cerocoma* (s.str.) *bernhaueri***
- 10'.** Maxillary palpomere II and III distinctly enlarged; antennae visibly modified within the *Cerocoma* subgenus (Figures 2-S and 3-S in Turco and Bologna [12]); apical lobes of parameres slightly swollen (Figure 7) ***Cerocoma* (s.str.) *schaefferi***
- 11.** Protarsomere III about as long as V, excluding claws; maxillary palpi IV thin, slightly widened in medio-distal (Figures 3-I and 4-I in Turco and Bologna [12]); aedeagal hooks equal in size; endophallic hooks equal in size (Figure 8) ***Cerocoma* (Meloides) *longiseta***
- 11'.** Protarsomere III distinctly shorter than V, excluding claws; maxillary palpi IV wide, widened in medio-proximal (Figures 3-Q and 4-Q in Turco and Bologna [12]); aedeagal hooks not equal, subapical hook slightly larger than the apical; endophallic hooks not equal, subapical hook slightly larger than the apical (Figure 9) ***Cerocoma* (Meloides) *turcica***
- 12.** Antennae moniliform, fusiform or subfiliform, not enlarged apically; mesepisterna separated or touching along the middle, in front of mesosternum; the dorsal blade of tarsal claws with one row of teeth along ventral margin; endophallic hook large and strongly sclerotize **13**
- 12'.** Antennae claviform, slightly enlarged apically; mesepisterna separated in middle, in front of mesosternum, this latter usually with distinct scutum; the dorsal blade of tarsal claws smooth in the ventral margin (except for *Eumylabris* subgenus belonging to *Mylabris*); endophallic hook not as large as above and less sclerotize **18**

- 13.** The last segment of maxillary palpi clearly narrowed apically; antennae short, not attaining the base of pronotum, V–X. segment transverse and symmetrical; male head strongly impressed behind the eye (Figure 58 in Bologna [8]) ***Oenas crassicornis***
- 13'.** The last segment of maxillary palpi not clearly narrowed apically; antennae long, attaining the base of pronotum, V–X. segment more elongate or if transverse then at least slightly asymmetrical; male head not impressed behind eye **14**
- 14.** Pronotum longer than wide; antennal segments VI–X more elongate, asymmetrical at the basal; colour not metallic ***Lydus turcicus***
- 14'.** Pronotum wider than long; antennal segments VI–X more enlarge, symmetrical at the basal; colour metallic **15**
- 15.** Frontal red spot present; first middle-tarsomere shorter than II in male (Figure 15) ***Alosimus marginicollis***
- 15'.** Frontal red spot absent; first middle-tarsomere equal with II, or longer than in male **16**
- 16.** Protibia with apically one spur; first middle-tarsomere relatively equal with II in male; aedeagal hooks almost equal-sized (Figure 14) ***Alosimus luteus***
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- 17.** In the male, middle-tarsomere I thin, clearly longer than II; the distal hook of aedeagus larger than the proximal one (Figure 12); body in metallic green or blue-green colours ***Alosimus armeniacus***
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- 19.** Mesepisterna with a relatively wide and distinctly furrowed anterior border area (Figures 66–67 in Bologna and Pinto [9]); pronotum with a very fine median furrow and depression at the central of disk **20**
- 19'.** Mesepisterna with anterior edge sometimes narrowly grooved, without a wide and furrowed anterior border area (Figures 68–69 in Bologna and Pinto [9]); pronotum without a fine median furrow at the central of disk **23**
- 20.** Mesosternum without a clear fore modified portion named scutum; last antennal segment thin, rounded at apex, not appears contiguous to before the last; gonoforceps proximally fused in ventral view (Figure 22)..... ***Hycleus sexmaculatus***
- 20'.** Mesosternum with a wide fore modified portion named scutum; last antennal segment of swollen, pointed at apex, appears contiguous to before the last; gonoforceps medially or medio-proximally fused in ventral view **21**
- 21.** Antennomere I shorter than twice II; elytra patterning with two spots on anterior 1/3; temples wider than eyes ***Hycleus scabiosae***
- 21'.** Antennomere I as long or longer than twice II; elytra patterning with the black fascia on anterior 1/3; temples not wider than eyes **22**
- 22.** Pronotum with transverse depression in anterior; only the distal hook of the aedeagus at the apex; gonoforceps medially fused in ventral view (Figure 19) ***Hycleus polymorphus***
- 22'.** Pronotum without depression in anterior; both hooks of the aedeagus at the apex; gonoforceps medio-proximally fused in ventral view (Figure 21) ***Hycleus zebraeus***
- 23.** Mesosternal scutum smooth; hooks of aedeagus similar or only slightly different, distal one far from apex **24**

- 23'.** Mesosternal scutum with punctate and pubescent posterior middle area; hooks of aedeagus different from one another, distal one apical or subapical (Subgenus: *Mylabris*) **30**
- 24.** Dorsal blade of tarsal claws with teeth along ventral margin; medium or large-sized species (Subgenus: *Eumylabris*) **25**
- 24'.** Dorsal blade of tarsal claws with smooth along ventral margin; small-sized species (Subgenus: *Micrabris*) **28**
- 25.** Head with small two red spots in between the eyes; elytral pattern with two spots in anterior and black fasciae in middle and posterior..... **26**
- 25'.** Head without a spot in between the eyes; elytral pattern with 5 black spots (2:2:1) **27**
- 26.** Antennomere III longer than IV; elytral pattern with two spots in anterior, wide fasciae in the median and subapical, which not reach the lateral margin; aedeagal hooks almost equal-sized (Figure 23) ***Mylabris calida***
- 26'.** Antennomere III as long as IV; elytral pattern with fascia in anterior, which not reach the lateral margin, wide fasciae in median and subapical, which reach the lateral margin; aedeagal hooks different-sized, the proximal one distinctly larger (Figure 24) ***Mylabris (E.) cincta***
- 27.** Lateral appendages of mesosternum short and blunt; elytral posterior spot wider than others; gonoforceps almost conical, suddenly narrowing from basal to proximal, gradually narrowing from proximal to apical in lateral view; aedeagal hooks almost equal-sized (Figure 25) ***Mylabris (E.) fabricii***
- 27'.** Lateral appendages of mesosternum long and pointed; elytral posterior spot as wide as, or narrower than others gonoforceps almost cylindrical at the basal, gradually narrowing towards the apical in lateral view; aedeagal hooks different-sized, the proximal one slightly larger (Figure 26) ***Mylabris (E.) crocata***
- 28.** Elytra unicolour yellow-brown; antenna long, reaches the basal of the elytra; the basal part of gonoforceps deeply emarginated in ventral view (Figure 29) ***Mylabris (Mic.) unicolor***
- 28'.** Elytra with brown but with black spots or fasciae; antenna short, reaches the medial of the pronotum; the basal part of gonoforceps shallow emarginated or straight in ventral view **29**
- 29.** Elytral pattern with two spots in anterior and posterior, one middle greatly sinuous narrow fascia; gonoforceps medio-proximally fused in ventral view; aedeagal hooks almost equal-sized (Figure 27) ***Mylabris (Mic.) geminata***
- 29'.** Elytral pattern with 6 spots (2:2:2); gonoforceps proximally fused in ventral view; aedeagal hooks different-sized, the distal one wider and shorter (Figure 28) ***Mylabris (Mic.) laevicollis***
- 30.** Elytral black apical fascia narrow; antennomeres III-X reddish; gonoforceps medially fused in ventral view; the apical lobe of gonoforceps distinctly curved in lateral view (Figure 30) ***Mylabris (s.str.) olivieri***
- 30'.** Elytral black apical fascia wide; antennomeres black; gonoforceps proximally fused in ventral view; the apical lobe of gonoforceps slightly curved in lateral view **31**
- 31.** Pronotum with a shallow anterior transverse depression; gonoforceps very wide in lateral view (Figure 31) ***Mylabris (s.str.) quadripunctata***
- 31'.** Pronotum without anterior transverse depression; gonoforceps almost slender in lateral view (Figure 32) ***Mylabris (s.str.) variabilis***

Subfamily: **NEMOGNATHINAE** Laporte, 1840
Tribe: Nemognathini Laporte, 1840
Genus: **Euzonitis** Semenov, 1893

This genus is represented by 17 species in the Palaearctic Region, 5 species in Turkey [15]. In this study, male specimens of two species belonging to this genus were examined. These species are *Euzonitis rubida* and *E. sexmaculata*. Differential diagnosis characters on male genital structures of examined species belonging to this genus were given Table 1.

Euzonitis rubida (Ménétriés, 1832)

Male Genital Organ Morphology (Figure 1): Gonoforceps completely fused in ventral view; phallobase convex and long; in lateral view gradually narrowing from basal to distal, rotated position in the apically, the phallobase is narrow, the ventral flat, is different in shape; aedeagus large, sclerotized and dense setae, pointed at the apex; spiculum gastrale long, the apodeme quite long and converged.

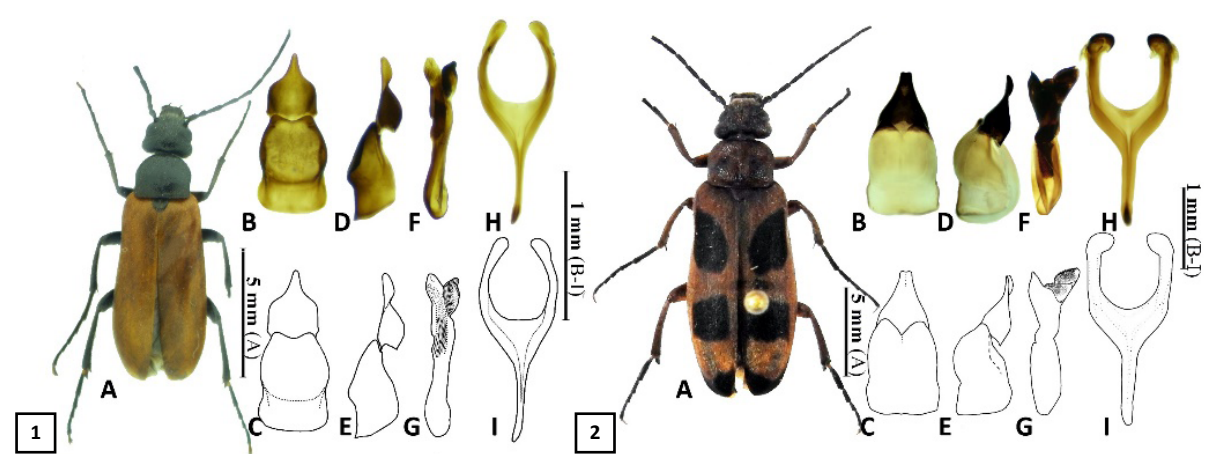


Figure 1-2. 1. *E. rubida*, 2. *E. sexmaculata*. A. Habitus (♂), B-I. Male genitalia photos and drawings (B-C. Tegmen (ventral view), D-E. Tegmen (lateral view), F-G. Aedeagus (lateral view), H-I. Spiculum gastrale).

