

# Systematic Studies on Male Genital Organs of Central Anatolian Elateridae (Coleoptera) Species Part II: The Subfamilies Agrypninae, Cardiophorinae, Dendrometrinae and Negastrinae

## İç Anadolu Bölgesi Elateridae (Coleoptera) Türlerinin Erkek Üreme Organları Üzerinde Sistemik Çalışmalar, Kısım II: Agrypninae, Cardiophorinae, Dendrometrinae ve Negastrinae Aİlfamilyaları

Research Article

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### ABSTRACT

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In this study, male genital organs of Central Anatolian species of the subfamilies Agrypninae, Cardiophorinae, Dendrometrinae and Negastrinae (Elateridae, Coleoptera) are examined. Morphologies of male genital organs are drawn and described in detail. Systematical status of species are discussed due to their male genital organ morphologies.

#### Key Words

Male genitalia, Agrypninae, Cardiophorinae, Dendrometrinae, Negastrinae, Systematic.

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### ÖZET

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Bu çalışma kapsamında, İç Anadolu bölgesi Agrypninae, Cardiophorinae, Dendrometrinae ve Negastrinae altfamilyalarına (Elateridae, Coleoptera) ait türlerin erkek üreme organları incelenmiştir. Erkek üreme organ morfolojileri ayrıntılı biçimde çizilmiş ve betimlenmiştir. Türlerin sistematik durumları erkek üreme organ morfolojilerine göre tartışılmıştır.

#### Anahtar Kelimeler

Erkek üreme organı, Agrypninae, Cardiophorinae, Dendrometrinae, Negastrinae, Sistemik.

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## INTRODUCTION

Taxonomical studies on the family Elateridae are mainly condensed on morphological characters. In palearctic region, most comprehensive studies were done in France, Armenia, Italy, Czech and Slovak Republics and Poland (1-5). These studies, which cover male genital organs, are systematical researches. Male genital organ of the family Elateridae is trilobate type [3]. That consist of basal piece, a pair of parameres and median lobe. Median lobe is situated between parameres, divided two arms at basal and it carries opening of sperm duct at apical [4].

## MATERIAL AND METHODS

Male genital organs of 32 species of the subfamilies Agrypninae, Cardiophorinae, Dendrometrinae and Negastrinae, which were collected from Central Anatolian populations of species, were prepared by using standart methods. Their male genital organs' morphologies were described and drawn in detail from dorsal view.

## RESULTS

**Subfamily: DENDROMETRINAE** Gistel, 1856

**Tribe: Athouini** Candéze, 1859

*Nothodes parvulus* (Panzer, 1799)

**Male Genitalia (in dorsal view) (Figure 1):**

Basal piece looks like 'U' letter, apex of arms of basal piece pointed, lateral margins medially cornered, posterior margin concave, corners of posterior margin triangularly projected, anterior margin medially roof like 'U' shapedly notched, outer margins heavily sclerotized thin and line like, rest of basal piece feebly sclerotized; median lobe feebly longer than parameres, slightly sclerotized, widely triangular at basal, arms of median lobe thick and similar to crescent, posteriorly gradually narrowing and pointed at basal, median lobe almost parallel sided from basal to medio-distal, gradually narrowing from medio-distal to apical, feebly pointed at apex; parameres rectangular, outer lateral outer margins of parameres almost parallel up to distal, with pointed teeth at distal, convex at apical.

**Genus: *Limonius*** Eschscholtz, 1829

*Limonius minutus* Linnaeus, 1758

**Male Genitalia (in dorsal view) (Figure 2):**

Basal piece lateral margins feebly arcuate, anterior margin 'U' shapedly notched, posterior margin concave except medial roof like projection, corners of posterior margin triangularly projected, arms of basal piece pointed; median lobe longer than parameres, feebly sclerotized, arms of median lobe thin and long, extending parallelly, exceeding ventral posterior margin of parameres, median lobe gradually narrowing from basal to medial, almost parallel sided from medial to distal, finger shaped at apical; lateral outer lateral margins of parameres parallel sided from basal to distal, distal teeth feebly pointed at distal, apex slightly pointed.

**Genus: *Limoniscus*** Reitter, 1905

*Limoniscus elegans* (Buysson, 1891)

**Male Genitalia (in dorsal view) (Figure 3):**

Basal piece wide, lateral margins pointed near medial, anterior margin 'U' shapedly notched, posterior margin roof like convex, corners of posterior margin small triangularly projected, arms of basal piece not pointed; median lobe slightly longer than parameres, feebly sclerotized, arms of median lobe thick, short, like dagger, not exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to medial, almost parallel sided from medial to apical, clearly narrowing at apical, feebly pointed at apex; outer lateral outer margins of parameres parallel from basal to proximal, gradually narrowing from proximal to medial, slightly sinuate from medial to distal, distal teth feebly pointed, apex rounded.