Table 1. Differential diagnosis characters on male genital structures of examined species belonging to *Euzonitis*.

Male genital structures/Species	<i>E. rubida</i>	<i>E. sexmaculata</i>
Gonoforceps (Ventral view)	Completely fused, pointed at the apex	Almost completely fused, only slightly separated and blunt at the apex
Phallobase (Ventral view)	Convex and long	Slightly convex and short
Gonoforceps (Lateral view)	Gradually narrowing from basal to distal	Gradually narrowing from basal to apical
Phallobase (Lateral view)	Narrow and ventral side straight	Wide and ventral side convex
Aedeagus	Pointed at the apex	Not pointed at the apex
Apodeme of the spiculum gastrale	Closer to each other	Parallel to each other

Remarks: There is no information on the male genital organ of this species in the available literature, and photos, drawings and detailed description of the male genital organ are given, for the first time by this study.

***Euzonitis sexmaculata* (Olivier, 1789)**

Male Genital Organ Morphology (Figure 2): For detailed description, see Bologna [8].

Remarks: With the drawing included in the findings of Bologna [8], it is seen that the aedeagus is quite similar, but the phallobase is narrower and less curved in the lateral view. With the drawing in the findings of lablorkoff-Khinzorian [16], it is seen that the structure of the gonoforceps is similar, but the aedeagus is different. It is thought that the reason for this difference is because the aedeagus cannot be drawn laterally. In the findings of Serri et al. [17], it is thought that the lateral view of

the gonoforceps is not included and the aspect ratio of the drawing is not preserved in the ventral view, so it is thought to be rather narrow and long.

Genus: *Nemognatha* Illiger, 1807

This genus is represented by 6 species in the Palaearctic Region, one species in Turkey [15]. In this study, male specimens of one species belonging to this genus were examined.

***Nemognatha chrysomelina* (Fabricius, 1775)**

Male Genital Organ Morphology (Figure 3): For detailed description, see Bologna [8].

Remarks: It was observed that the drawings in this study were compatible with the drawings in the findings of Bologna [8, 18].

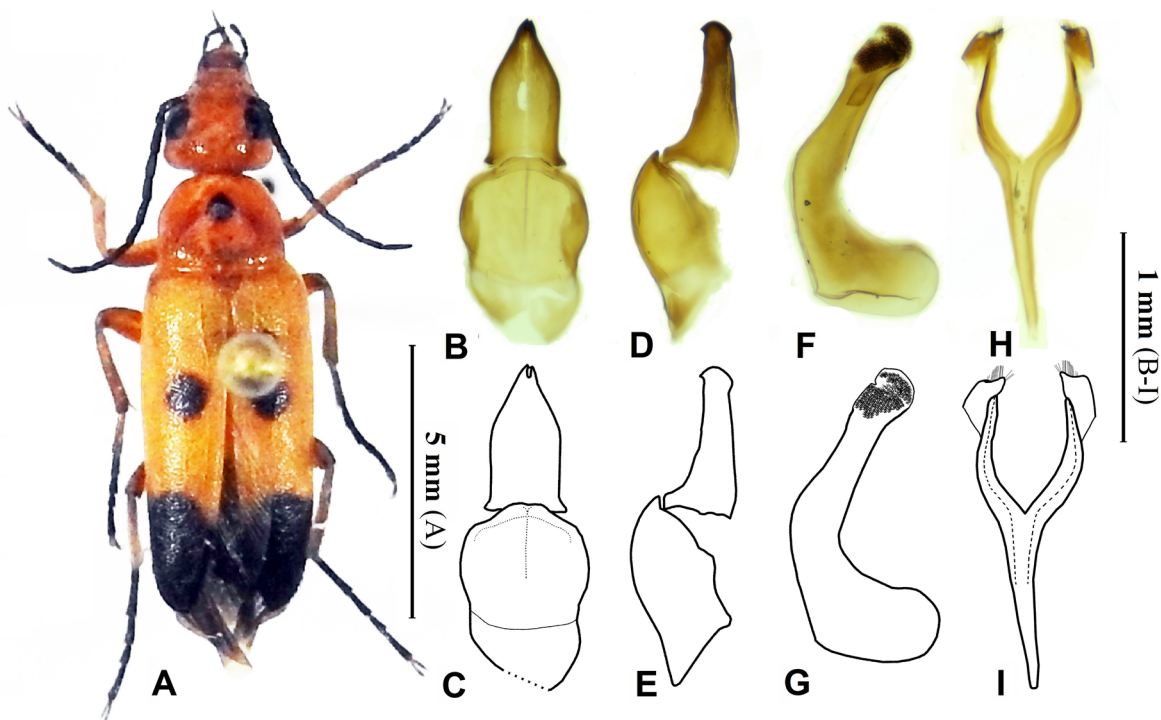


Figure 3. *Nemognatha chrysomelina*. A. Habitus (♂), B-I. Male genitalia photos and drawings (B-C. Tegmen (ventral view), D-E. Tegmen (lateral view), F-G. Aedeagus (lateral view), H-I. Spiculum gastrale).

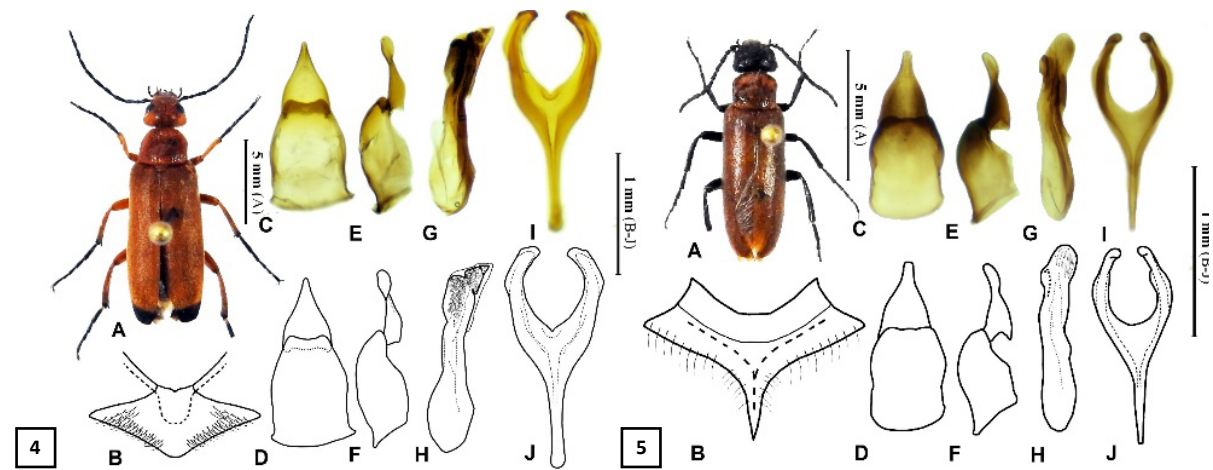


Figure 4-5. 4. *Z. (s.str.) flava*, 5. *Z. (s.str.) immaculata*. A. Habitus (♂), B. Prosternum, C-J. Male genitalia photos and drawings (C-D. Tegmen (ventral view), E-F. Tegmen (lateral view), G-H. Aedeagus (lateral view), I-J. Spiculum gastrale).

Table 2. Differential diagnosis characters on male genital structures of examined species belonging to *Zonitis*

Male genital structures/Species	<i>Z. (s.str.) flava</i>	<i>Z. (s.str.) immaculata</i>
Gonoforceps (Ventral view)	Slightly narrowing from basal to proximal, suddenly narrowing from proximal to apical, pointed at the apex	Slightly narrowing from basal to medial, suddenly narrowing from medial to apical, blunt at the apex
Phallobase (Ventral view)	Convex	Medially arched
Gonoforceps (Lateral view)	Narrow at the basal	Wide at the basal
Aedeagus	Pointed at the apex	Rounded at the apex

Genus: ***Zonitis*** Fabricius, 1775
This genus is represented by 29 species in the Palaearctic Region, 8 species in Turkey [15]. Male specimens of two species were examined in this study. These species are *Zonitis (s.str.) flava* and *Z. (s.str.) immaculata*. Differential diagnosis characters on male genital structures of examined species belonging to this genus were given Table 2.

Zonitis (s.str.) flava Fabricius, 1775
Male Genital Organ Morphology (Figure 4): For detailed description, see Bologna [8].

Remarks: The drawings in this study showed differences in the apex of the aedeagus with the drawings included in the findings of Bologna [8] and Ruiz [19]. It was observed that the male genital organ structure of the determined species was more similar to the drawing in the findings of Ruiz [19].

Zonitis (s.str.) immaculata (Olivier, 1789)
Male Genital Organ Morphology (Figure 5): For detailed description, see Bologna [8].

Remarks: It was observed that the drawings in this study were compatible with the drawing in the findings of Bologna [8].

Subfamily: **MELOINAE** Gyllenhal, 1810
 Tribe: Cerocomini Leach, 1815
 Genus: **Cerocoma** Geoffroy, 1762

The genus *Cerocoma* is the most species-rich genus of the Cerocomini tribe. This genus is represented by 29 species belonging to 5 subgenera in the Palaearctic Region, and 23 species belonging to four subgenera in Turkey [12, 15]. In this study, male specimens of four species belonging to this genus were examined. These species are *C. (s.str.) bernhaueri*, *C. (s.str.) schaefferi*, *C. (Meloides) longiseta* and *C. (Meloides) turcica*. Differen-

tial diagnosis characters on male genital structures of examined species belonging to this genus were given Table 3.

Cerocoma (s.str.) bernhaueri Pardo Alcaide, 1977
Male Genital Organ Morphology (Figure 6): For detailed description, see Turco and Bologna [12].

Remarks: Turco and Bologna [12] were reported that *Cerocoma (s.str.) bernhaueri* is quite similar to *C. (s.str.) dahli*, and these two species were confused so much so far. Compared to the current literature, the external

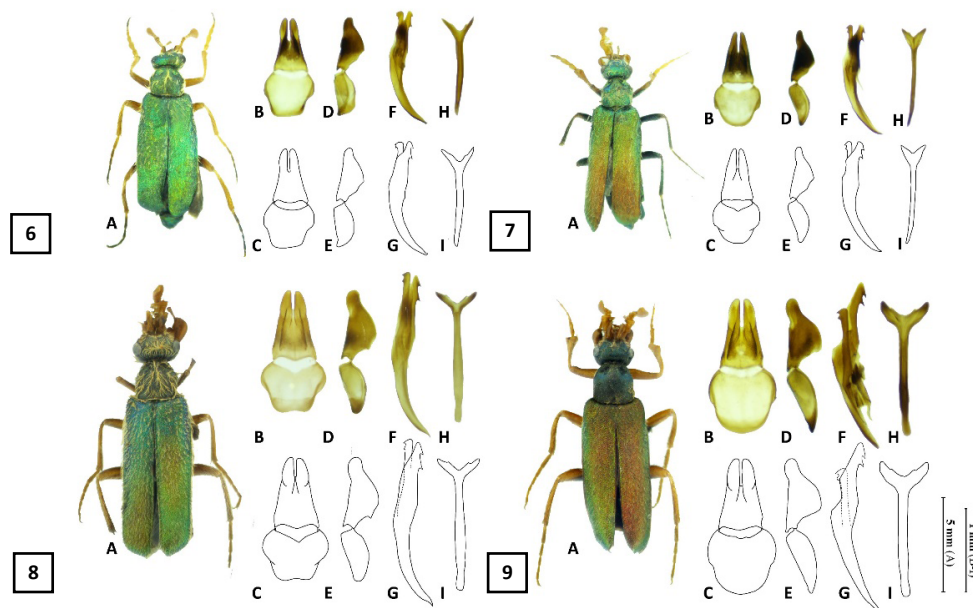


Figure 6-9. Male habitus and genitalia. 6. *Cerocoma (s.str.) bernhaueri*, 7. *C. (s.str.) schaefferi*, 8. *C. (Meloides) longiseta*, 9. *C. (Meloides) turcica*; A. Habitus (♂), B-I. Male genitalia photos and drawings (B-C. Tegmen (Ventral view), D-E. Tegmen (Lateral view), F-G. Aedeagus (Lateral view), H-I. Spiculum gastrale).

Table 3. Differential diagnosis characters on male genital structures of examined species belonging to *Cerocoma*.

Male genital structures /Species	<i>C. bernhaueri</i>	<i>C. schaefferi</i>	<i>C. longiseta</i>	<i>C. turcica</i>
Apical lobes of parameres (Ventral)	Swollen	Slightly swollen	Swollen	Swollen
Apical lobes of parameres (Lateral)	Straight, with apical lobes directed forward	Straight, with apical lobes directed forward	Straight, with apical lobes directed forward	Slightly curved, with apical lobes dorsally directed
Apex of aedeagus	Rounded	Rounded	Pointed	Pointed
Dorsal hooks of aedeagus	Subapical hook slightly larger than the apical	Almost equal (subapical hook slightly larger than the apical)	Equal in size	Subapical hook slightly larger than the apical
Endophallic hooks of aedeagus	Equal in size	Equal in size	Equal in size	Subapical hook slightly larger than the apical

morphologies (antenna and maxillary palpus segments, the structure of the protibia) and the male genital organ of this species appear to be compatible with the drawings of Turco and Bologna [12].

Cerocoma (s.str.) schaefferi (Linnaeus, 1758)

Male Genital Organ Morphology (Figure 7): For detailed description, see Turco and Bologna [12].

Remarks: It was observed that this species detected in this study is compatible with the drawings of Turco and Bologna [12] rather than the drawing of Bologna [8].

Cerocoma (Meloides) longiseta Turco & Bologna, 2011

Male Genital Organ Morphology (Figure 8): For detailed description, see Turco and Bologna [12].

Remarks: It was observed that this species detected in this study is compatible with the drawings of Turco and Bologna [12].

Cerocoma (Meloides) turcica Pardo Alcaide, 1977

Male Genital Organ Morphology (Figure 9): For detailed description, see Turco and Bologna [12].

Remarks: It was observed that this species detected in this study is compatible with the drawings of Turco and Bologna [12].

Tribe: Meloini Gyllenhal 1810

Genus: **Meloe** Linnaeus, 1758

This genus is represented by 122 species in the Palaearctic Region, 20 species in Turkey [15]. In this study, male specimens of two species belonging to this genus were examined. These species are *Meloe (Eurymeloe) glazunovi* and *M. (Eurymeloe) mediterraneus*. Differential diagnosis characters on male genital structures of examined species belonging to this genus were given Table 4.

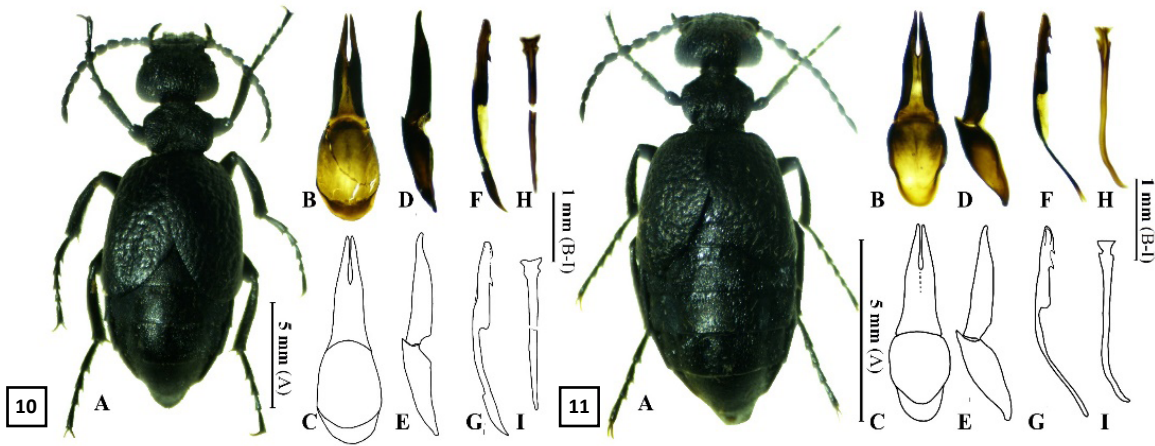


Figure 10-11. 10. *M. (Eurymeloe) glazunovi*, 11. *M. (Eurymeloe) mediterraneus*. **A.** Habitus (♂), **B-I.** Male genitalia photos and drawings (**B-C.** Tegmen (ventral view), **D-E.** Tegmen (lateral view), **F-G.** Aedeagus (lateral view), **H-I.** Spiculum gastrale).

Table 4. Differential diagnosis characters on male genital structures of examined species belonging to *Meloe*.

Male genital structures/Species	<i>M. (E.) glazunovi</i>	<i>M. (E.) mediterraneus</i>
The basal part of parameres (Ventral view)	Slightly wide	Very wide
Phallobase (Ventral view)	Gradually wider towards the apical	Gradually narrower towards the apical
Parameres (Lateral view)	Slender, prominently curved in before apical lobe	Slightly wider, slightly curved in before apical lobe
Phallobase (Lateral view)	Slender	Wide

***Meloe (Eurymeloe) glazunovi* Pliginskij, 1910**

Male Genital Organ Morphology (Figure 10): Gonoforceps fused medio-distally in ventral view, parameres parallel, narrows in the medio-distal, basal of parameres deeply emarginated; in lateral view parameres slender, prominently curved in before apical lobe; the proximal hook of the aedeagus curved, the endophallic hook is at the apex, very small, within the membrane; spiculum gastrale thin, blunt at the apex.

Remarks: Compared to the current literature of the male genital organ of this species, it was found to be compatible with the drawing included in the findings of Iablokoff-Khznorian [16], although it is somewhat without details and confusion.

***Meloe (Eurymeloe) mediterraneus* G. Müller, 1925**

Male Genital Organ Morphology (Figure 11): For detailed description, see Bologna [8, 20].

Remarks: Compared to the current literature of the male genital organ of this species, it was found to be compatible with the drawings included in the findings of Iablokoff-Khznorian [16] and Bologna [8, 20].

Tribe: Lyttini Solier, 1851

Genus: ***Alosimus*** Mulsant, 1857

The genus *Alosimus* described as the subgenus of the genus *Lydus* in the early literature, such as Escherich (1896) and Mařan (1942) [9]. The received taxonomic status has been defined by Kaszab [7] and some taxonomic problems have been clarified by studies of Bologna [8, 18, 21]. This genus represented by 27 species in the Palaearctic Region and 15 species in Turkey [15]. In this study, male specimens of four species belonging to this genus were examined. These species are *Alosimus armeniacus* (Falderman, 1837), *A. chalybaeus* (Tauscher, 1812), *A. luteus* (Waltl, 1838) and *A. marginicollis* (Haag-Rutenberg, 1880). Differential diagnosis characters on male genital structures of examined species belonging to this genus were given Table 5.