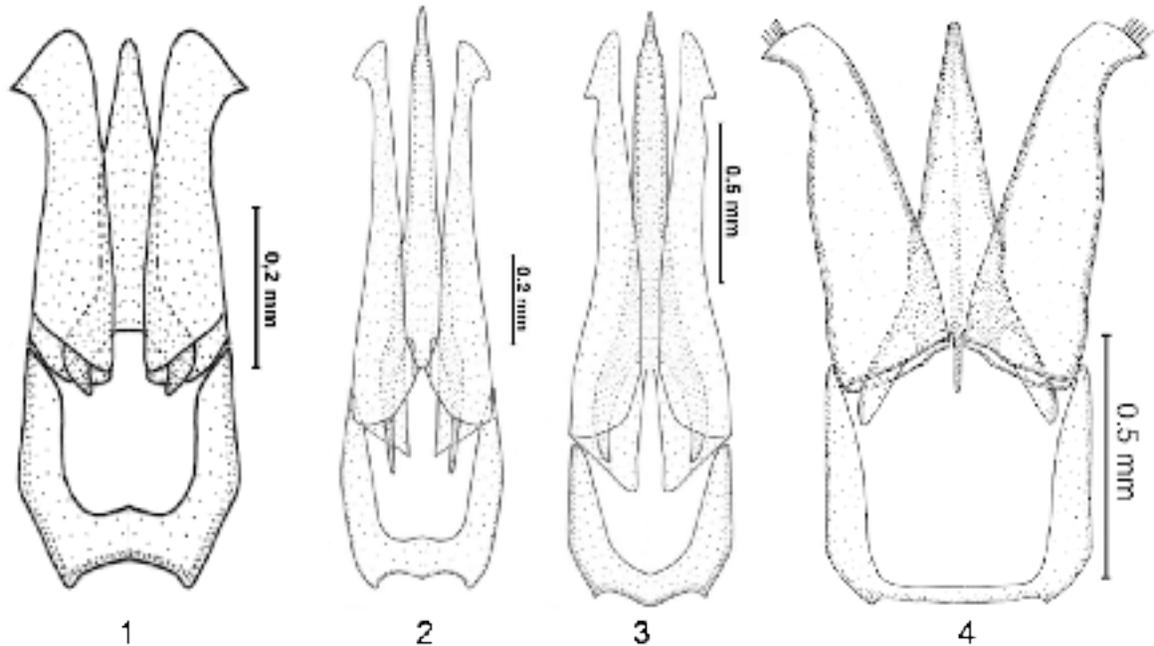
**Genus: *Athous*** Eschscholtz, 1829

**Subgenus: *Athous*** Eschscholtz, 1829

*Athous (A.) haemorrhoidalis* (Fabricius, 1801)

**Male Genitalia (in dorsal view) (Figure 4):**

Basal piece like 'U' letter, posterior margin almost straight, anterior margin 'U' shapedly notched, basal piece slightly sclerotized except heavily sclerotized outer margins, arms of basal piece feebly pointed; median lobe as long as parameres, slightly sclerotized, arms of median lobe short, like 'V' shape, slightly pointed at basal, median lobe almost parallel sided from basal to



**Figures 1-4.** *Nothodes parvulus*; *Limonius minutus*; *Limoniscus elegans*; *Athous (s.str.) haemorrhoidalis*.

medial, strongly gradually narrowing from medial to apical, feebly pointed at apex; parameres slightly sclerotized except heavily sclerotized outer margins, outer lateral margins feebly sinuate, distal teeth short and clearly pointed, slightly pointed apex with five hairs.

**Subgenus:** *Haplathous* Reitter, 1905

*Athous (H.) subfuscus* (O. F. Müller, 1764)

**Male Genitalia (in dorsal view) (Figure 5):**

Basal piece lateral margins broadening from posterior to anterior, posterior margin straight, anterior margin 'U' shapedly notched and roof like at bottom, arms of basal piece slightly pointed, basal piece slightly sclerotized except heavily sclerotized outer margins; median lobe slightly longer than parameres, feebly sclerotized, arms of median lobe short, look like cornered crescent, almost rounded at basal, median lobe almost parallel sided from basal to distal, gradually narrowing from distal to apical, slightly pointed at apex; outer lateral margins of parameres feebly gradually narrowing from basal to medio-distal, strongly broadening from medio-distal and forming strongly pointed teeth, apex triangularly rounded, bearing two hairs.

**Tribe:** *Hemicrepidiini* Champion, 1894

**Genus:** *Hemicrepidius* Germar, 1829

*Hemicrepidius hirtus* (Herbst, 1784)

**Male Genitalia (in dorsal view) (Figure 6):**

Basal piece lateral margins divergent and look like medially cornered 'U' letter, posterior margin concave, corners of posterior margin and its medial with small triangular projections, anterior margin 'U' shapedly notched and its bottom flat, arms of basal piece pointed at apex, basal piece feebly sclerotized except heavily sclerotized arms and outer lateral margins; median lobe clearly longer than parameres, outer margins heavily sclerotized from posterior part and rest part slightly sclerotized, arms of median lobe short, towards posterior look like long triangle, finger shaped at basal; parameres feebly sclerotized except heavily sclerotized medial to distal, outer lateral margins parallel sided from posterior to distal teeth, concave before distal teeth, distal teeth pointed, long and diverted posteriorly, apical of parameres look like right triangle, apex of parameres pointed.

*Hemicrepidius nigrifulus* (Reitter, 1890)

**Male Genitalia (in dorsal view) (Figure 7):**

Basal piece lateral margins not divergent cornered near posterior margin, look like 'U'

letter, corners and medial part of posterior margin with small triangular projections, anterior margin 'U' shapedly notched and its bottom flat, arms of basal piece pointed at apex, basal piece slightly sclerotized except heavily sclerotized arms and outer lines of lateral margins close to posterior margin; median lobe slightly longer than parameres, outer margins of median lobe heavily sclerotized from posterior and rest feebly sclerotized, arms of median lobe short, finger shaped, almost rounded at basal, median lobe almost parallel sided from basal to medial, slightly gradually narrowing from medial to distal, strongly narrowing from distal to apical, apex almost rounded; parameres heavily sclerotized except feebly sclerotized apex, outer lateral margins slightly arcuate from posterior to distal teeth, before distal teeth strongly concave, distal teeth pointed, long and diverted to posterior at apex, apex of parameres almost rounded; bearing two hairs before distal teeth and also two hairs after distal teeth.