***Alosimus armeniacus* (Faldermann, 1837)**

Male Genital Organ Morphology (Figure 12): Gonoforceps fused medially in ventral view, the width of the middle cavity is narrower than the width of a paramere; in lateral view proximally arched, apical lobe curved; aedeagal distal hook positioned almost at the apex, different in shape and size from the proximal hook, the

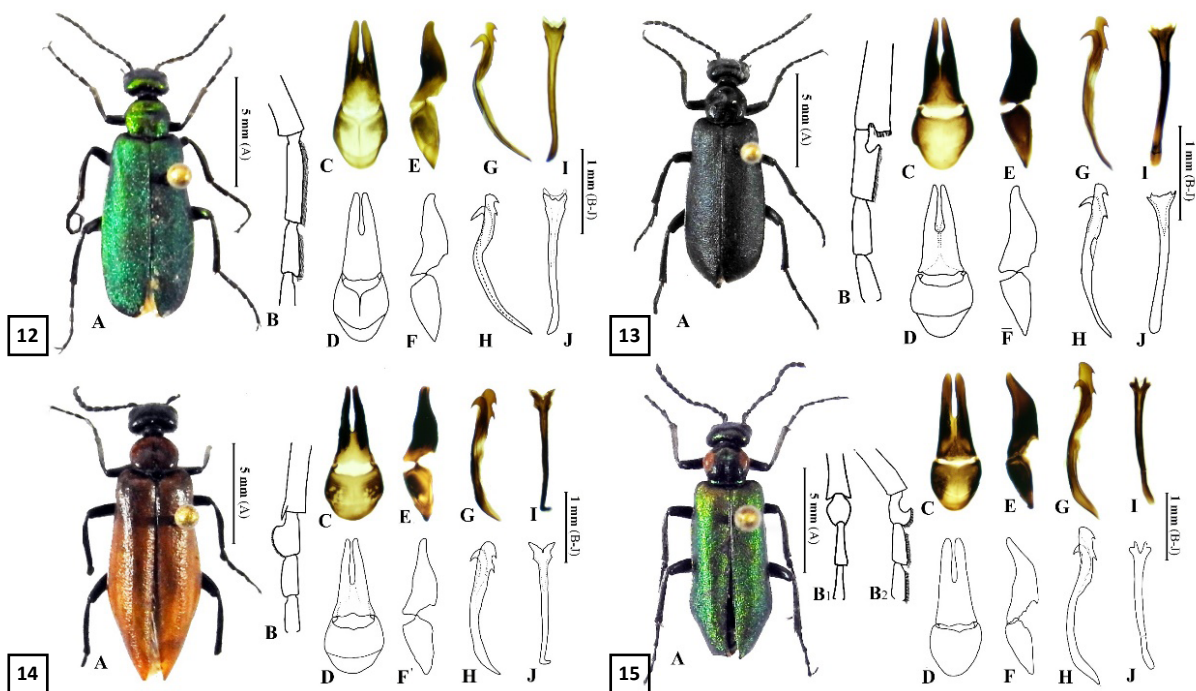


Figure 12-15. Male habitus and genitalia. 12. *Alosimus armeniacus*, 13. *A. chalybaeus*, 14. *A. luteus*, 15. *A. marginicollis*, A. Habitus (σ), B. First middle-tarsomere (B₁, dorsal view, B₂, lateral view), C-J. Male genitalia photos and drawings (C-D. Tegmen (ventral view), E-F. Tegmen (lateral view), G-H. Aedeagus (lateral view), I-J. Spiculum gastrale).

Table 5. Differential diagnosis characters on male genital structures of examined species belonging to *Alosimus*.

Male genital structures /Species	<i>A. armeniacus</i>	<i>A. chalybaeus</i>	<i>A. luteus</i>	<i>A. marginicollis</i>
Fusion state of Gonoforceps (Ventral view)	Medially fused	Medially fused	Medio-proximally fused	Medially fused
Width of the cavity between parameres (Ventral view)	Narrower than the width of a paramere	Clearly as wide as paramere	Almost as wide as paramere	Narrower than the width of a paramere
Gonoforceps (Lateral view)	Proximally arched, apical lobe curved	Medially arched, apical lobe relatively curved	Distally and proximally arched, apical lobe slightly curved	Proximally slight arched, very strongly curved distally towards the ventral
Dorsal hooks of aedeagus	Distal hook distinctly larger	Proximal hook distinctly larger	Hooks almost equal-sized	Proximal hook larger
Distance between the dorsal hooks	Relatively far	Far	Relatively close	Distinctly far
Endophallic hook of aedeagus	Thin and elongated straight down	Thin and elongated straight down	Short and curved downward	Short and curved downward
Apodeme of the spiculum gastrale	Relatively short	Short	Relatively long	Relatively short

proximal hook directed downward, the distal hook of aedeagus clearly larger than the proximal one, the distance between them relatively far, endophallic hook thin and elongated straight down; apodeme of the spiculum gastrale relatively short.

Remarks: Compared to the present literature, the male genital organ was found to be compatible with the drawing of Bologna [18]. Since the aedeagus and tegmen were drawn as a whole without separation in the study by Bologna [18], the tegmen could not be compared ventrally. Also, in several studies were conducted by various researchers from different regions of Iran [17, 22, 23] drawings of male genital organ structures of this species are included. However, in these studies, it is seen that the aspect ratios of the drawings cannot be maintained and therefore the aedeagus is quite bulging from the medial and the proximal hook is larger than the distal hook.

Alosimus chalybaeus (Tauscher, 1812)

Male Genital Organ Morphology (Figure 13): Gonoforceps fused medially in ventral view, the width of middle cavity width of a paramere; in lateral view medially arched, apical lobe relatively curved; aedeagal distal hook positioned almost at the apex, different in shape and size from the proximal hook, proximal hook directed

downward, the distal hook of aedeagus clearly smaller than proximal one, the distance between them far, endophallic hook thin and elongated straight down; apodeme of the spiculum gastrale are short.

Remarks: The specimens examined in this study was more similar to the drawing in Bologna [18] than in the drawing of Gupta [24]. However, in both studies, aedeagus and gonoforceps were evaluated only laterally and the ventral view of gonoforceps could not be compared. When looking at the drawing of this species in the findings of Iablokoff-Khinzorian [16], it was observed that the proximal hook of aedeagus was smaller than the distal one and was more similar to the *A. armeniacus* species detected in this study.

Alosimus luteus (Waltl, 1838)

Male Genital Organ Morphology (Figure 14): Gonoforceps fused medio-proximally in ventral view, width of middle cavity relatively width of a paramere; in lateral view distally and proximally arched, apical lobe slightly curved; aedeagal distal hook positioned almost at the apex, similar in shape and size with proximal hook, the proximal hook directed downward and significantly smaller than the distal hook, the distance between them relatively near, with the small prominent protrusion on the proximal hook, endophallic hook short and

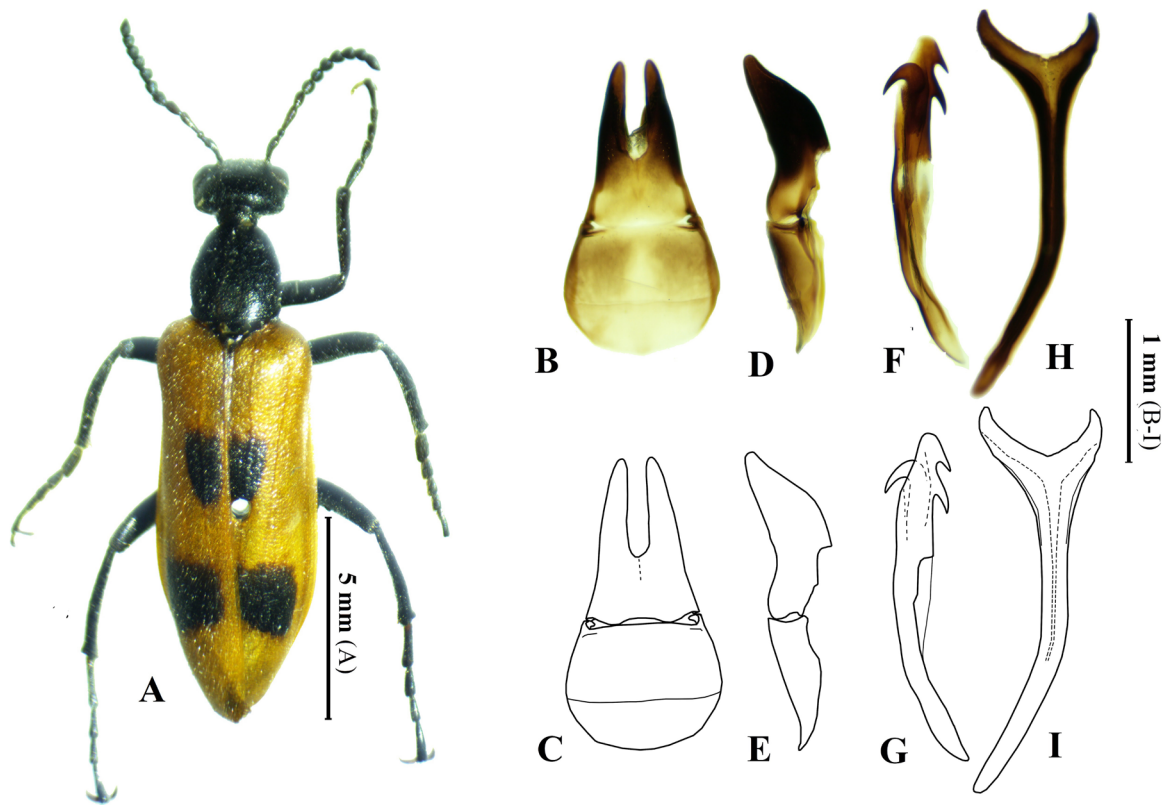


Figure 16. *Lydus turcicus*; A. Habitus (♂), B-I. Male genitalia photos and drawings (B-C. Tegmen (ventral view), D-E. Tegmen (lateral view), F-G. Aedeagus (lateral view), H-I. Spiculum gastrale).

curved downward; spiculum gastrale emarginated in the apex, and its apodeme relatively long.

Remarks: *Alosimus luteus*, differs from other species of the genus with a protibial spur, pronotum and elytra yellowish-brown, and two black spots on the pronotum [7]. In the studied specimens, the black spots on the pronotum are seen as a large, slightly pronounced black spot. No information has been found and compared in the literature regarding the male genital organ of this species. For the first time in this study, the photo, drawing and detailed description of the male genital organ were given. This species was morphologically similar to *Alosimus decolor* (Abeille de Perrin, 1880) and most distinctly distinguished by the presence of black spots on the pronotum [7]. The examined specimen was compared with the male genital organ of the *A. decolor* in the findings of Bologna [18]. In the drawing of Bologna [18], it was observed to be different than the different were aedeagus hooks of *A. decolor* was short and gonoforceps was prominent curved in the medial position in the lateral view, compared to the *A. luteus* detected in this study.

Alosimus marginicollis (Haag-Rutenberg, 1880)

Male Genital Organ Morphology (Figure 15): For detailed description, see Mařan [6].

Remarks: *A. marginicollis*, is easily distinguished from other species of the genus with its two large, distinctive lemon yellow-orange spots in the pronotum [7]. This species is endemic to Turkey, photos and drawings of the male genital organ are given, for the first time by this study.

Genus: ***Lydus*** Dejean, 1821

The genus *Lydus* is represented by 16 species in the Palearctic Region and 10 species in Turkey [15]. In this study, male specimens of one species belonging to this genus were examined.

Lydus turcicus Kaszab, 1952_

Male Genital Organ Morphology (Figure 16): Gonoforceps fused medio-proximally in ventral view, the width of the middle cavity is the width of a paramere; in lateral view proximally strongly arched, phallobase narrow; aedeagal distal hook positioned at the apex, different

in shape and size from the proximal hook, the proximal hook directed downward and almost twice the distal hook, the distance between them relatively near, endophallic hook long and directed downward; spiculum gastrale deeply emarginated in the apex, and its apodeme large.