**Tribe:** *Ctenicerini* Fleutiaux, 1936

**Genus:** *Prosternon* Latreille, 1834

*Prosternon syriacum* (Buysson, 1891)

**Male Genitalia (in dorsal view) (Figure 8):**

Basal piece wide, it looks like slightly divergent

lateral margined 'U', its anterior margin notched widely 'U' shaped, its posterior margin flat, arms of basal part pointed; median lobe slightly longer than parameres, normally sclerotized, arms of median lobe thin, short, dagger shaped, pointed at basal, not exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to medial, from medial to distal parallel sided, gradually narrowing from distal to apical, its apex strongly pointed; outer lateral margins of parameres arcuate from basal to medio-proximal, from medio-proximal to distal almost parallel sided, carrying short, slightly pointed, diverted to posterior teeth, apical of parameres triangular, its apex thin and pointed.

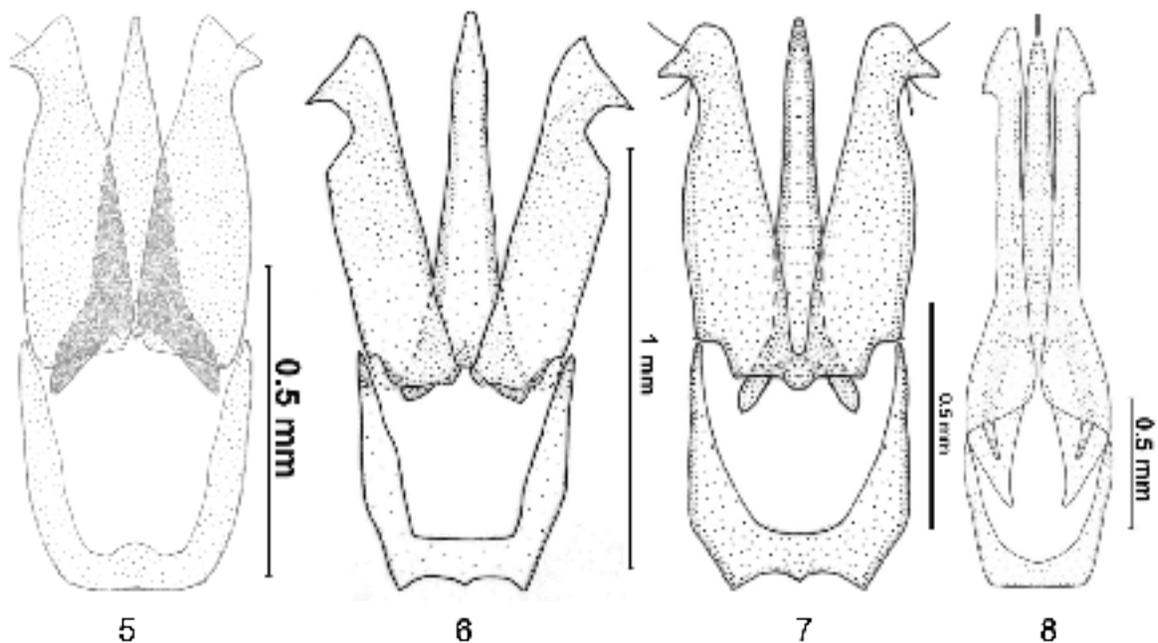
**Genus:** *Selatosomus* Stephens, 1830

**Altcons:** *Selatosomus* Stephens, 1830

*Selatosomus (s. str.) latus* (Fabricius, 1801)

**Male Genitalia (in dorsal view) (Figure 9):**

Basal piece wide, square shaped, anterior margin 'V' shapedly notched with flat bottom, posterior margin feebly roof-like concave, corners of posterior margin with pointed projections, arms of basal piece pointed, basal piece slightly sclerotized except heavily sclerotized outer margins; median lobe feebly longer than parameres, heavily sclerotized, look like long triangle from basal to



**Figures 5-8.** *Athous. (Haplathous) subfuscus*; *Hemicrepidius hirtus*; *Hemicrepidius nigrutilus*; *Prosternon syriacum*.

apical, arms of median lobe thin, short, arcuate, finger shaped at basal, exceeding ventral posterior margins of parameres, apex of median lobe truncated; outer lateral margins of parameres slightly sinuate from basal to apical, curved to outside at apex and slightly pointed.

**Subfamily: NEGASTRIINAE** Nakane et Kishii, 1956

**Genus: *Quasimus*** Des Gozis, 1886

*Quasimus minutissimus* (Germar, 1817)

**Male Genitalia (in dorsal view) (Figure 10):**

Basal piece anterior and posterior margins concave, lateral margins arcuate, arms of basal piece reduced and short and pointed at apex, feebly sclerotized except lateral outer margins; median lobe clearly longer than parameres, slightly sclerotized except arms of median lobe and outer lateral margins, arms of median lobe short and thin, slightly short from ventral posterior margins of parameres, median lobe gradually narrowing from basal to apical and bullet shaped, its apex finger shaped and feebly pointed; parameres slightly sclerotized except lateral margins, outer lateral margins of parameres almost parallel side from basal to medio-distal, clearly narrowing from medio-distal to apical, parameres without distal teeth.