Remarks: In the current literature [18, 25], it is reported that *L. trimaculatus*, *L. quadrimaculatus* Tauscher, 1812 and *L. turcicus* can be confused with each other. Pronotum of *Lydus turcicus* is widest just behind the medial, significantly narrowed towards the anterior; head is long; the temple is very long and longer than the longitudinal diameter of the eye, and differs from other species of this genus [25]. Compared to the current literature of the male genital organ of this species, it was found to be compatible with the drawing in the findings of Bologna [18]. Kaszab [25] mentioned only the dorsal hooks of the aedeagus when described this species.

Genus: **Oenas** Latreille, 1802

The genus *Oenas* is represented by 12 species in the Palearctic Region and 3 species in Turkey [15]. In this study, male specimens of one species belonging to this genus were examined.

Oenas crassicornis (Illiger, 1800)

Male Genital Organ Morphology (Figure 17): For detailed description, see Bologna [8].

Remarks: This species differs from other species of this genus by the fact that I. segment of middle tarsi in the male is laterally compressed and enlarged considerably towards the ventral, furrow under the eye of male deeper and the pronotum and elytra are yellow-ochre [8, 26]. According to current literature, there are differences between the drawings of the male genitalia of this species [8, 18, 23]. In particular, it is seen in some studies that the apex of the aedeagus is round [8, 18] or pointed [23]. Also, it is seen that, positions and sizes of the dorsal hooks of aedeagus are different. Aedeagus of examined specimens was seen to be compatible with the aedeagus of specimens collected from Turkey by [8, 18]. However, it differs with gonoforceps being thinner in lateral view. This suggests that the *Oenas*, whose external morphological characters were revealed by Kaszab [26], requires a re-examination and taxonomic revision with current methods.

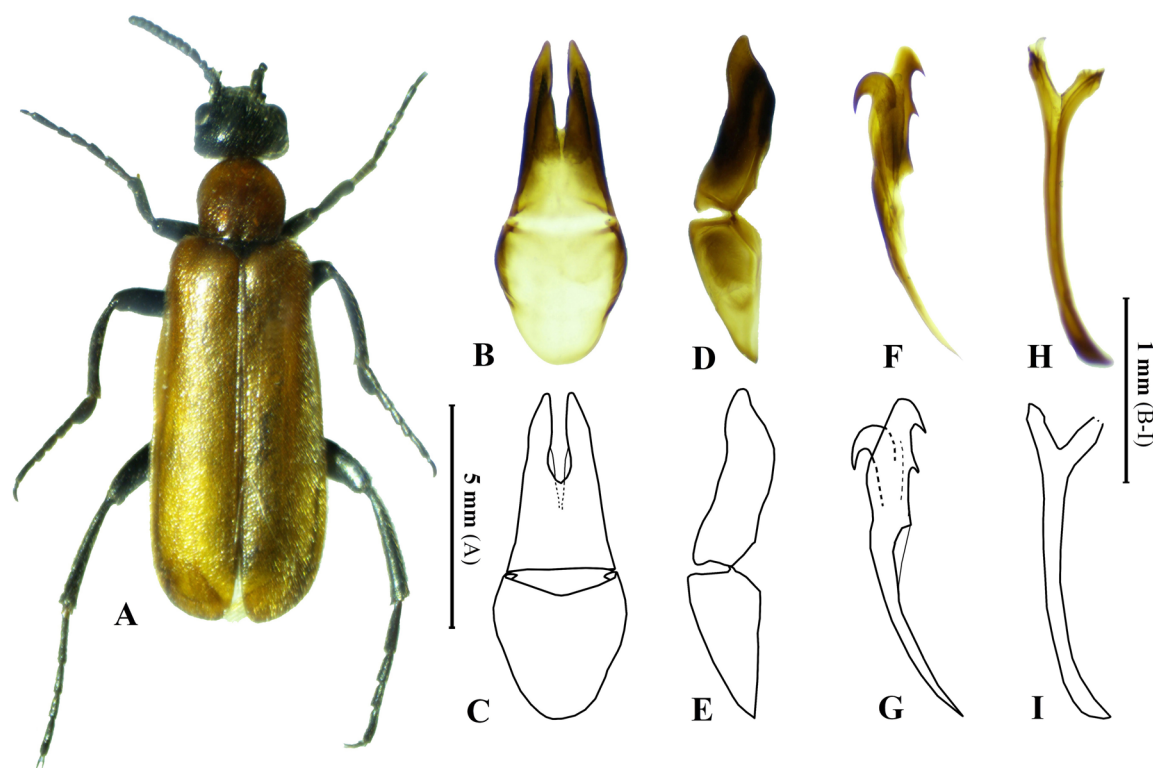


Figure 17. *Oenas crassicornis*; A. Habitus (♂), B-I. Male genitalia photos and drawings (B-C. Tegmen (ventral view), D-E. Tegmen (lateral view), F-G. Aedeagus (lateral view), H-I. Spiculum gastrale).

Tribe: Mylabrini Laporte, 1840

Genus: **Actenodia** Laporte, 1840

This genus is represented by 9 species in Palaearctic Region, 18 species in World and 2 species in Turkey [10, 15]. In this study, male specimens of one species belonging to this genus were examined.

Actenodia confluens (Reiche, 1866)

Male Genital Organ Morphology (Figure 18): For detailed description, see Bologna et al. [10].

Remarks: Compared to the current literature of the male genital organ of this species, it was found to be compatible with the drawings of Bologna et al. [10].

Genus: **Hycleus** Latreille, 1817

The hyper-diverse genus *Hycleus* is the most species-rich genus of Meloidae. This genus is represented by more than 500 species and widely distributed in the Old World [27]. This genus is represented by 117 species in the Palaearctic Region, and 10 species in Turkey [15]. In this study, male specimens of four species belonging to this genus were examined. These species are *Hycleus polymorphus*, *H. scabiosae*, *H. zebraeus* and *H. sexma-*

culatus. In the current literature [3, 5, 8, 18, 28-30] no diagnostic keys are covering all of the detected species. Species diagnoses were made by comparing species descriptions and some taxonomic characters such as structures of mesosternum and drawings of male genital organ. Differential diagnosis characters on male genital structures of examined species belonging to this genus was given Table 6.

Hycleus polymorphus (Pallas, 1771)

Male Genital Organ Morphology (Figure 19): For detailed description, see Bologna [8].

Remarks: Compared with the current literature, it is seen that the genitalia of the detected species is compatible with the drawing in the findings of Bologna [8]. This species, which is included in the findings of Iablokoff-Khinzorian [16] and given as *Mylabris polymorpha*, is thought to be *H. zebraeus*, since the aedeagus does not have a distal longitudinal area between the distal and proximal hooks in the male genital organ drawing. However, in both studies, aedeagus and gonoforceps were evaluated only laterally and the ventral view of gonoforceps could not be compared.

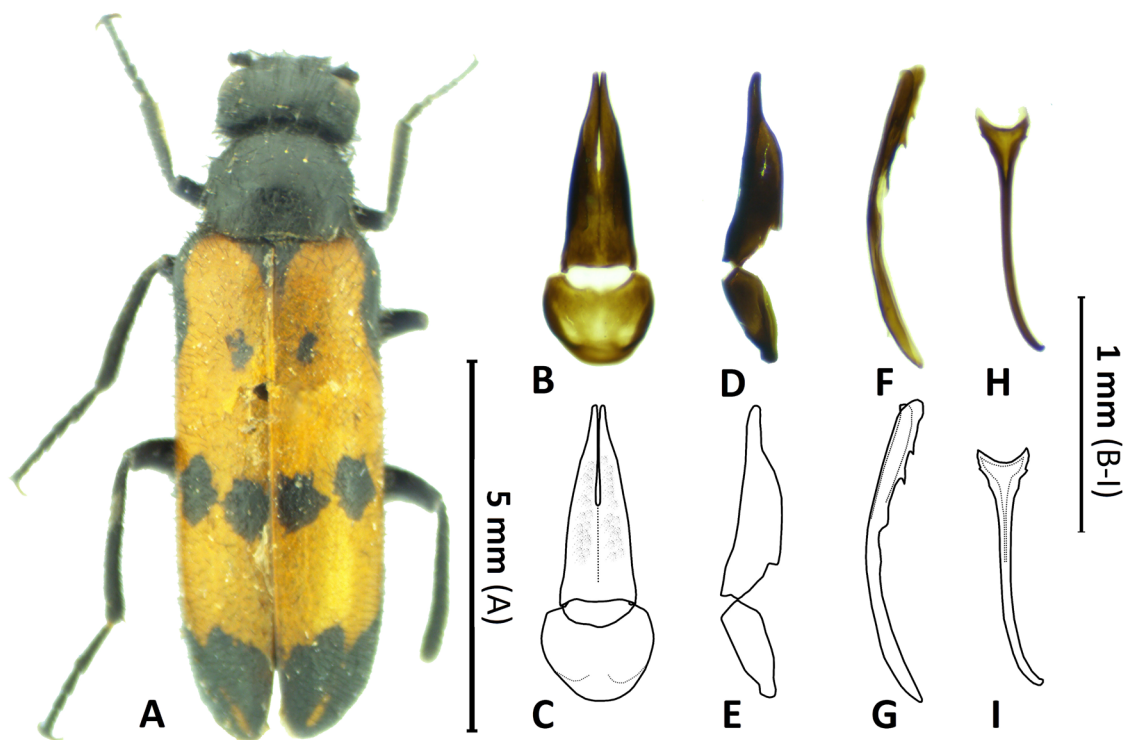


Figure 18. *Actenodia confluens* (Reiche, 1866); A. Habitus (♂), B-I. Male genitalia photos and drawings (B-C. Tegmen (Ventral view), D-E. Tegmen (Lateral view), F-G. Aedeagus (Lateral view), H-I. Spiculum gastrale).