**Genus: *Zorochros*** C. G. Thomson, 1859

*Zorochros dermestoides* (Herbst, 1806)

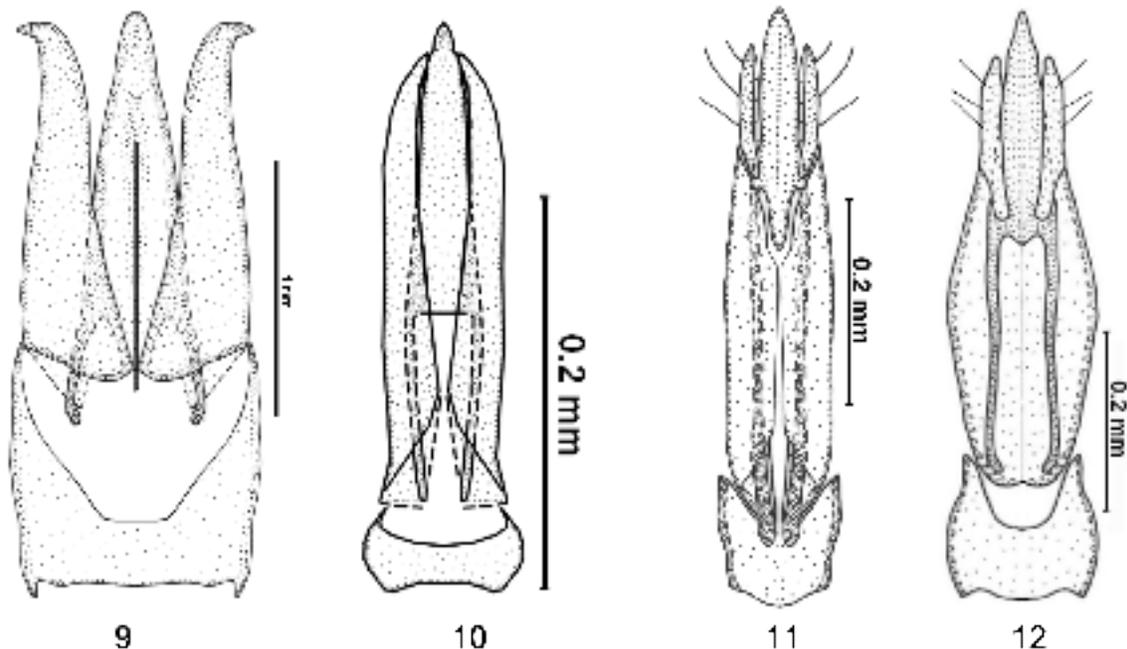
**Male Genitalia (in dorsal view) (Figure 11):**

Basal piece narrow, posterior margin arcuate, lateral margins parallel until medial, suddenly broadening at medial and slightly arcuate, anterior margin feebly 'V' shapedly notched, arms of basal piece pointed, lateral margins heavily sclerotized and rest slightly sclerotized; median lobe clearly longer than parameres, arms of median lobe thin and extending parallelly, clearly exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to proximal, bullet shaped from proximal to apical and pointed at apex, median lobe basal margin with small triangular projection; lateral margins and apical of parameres heavily sclerotized and rest slightly sclerotized, outer lateral margins of parameres slightly arcuate from basal to distal, almost parallel sided from distal to apical, bearing three hairs between distal and apical, pointed at apex.

*Zorochros georgicus* Dolin and Tschatlandze, 1980

**Male Genitalia (in dorsal view) (Figure 12):**

Basal piece wide, anterior margin feebly 'U'



**Figures 9-12.** *Selatosomus (s. str.) latus*; *Quasimus minutissimus*; *Zorochros dermestoides*; *Zorochros georgicus*.

shapedly notched, posterior medially convex sinuate, lateral margins arcuate from basal to distal and parallel sided from distal to apical, arms of basal piece slightly pointed, feebly sclerotized except heavily sclerotized outer margin; median lobe clearly longer than parameres, median lobe slightly sclerotized, arms of median lobe thin, long, curved at basal and feebly pointed, not exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to apical, slightly pointed at apex; outer lateral margins of parameres broadening from basal to medial, gradually narrowing from medial to distal, parallel sided from distal to apical, almost rounded at apex, with three hairs at apical.

**Zorochros heyrovskyi** Roubal, 1940

**Male Genitalia (in dorsal view) (Figure 13):**

Basal piece wide, anterior margin widely 'U' shapedly notched, posterior margin almost straight, lateral margins feebly arcuate, arms of basal piece slightly pointed, feebly sclerotized except heavily sclerotized outer margin; median lobe clearly longer than parameres, normally sclerotized, arms of median lobe thick, long, parallel sided, slightly pointed at basal and exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to medial, parallel sided from medial to distal, gradually narrowing from distal to apical, roof like at apex, basal margin of median lobe with thin triangular projection; parameres slightly sclerotized, outer lateral margins broadening from basal to proximal, gradually narrowing from proximal to apical, rounded at apex.

**Subfamily: AGRYPNINAE** Candèze, 1857

**Tribe: Agrypnini** Candèze, 1857

**Genus: Agrypnus** Eschscholtz, 1829

**Male Genitalia (in dorsal view) (Figure 14):**

Basal piece wide, look like depressed bowl, right angled to parameres and median lobe, posterior margin slightly concave, feebly sclerotized except heavily sclerotized outer margins; median lobe barely longer than parameres, median lobe heavily sclerotized except feebly sclerotized lateral parts alongside median heavily sclerotized line, arms of median wide until medial, strongly narrowing at medial, thin and finger shaped from medial to posterior, not exceeding ventral

posterior margin of parameres, median lobe strongly narrowing from basal to proximal, gradually narrowing from proximal to apical, pointed at apex; parameres heavily sclerotized, lateral outer margins broadening between basal and proximal, concave from proximal to distal, bearing short, pointed and diverted posterolateral distal teeth, apical part look like right triangle and slightly pointed at apex, parameres bearing long hairs at distal and short hairs at apical.

**Tribe: Oophorini** Candèze, 1857

**Genus: Drasterius** Eschscholtz, 1829

**Drasterius bimaculatus** Rossi, 1790

**Male Genitalia (in dorsal view) (Figure 15):**

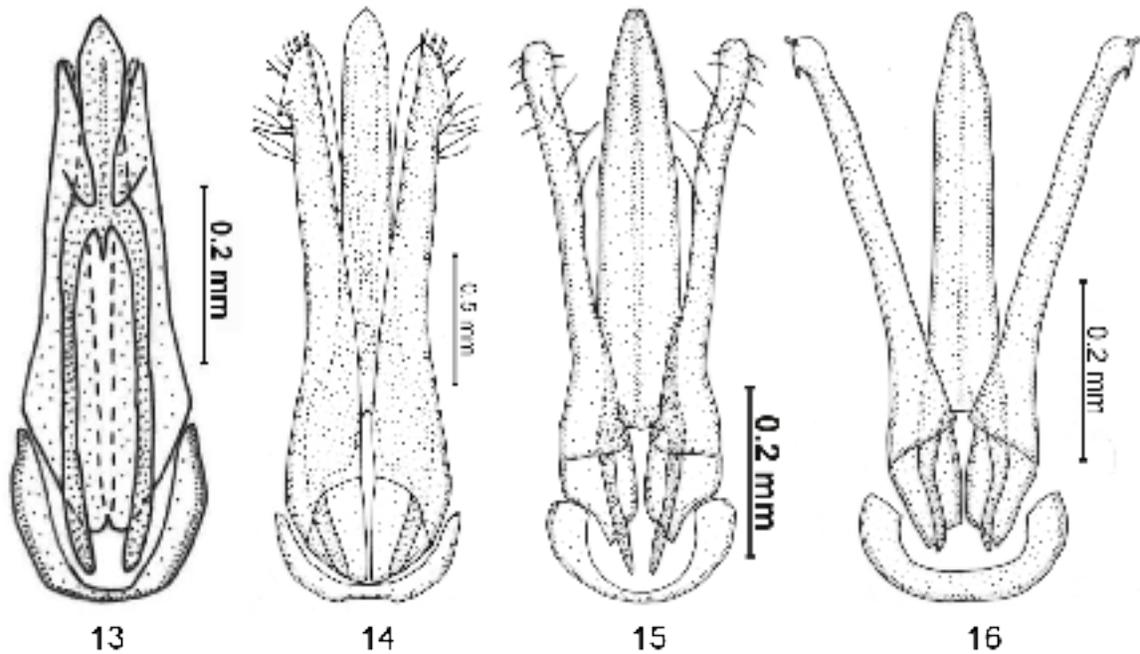
Basal piece wide, bowl shaped, anterior margin 'U' shapedly notched, posterior and lateral margins arcuately united, basal piece angled to parameres and median lobe, feebly sclerotized except heavily sclerotized outer margins, arms of basal piece truncated at apex; median lobe clearly longer than parameres, median lobe slightly sclerotized except heavily sclerotized arms, outer margins and median line, arms of median lobe extending thinly towards posterior, slightly approaching each other and pointed at basal, long and clearly exceeding ventral posterior margins of parameres, median lobe feebly concave from basal to proximal, bullet shaped from proximal to apical, truncated at apex; parameres heavily sclerotized except feebly sclerotized apex, basal margins of parameres triangular, thin, long and outer lateral margins slightly sinuate from proximal to apical, bearing rigid long and short, scattered hairs on inner and outer margins from medio-distal, apex bulky and almost rounded, parameres without distal teeth.

**Genus: Aeoloderma** Fleutiaux, 1928

**Aeoloderma crucifer** (Rossi, 1790)

**Male Genitalia (in dorsal view) (Figure 16):**

Basal piece wide, bowl shaped, anterior margin 'U' shapedly notched, posterior and lateral margins arcuately united, basal piece angled to parameres and median lobe, feebly sclerotized except heavily sclerotized outer margins, arms of basal piece truncated at apex; median lobe feebly longer than parameres, median lobe slightly sclerotized except heavily sclerotized arms, outer margins and median line, arms of median lobe cornered at medial, pointed at basal, feebly exceeding ventral



**Figures 13-16.** *Zoroachros heyrovskyi*; *Agrypnus crenicollis*; *Drasterius bimaculatus*; *Aeoloderma crucifer*.

posterior margins of parameres, median lobe parallel sided from basal to apical, gradually narrowing at apical, rounded at apex; parameres heavily sclerotized except feebly sclerotized basal - proximal part and apex, basal margin of parameres with triangular projection, outer lateral margins bulky from basal to proximal, feebly narrowing from proximal to medio-proximal, thin from medio-proximal to apical, long and parallel sided, without hairs, apex not bulky, parameres with two spines on distal posterior outer margin and apex.