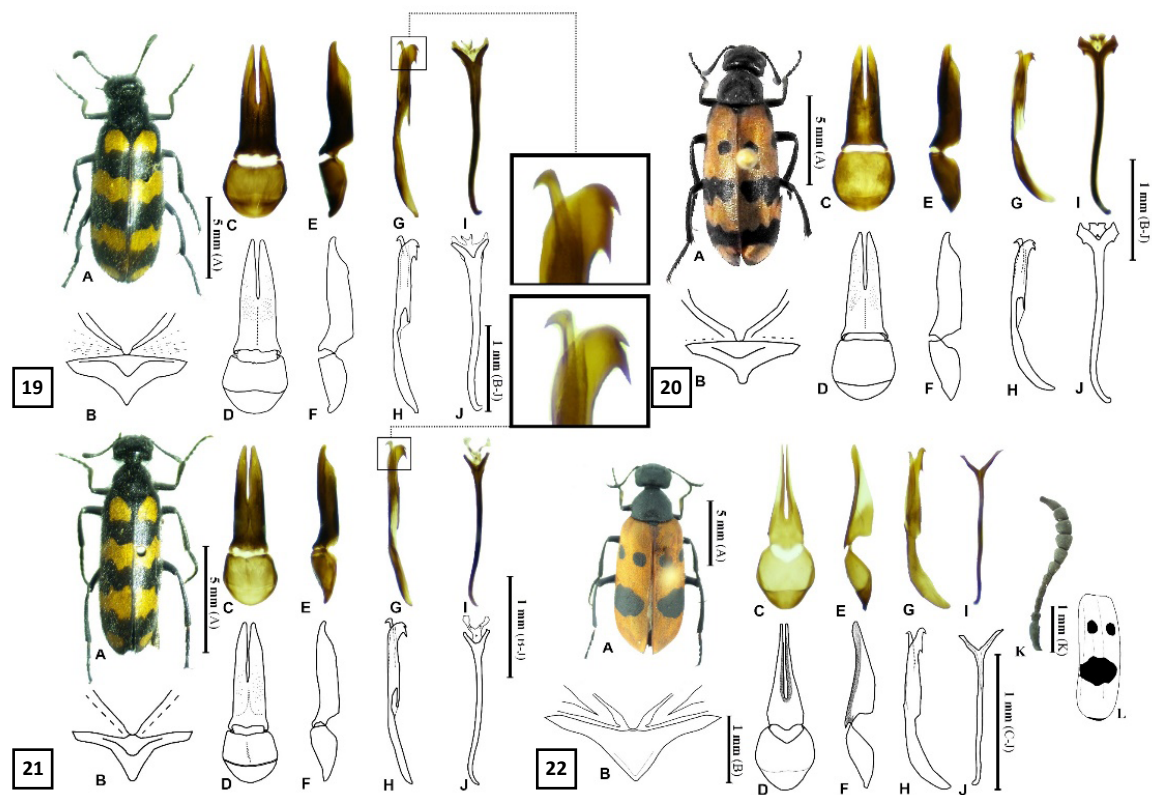


Figure 19-22. 19. *Hycleus polymorphus*, 20. *H. scabiosae*, 21. *H. zebraeus*, 22. *H. sexmaculatus*. A. Habitus (♂), B. Mesosternum, C-J. Male genitalia photos and drawings (C-D. Tegmen (ventral view), E-F. Tegmen (lateral view), G-H. Aedeagus (lateral view), I-J. Spiculum gastrale), K. Antenna, L. Elytra.

Table 6. Differential diagnosis characters on male genital structures of examined species belonging to *Hycleus*.

Male genital structures/Species	<i>H. polymorphus</i>	<i>H. scabiosae</i>	<i>H. zebraeus</i>	<i>H. sexmaculatus</i>
Fusion state of Gonoforceps (Ventral view)	Medially fused	Medio-proximally fused	Medio-proximally fused	Proximally fused
Location of the dorsal hooks of aedeagus	The distal hook at the apex	Both hooks at the apex	Both hooks at the apex	The distal hook at the apex
Dimensions of the dorsal hooks of aedeagus	The proximal hook longer and pointed downwards	The proximal hook longer, wider, and downward curved	The proximal hook longer, wider, and downward curved	The proximal hook longer, wider and pointed downwards
Distal dent placed between the dorsal hooks	Present	Absent	Present (very small)	Absent

Hycleus scabiosae (Olivier, 1811)

Male Genital Organ Morphology (Figure 20): For detailed description, see Bologna [18].

Remarks: Compared with the current literature [16-18, 22, 23, 30], it is seen that between genitalia drawings of this species is very little difference between, and

it appears to be consistent with the male genitalia of the specimens collected in the findings by Bologna [18] from Turkey.

Hycleus zebraeus (Marseul, 1870)

Male Genital Organ Morphology (Figure 21): For detailed description, see Bologna [18].

Remarks: In the current literature, this species has been seen to be very confused with *H. polymorphus* [8, 18, 27, 31]. Bologna [31] stated the distinctive characters of these two species. In the specimens examined, it is thought that it is very difficult to distinguish these species by both the width of the basal yellow point of the elytra and the width of the antenna. It is thought that male genital organ and mesosternum structures can give a clearer distinction character. In this study, it is thought that the visual (dorsal hooks of the aedeagus) which is given in figures 19 and 21, to differentiate from the male genitalia, can contribute to the current literature. Also, compared to the current literature of the male genital organ of this species, it was found to be compatible with the drawings of Bologna [18] rather than the drawing of Moslemi et al. [23].

***Hycleus sexmaculatus* (Olivier, 1811)**

Male Genital Organ Morphology (Figure 22): For detailed description, see Serri et al. [32].

Remarks: Compared to the current literature of the male genital organ of this species, it was found to be compatible with the drawing in the findings of Serri et al. [32] and Iablokoff-Khinzorian [16]. Also, the elytral pattern of this species varies. The elytral pattern of the examined specimens in this study is compatible with the drawing of Marseul [3], Iablokoff-Khinzorian [16] and Serri et al. [32] rather than drawing in the findings of Bologna [18]. Iablokoff-Khinzorian [16] was drawn the antenna of this species, but it is seen that the last segment is quite short and chunk and this drawing is thought to belong to the female specimen.

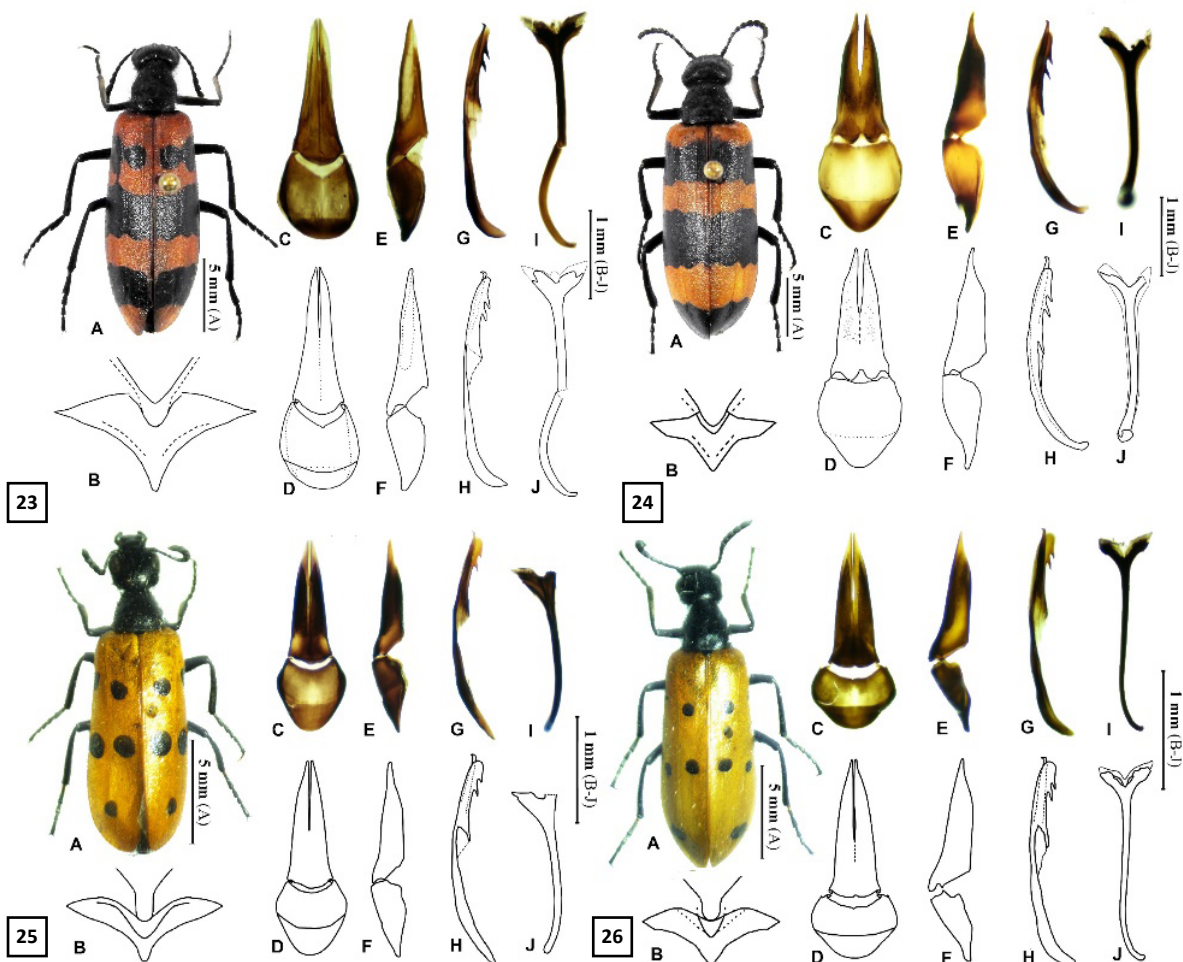


Figure 23-26. 23. *Mylabris (E.) calida*, 24. *M. (E.) cincta*, 25. *M. (E.) crocata*, 26. *M. (E.) fabricii*. A. Habitus (♂), B. Mesosternum, C-J. Male genitalia photos and drawings (C-D. Tegmen (ventral view), E-F. Tegmen (lateral view), G-H. Aedeagus (lateral view), I-J. Spiculum gastrale).

Table 7. Differential diagnosis characters on male genital structures of examined species belonging to *Mylabris* (*Eumylabris*).