**Genus:** *Aeolosomus* Dolin, 1982

*Aeolosomus rossi* (Germar, 1844)

**Male Genitalia (in dorsal view) (Figure 17):**

Basal piece wide, almost rounded, anterior margin 'U' shapedly notched, posterior and lateral margins arcuately united, feebly sclerotized except heavily sclerotized outer margins; median lobe feebly shorter than parameres, median lobe slightly sclerotized except heavily sclerotized arms, outer margins and median line, arms of median lobe short and posteriorly thinning, truncated at basal, not exceeding ventral posterior margins of parameres, median lobe slightly arcuate from basal to medio-proximal, bullet shaped from medio-proximal to apical, truncated

at apex; parameres heavily sclerotized except feebly sclerotized basal - proximal part and apex, posterior margins of parameres triangular, outer lateral margins cornered from basal to proximal, almost parallel sided from medio-proximal to apical, apex bulky and blunt, apical outer margin distally swollen with two short and long spines, distal inner margins of parameres with two long hairs.

**Subfamily:** **CARDIOPHORINAE** Candèze, 1860

**Tribe:** **Cardiophorini** Candèze, 1860

**Genus:** *Cardiophorus* Eschscholtz, 1829

**Altains:** *Cardiophorus* Eschscholtz, 1829

*Cardiophorus (s.str.) dolini* Mardjanian, 1985

**Male Genitalia (in dorsal view) (Figure 18):**

Basal piece wide, anterior margin 'U' shapedly notched, posterior margin sinuate, corners of posterior margin with small triangular projections; median lobe longer than parameres, heavily sclerotized, arms of median lobe very thin, long, extending slightly arcuate, exceeding ventral posterior margins of parameres, curved at basal, median lobe gradually narrowing from basal to medial, almost parallel sided from medial to apical, apex finger shaped; outer lateral margins of parameres gradually broadening from basal

to proximal, parallel sided from proximal to medio-distal, gradually narrowing from medio-distal to apical, heavily sclerotized, inner margin of movable part slightly sinuate, posterior part wider than anterior part, with three short hairs at distal, without teeth, pointed at apex.

***Cardiophorus (s.str.) frequens*** Platia and Gudenzi, 2002

**Male Genitalia (in dorsal view) (Figure 19):**

Basal piece wide, anterior margin 'U' shapedly notched and its bottom roof like, posterior margin almost straight, feebly sclerotized except heavily sclerotized outer margins; median lobe longer than parameres, heavily sclerotized, arms of median lobe thin, long, feebly arcuate, not exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to distal, almost parallel sided from distal to apical, finger shaped at apex; outer lateral margins of parameres clearly gradually broadening from basal to proximal, slightly broadening from proximal to distal, strongly narrowing from distal to apical, feebly narrowing at apical, heavily sclerotized, inner margin of movable part feebly sinuate, posterior part knife shaped, with two hairs and vertically situated very small teeth at apical, apex pointed.

***Cardiophorus (s.str.) impressiventris*** Schwarz, 1900

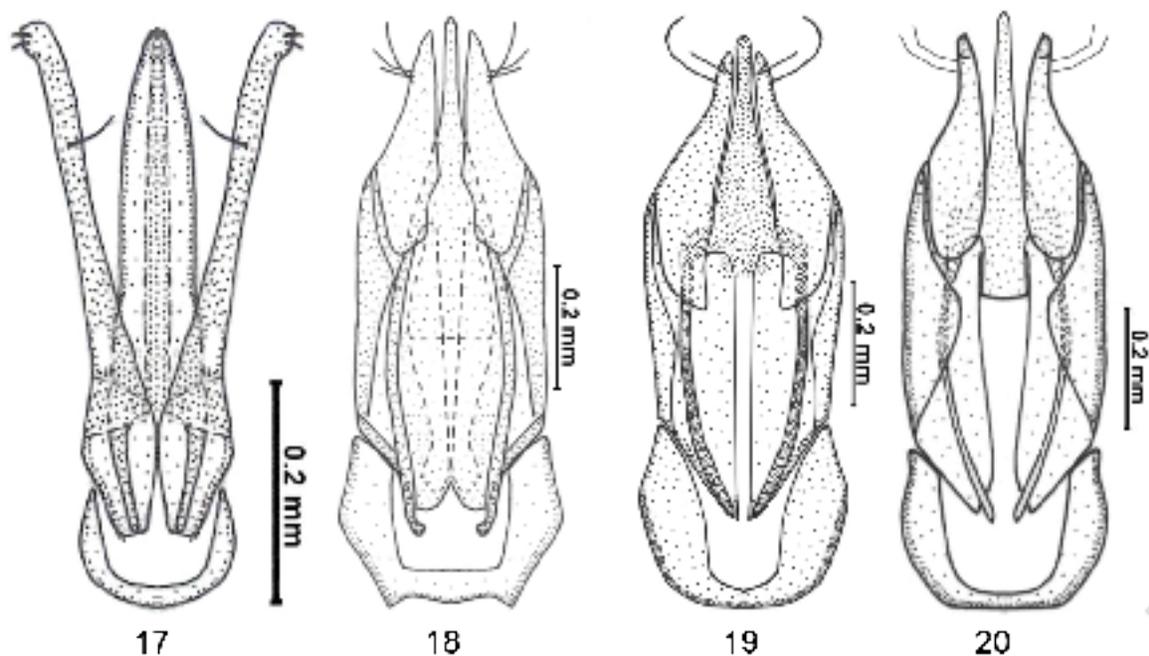
**Male Genitalia (in dorsal view) (Figure 20):**