Male genital structures/Species	<i>M. (E.) calida</i>	<i>M. (E.) cincta</i>	<i>M. (E.) crocata</i>	<i>M. (E.) fabricii</i>
Fusion state of Gonoforceps (Ventral view)	Medio-distally fused	Medially fused	Medio-proximally fused	Proximally fused
Gonoforceps (Lateral view)	Gradually narrowing from basal to apical	Narrowing from basal to proximal, almost parallel from proximal to distal, suddenly narrowing from distal to apical	Almost cylindrical at the basal, gradually narrowing towards the apical	Almost conical, suddenly narrowing from basal to proximal, gradually narrowing from proximal to apical
Dorsal hooks of aedeagus	Hooks almost equal-sized, differently curved	Proximal hook distinctly larger	Proximal hook slightly larger	Hooks almost equal-sized
Spiculum gastrale (Ventral view)	Spiculum gastrale deeply "V" shaped notched at apex	Spiculum gastrale deeply "V" shaped notched at apex	Spiculum gastrale slightly deep "V" shaped notched at apex	Spiculum gastrale deeply "V" shaped notched at apex
Apodeme of the spiculum gastrale	Relatively long	Relatively long	Wide and relatively short	Relatively long

Genus: ***Mylabris*** Fabricius, 1775

This genus is represented by 16 subgenera and 173 species in Palaearctic Region [13-15, 33, 34], and is represented by 6 subgenera and 33 species in Turkey [13, 15, 35]. In this study, male specimens of 10 species (most species) and 3 subgenera belonging to this genus were examined. These subgenera are *Eumylabris* Kuzin, 1954, *Micrabris* Kuzin, 1954 and *Mylabris* Fabricius, 1775.

Subgenus: ***Eumylabris*** Kuzin, 1954

This subgenus is represented by 19 species in the Palaearctic Region, 5 species in Turkey [15]. Bologna et al. [36] reported that this subgenus needs revision, there are many undefined species, and some defined taxa may also be synonymous. In this study, male specimens of four species belonging to this subgenus were examined. These species are *Mylabris (Eumylabris) calida*, *M. (E.) cincta*, *M. (E.) crocata* and *M. (E.) fabricii*. There is no taxonomic key covering all species identified in the current literature [3, 5, 8, 16-18, 22, 23, 29, 30]. While the species were determined, descriptions, drawings of mesosternum, and male genitalia were compared. Also, as seen below, male genital organs show some differs in the current literature. Whether this difference is due to drawings, whether it is due to variation in male genital organs of different populations, or if it is drawings of different taxa, by re-examining all species of this subge-

nus and, as reported by Bologna et al. [36], it is thought that the subgenus can be understood by revision. Differential diagnosis characters on male genital structures of examined species belonging to this subgenus were given Table 7.

Mylabris (Eumylabris) calida (Pallas, 1782)

Male Genital Organ Morphology (Figure 23): Gonoforceps fused medio-distal in ventral view; in lateral view relatively flat, gradually narrowing from basal to apical; aedeagal distal hook far from the apex, is same in shape, differently curved from the proximal hook, the endophallic hook is almost at the apex; spiculum gastrale deeply "V" shaped notched at apex, the apodeme relatively long.

Remarks: It was reported by Bologna [18] that description and important taxonomic drawings of this species were given by Pardo Alcaida (1954). However, due to the difficulty of accessing this publication, the description of the male genital organ is also given here. Compared to the current literature, it is very similar to the male genital organ drawing (given as *M. (E.) posticalis* (Dokhtouroff, 1889)) in the findings of Pan et al. [11]. Also, the drawing in this study was observed that the drawings of Kuzin [30] and Iablokoff-Khnzorian [16] were compatible with except for minor differences.

***Mylabris (Eumylabris) cincta* Olivier, 1795**

Male Genital Organ Morphology (Figure 24): Gonoforceps fused medially in ventral view; in lateral view narrowing from basal to proximal, almost parallel from proximal to distal, suddenly narrows from distal to apical; aedeagal distal hook far from the apex, is different in shape, the distal hook of aedeagus clearly short and thick than the proximal one, the endophallic hook is at the apex; spiculum gastrale deeply "V" shaped notched at apex, the apodeme relatively long.

Remarks: It was reported by Bologna [18] that description and important taxonomic drawings of this species were given by Pardo Alcaida (1954). However, due to the difficulty of accessing this publication, the description of the male genital organ is also given here. Compared to the current literature, it has been observed that there are quite different drawings. Although the hooks of Aedeagus are compatible with the drawing given by findings of Iablokoff-Khnzorian [16] from Armenia, the

proximal hook of the aedeagus looks quite long and curved; in the drawing in Moslemi et al. [23] findings, the proximal hook is quite short and chunk.

***Mylabris (Eumylabris) crocata* (Pallas, 1781)**

Male Genital Organ Morphology (Figure 25): For detailed description, see Bologna [8].

Remarks: Elytral pattern of specimens belonging to this species, with five (2:2:1) spots are similar to *M. fabricii*. This species was determined with examining mesosternum structure and male genital organ. Compared with the current literature, male genitalia of this species is compatible with the drawing and description in the findings of Bologna [8, 18]. However, in both studies, aedeagus and gonoforceps were evaluated only laterally and the ventral view of gonoforceps could not be compared. In the studies of Serri et al. [17], the aedeagus was not drawn, and the drawing of the gonoforceps structure from the ventral and lateral is more similar to the male

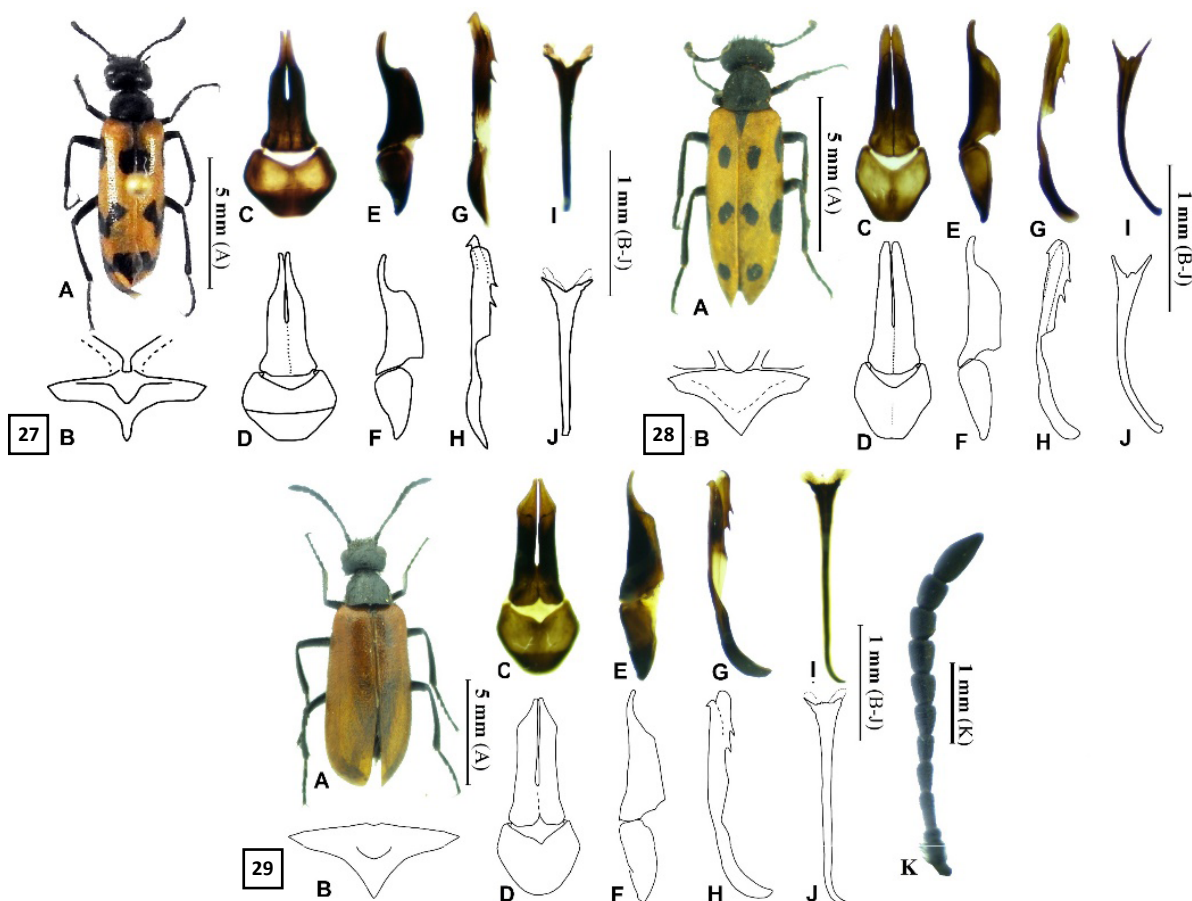


Figure 27-29. 27. *Mylabris (Mic.) geminata*, 28. *M. (Mic.) laevicollis*, 29. *M. (Mic.) unicolor*. A. Habitus (♂), B. Mesosternum, C-J. Male genitalia photos and drawings (C-D. Tegmen (ventral view), E-F. Tegmen (lateral view), G-H. Aedeagus (lateral view), I-J. Spiculum gastrale).

Table 8. Differential diagnosis characters on male genital structures of examined species belonging to *Myalabris* (*Micrabris*).

Male genital structures / Species	<i>M. (Mic.) geminata</i>	<i>M. (Mic.) laevicollis</i>	<i>M. (Mic.) unicolor</i>
Fusion state of Gonoforceps (Ventral view)	Medio-proximally fused	Proximally fused	Proximally fused
Gonoforceps (Ventral view)	Narrowing from basal to proximal, parallel from proximal to distal, suddenly narrowing from distal to apical, separated apex	Narrowing from basal to proximal, relatively parallel from proximal to apical, narrowing at the apical, rounded apex	Narrowing from basal to proximal, parallel from proximal to distal, narrowing at the apical, parallel in the apex
The basal part of gonoforceps (Ventral view)	Straight	Shallow emarginated	Deeply emarginated
Gonoforceps (Lateral view)	Gradually narrowing from basal to distal, distally with large round grooves	Relatively parallel from basal to the distal, sharp narrowing at distal, thin apical	Parallel from basal to the distal, sharp narrowing at distal, thin apical
Dorsal hooks of aedeagus	Hooks almost equal-sized	The distal hook wider and shorter	Hooks almost equal-sized, the distal hook thinner

Myalabris (Eumylabris) fabricii Soumacov, 1924

Male Genital Organ Morphology (Figure 26): For detailed description, see Bologna [8].

Remarks: Compared with the current literature, male genitalia of this species is compatible with the drawing and description in the findings of Bologna [8, 18]. However, in both studies, aedeagus and gonoforceps were evaluated only laterally and the ventral view of gonoforceps could not be compared. In studies in Iran [17, 22, 23], the male genital organ drawings are quite similar to the *M. (E.) crocata* determined in this study.

Subgenus: ***Micrabris*** Kuzin, 1954

This subgenus is represented by 19 species in the Palaearctic Region, 5 species in Turkey [15]. In this study, male specimens of three species belonging to this subgenus were examined. These species are *Myalabris (Micrabris) geminata*, *M. (Micrabris) laevicollis* and *M. (Micrabris) unicolor*. Differential diagnosis characters on male genital structures of examined species belonging to this subgenus were given Table 8.