Basal piece wide, anterior margins 'U' shapedly notched, posterior margin straight, lateral margins arcuate, feebly sclerotized except heavily sclerotized outer margins; median lobe longer than parameres, normally sclerotized except arms, arms of median lobe very thin, long, slightly arcuate, exceeding ventral posterior margins of parameres, median lobe gradually narrowing from basal to medial, almost parallel sided from medial to apical, pointed at apex; outer lateral margins of parameres gradually broadening from basal to proximal, arcuate from proximal to distal, gradually narrowing from distal to apical, heavily sclerotized, inner margin of movable part feebly sinuate, posterior part larger than anterior part, with two hairs and vertically very small teeth at apical, blunt at apex.

***Cardiophorus (s.str.) megathorax*** Faldermann, 1835

**Male Genitalia (in dorsal view) (Figure 21):**

Basal piece wide, anterior margin 'U' shapedly notched, posterior margin sinuate, corners of posterior margins with small triangular projections, lateral margins cornered at medial,



**Figures 17-20.** *Aeolosomus rossi*; *Cardiophorus (s.str.) dolini*; *C. (s.str.) frequens*; *C. (s.str.) impressiventris*.

feebly sclerotized except heavily sclerotized outer margins; median lobe longer than parameres, heavily sclerotized, arms of median lobe thin, long, slightly arcuate, exceeding ventral posterior margins of parameres, median lobe strongly narrowing from basal to proximal, slightly broadening from proximal to apical, swollen at apical, rounded at apex; outer lateral margins of parameres gradually broadening from basal to proximal, arcuate from proximal to medio-distal, strongly narrowing at medio-distal, parallel sided towards apical, heavily sclerotized, inner margin of movable part not sinuate basal- proximal part slightly wider than proximal apical part, without teeth and hair at apical, rounded at apex.

***Cardiophorus (s.str.) miniaticollis*** Candèze, 1860

**Male Genitalia (in dorsal view) (Figure 22):**

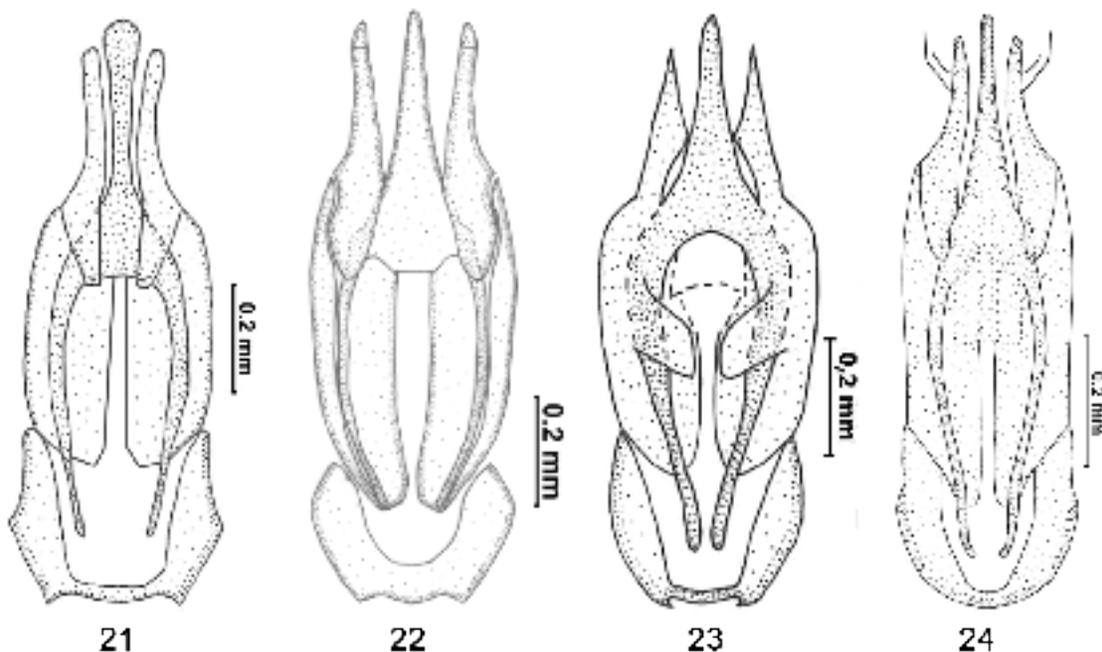
Basal piece narrow, anterior margin 'U' shapedly notched, posterior margin medially arcuate, corners of posterior margin with small triangular projections, lateral margins distinctly cornered near parameres, normally sclerotized except heavily sclerotized outer margins; median lobe slightly longer than parameres, normally sclerotized except heavily sclerotized arms, arms of median lobe thin, long, slightly arcuate, not exceeding ventral posterior margins of

parameres, median lobe strongly narrowing from basal to proximal, gradually narrowing from proximal to apical, finger shaped at apex; outer lateral margins of parameres arcuate from basal to medio-distal, almost parallel sided from medio-distal to apical, heavily sclerotized, movable part slightly sinuate from basal to medial and wider than medial-apical part, with vertically situated apical teeth, feebly pointed at apex.