Myalabris (Micrabris) geminata Fabricius, 1798

Male Genital Organ Morphology (Figure 27): For detailed description, see Bologna [8].

Remarks: Compared to the current literature of the male genital organ of this species, it was found to compatible with the drawings included in the findings of Bologna [8, 18] and Iablokoff-Khznorian [16]. However, in both studies, aedeagus and gonoforceps were evaluated only laterally and the ventral view of gonoforceps could not be compared.

Myalabris (Micrabris) laevicollis Marseul, 1870

Male Genital Organ Morphology (Figure 28): Gonoforceps fused proximally in ventral view, narrowing from basal to proximal, relatively parallel to proximal to apical, narrowing at the apical, rounded apex; in lateral view relatively parallel to basal to distal, sharp narrowing at distal, thin apical; aedeagal distal hook far from the apex, is different in shape, the distal hook of aedeagus clearly long and thick than the proximal one, the endophallic hook is almost at the apex, wide and sharply curved; the apodeme of the spiculum gastrale are thinning, relatively short

Remarks: Compared to the current literature of the male genital organ of this species, it was found to compatible with the drawing included in the finding of Iablokoff-Khznorian [16]. However, aedeagus and gonoforceps were evaluated only laterally and the ventral view of gonoforceps could not be compared.

***Mylabris (Micrabris) unicolor* Faldermann, 1837**

Male Genital Organ Morphology (Figure 29): Gonoforceps fused proximally in ventral view, narrowing from basal to proximal, parallel to proximal to distal, narrowing at the apical, parallel in apex; basal of parameres deeply emarginated; in lateral view parallel to basal to the distal, sharp narrowing at distal, thin apical; aedeagal distal hook far from the apex, is almost equal in length, the distal hook of aedeagus narrower than the proximal one, the endophallic hook is at the apex, wide and sharply curved; the apodeme of the spiculum gastrale are thin and short

Remarks: This species, as reported by Pan and Bologna [13], *M. (s.str.) concolor* Marseul 1870 is very similar and morphological characters of these species, especially the male genital organ and mesosternum, should be examined carefully. Compared to the current literature of the male genital organ of this species, it was found to compatible with the drawing included in the finding of Iablokoff-Khinzorian [16]. However, aedeagus and go-

Subgenus: *Mylabris* Fabricius, 1775

This subgenus is represented by 26 species in Palaearctic Region [13, 15, 33, 34, 37, 38] and 9 species in Turkey [13, 15]. This subgenus was revised Pan and Bologna [13] and species descriptions, diagnostic keys and drawings of some taxonomic characters (male genitals, mesosternums and elytral patterns) are given. In this study, male specimens of three species belonging to this subgenus were examined. These species are *Mylabris* (s. str.) *olivieri*, *M. (s. str.) quadripunctata* and *M. (s. str.) variabilis*. Differential diagnosis characters on male genital structures of examined species belonging to this subgenus were given Table 9.

***Mylabris* (s.str.) *olivieri* Billberg, 1813**

Male Genital Organ Morphology (Figure 30): For detailed description, see Bologna [8] and Pan and Bologna [13].

Remarks: Compared to the current literature of the male genital organ of this species, it was found to com-

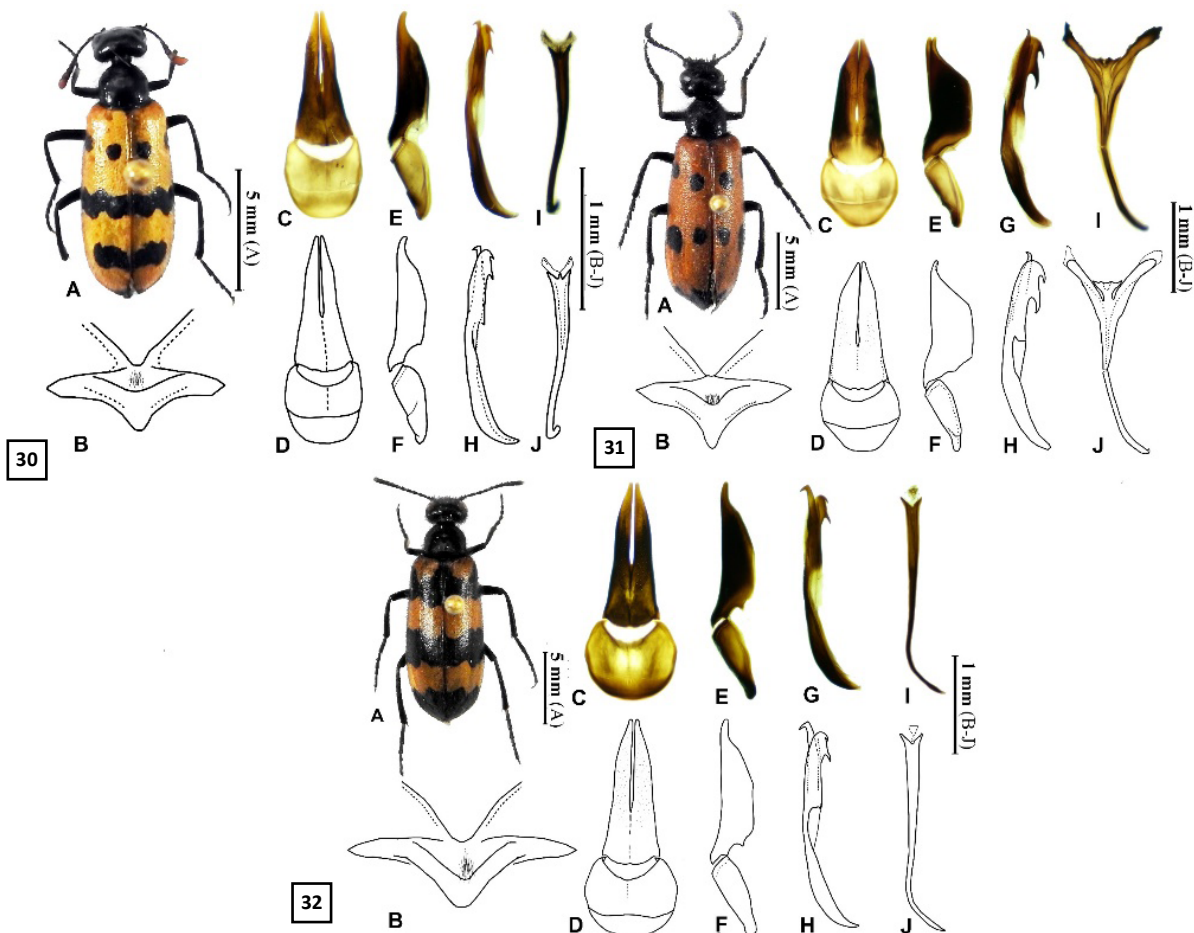


Figure 30-32. 30. *Mylabris* (s.str.) *olivieri*, 31. *M. (s.str.) quadripunctata*, 32. *M. (s.str.) variabilis*. A. Habitus (♂), B. Mesosternum, C-J. Male genitalia photos and drawings (C-D. Tegmen (ventral view), E-F. Tegmen (lateral view), G-H. Aedeagus (lateral view), I-J. Spiculum gastrale).

Table 9. Differential diagnosis characters on male genital structures of examined species belonging to *Mylabris* (*Mylabris*).

Male genital structures/ Species	<i>M. (s.str.) olivieri</i>	<i>M. (s.str.) quadripunctata</i>	<i>M. (s.str.) variabilis</i>
Fusion state of Gonoforceps (Ventral view)	Medially fused	Proximally fused	Proximally fused
Gonoforceps (Ventral view)	Gradually narrowing from basal to medial, almost parallel from medial to distal, gradually narrowing from distal to apical	Slightly narrowing from basal to distal, suddenly from distal to apical	Gradually narrowing from basal to medial, almost parallel from medial to distal, gradually narrowing from distal to apical
Gonoforceps (Lateral view)	Slender	Very wide	Slender
The apical lobe of Gonoforceps (lateral view)	Curved	Slightly curved	Slightly curved
Dorsal hooks of Aedeagus	Proximal hook slightly larger	Proximal hook much larger	Proximal hook larger

Mylabris* (s.str.) *quadripunctata (Linnaeus, 1767)
Male Genital Organ Morphology (Figure 31): For detailed description, see Bologna [8] and Pan and Bologna [13].

Remarks: Compared to the current literature of the male genital organ of this species, it was found to compatible with the drawing included in the finding of Bologna [8] and Pan and Bologna [13]. According to Pan and Bologna [13], this species is very similar to *M. (s.str.) cernyi* Pan and Bologna, 2014, and is distinguished by examined their genitalia. In this study, many specimens were examined, and diagnoses were supported.

Mylabris* (s.str.) *variabilis (Pallas, 1782)
Male Genital Organ Morphology (Figure 32): For detailed description, see Bologna [8] and Pan and Bologna [13].

Remarks: According to Pan and Bologna [13], this species is similar to *M. (s.str.) ciliciensis* (Escherich, 1899) and commonly confused with it, being distinguished with frontal red spot wide, antennomeres usually black, structures of scutum and male genitalia. Compared to the current literature of the male genital organ of this species, it was found to compatible (except minor differs) with the drawing included in the finding of Bologna

[8] and Pan and Bologna [13]. It is thought that these small differences, especially in the proximal hook of the aedeagus, may be due to the position of the aedeagus.

CONCLUSION

When the current literature on genital organs of this family is examined, Gupta [24] 's a higher classification based on the structure of male and female genital organs draws attention. In the publication of Gupta [24], a total of 15 tribe and many genera belonging to Meloinae and Nemognathinae subfamilies were studied. However, since only the structure of the genital organs was examined, differences were observed in the taxonomic situations of many higher taxa and therefore this classification was not accepted [8]. In the current classification of the family, first-instar morphology, adult morphology and adult behavior characters were used [39], then this classification as combined with the molecular data set (nuclear ITS2 and mitochondrial 16S) was supported [1].

Male genital organs from species determined in this study and current literature [8, 11, 13, 16-19, 22-24, 30] were examined. As a result, it is thought that they give important taxonomic characters for the Meloidae family as well as in many other Coleoptera families. Ho-

wever, this does not mean that other taxonomic characters are less important or not and that species determine can only be made on the male genital organ. The combined use of taxonomic characters gives the most accurate results.

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