***Cardiophorus (s.str.) nigratissimus*** Buysson, 1891

**Male Genitalia (in dorsal view) (Figure 23):**

Basal piece narrow, circular, anterior margin 'U' shapedly notched, posterior margin straight, corners of posterior margin with curved triangular projections; median lobe longer than parameres, normally sclerotized except arms, arms of median lobe slightly thin, long, closing each other, exceeding ventral posterior margin of parameres, median lobe gradually narrowing from basal to apical, feebly pointed at apex; lateral outer margins of parameres arcuate from basal to distal, before distal part strongly narrowing and towards apical gradually narrowing, clearly pointed at apex, heavily sclerotized, dorsally medial situated two arms shaped, without teeth, inner margin cornered at distal.



**Figures 21-24.** *Cardiophorus (s.str.) megathorax*; *Cardiophorus (s.str.) miniaticollis*; *Cardiophorus (s.str.) nigratissimus*; *Cardiophorus (s.str.) parvulus*.

*Cardiophorus (s.str.) parvulus* Platia and Gudenzi, 2000

**Male Genitalia (in dorsal view) (Figure 24):**

Basal piece wide, semi-circle shaped, anterior margin 'V' shapedly notched, junction point of posterior and lateral margins without triangular projection, lateral margins narrowing medially and parallel sided from medial to apical, normally sclerotized except heavily sclerotized outer margins, arms of basal piece pointed at apex; median lobe longer than parameres, slightly sclerotized except heavily sclerotized arms, arms of median lobe thin, long, slightly sinuate, exceeding ventral posterior margins of parameres, median lobe strongly narrowing from basal to apical, blunt at apex; outer lateral margins of parameres gradually broadening from basal to proximal, parallel sided from proximal to medio-distal, suddenly narrowing at medio-distal, almost parallel up to apical, heavily sclerotized, movable part inner margin slightly sinuate from basal to medial and posterior part wider than anterior part, at apical with two long and short hairs, parameres with vertically situated small apical teeth, pointed at apex.

*Cardiophorus (s.str.) ruficruris* (Brullé, 1832)

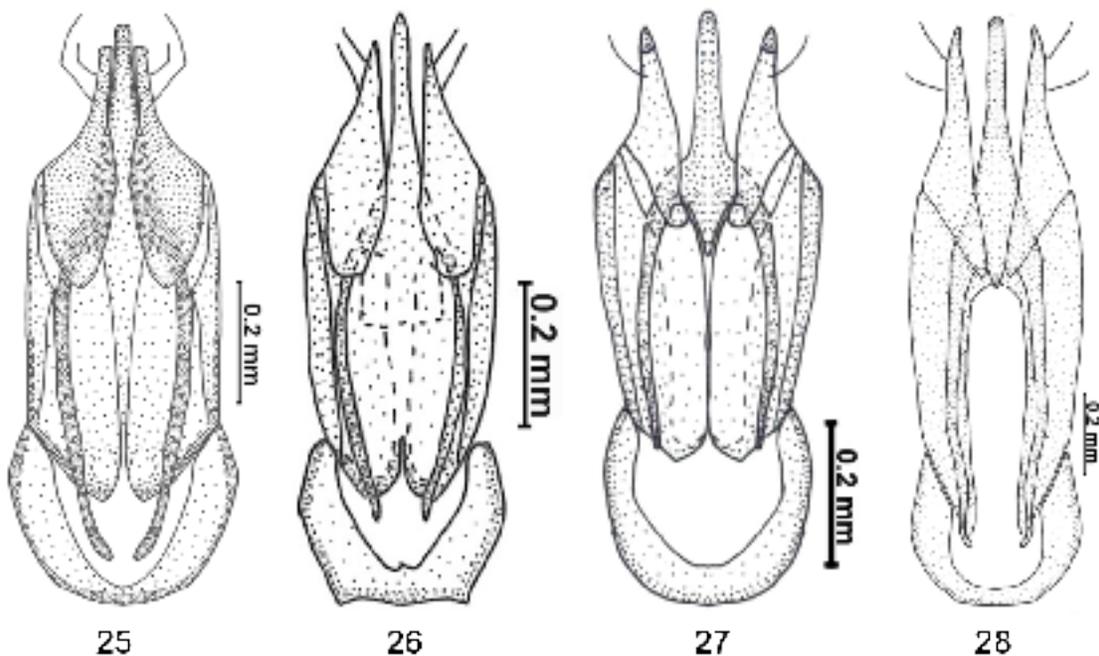
**Male Genitalia (in dorsal view) (Figure 25):**

Basal piece wide, anterior margin 'V' shapedly notched, posterior margin convex, lateral margins cornered near apical, feebly sclerotized except heavily sclerotized outer margins; median lobe longer than parameres, feebly sclerotized except heavily sclerotized arms, arms of median lobe thin, long, slightly arcuate, exceeding ventral posterior margins, median lobe gradually narrowing from basal to apical, blunt at apex; outer lateral margins of parameres gradually broadening from basal to proximal, slightly narrowing from proximal to distal, strongly narrowing at distal and almost parallel sided towards apical, heavily sclerotized, posterior part of movable part half elipsoidal, at apical short and long two hairs, parameres with laterally situated small apical teeth, blunt at apex.

*Cardiophorus (s.str.) sacratus* Erichson, 1840

**Male Genitalia (in dorsal view) (Figure 26):**

Basal piece wide, anterior margin medially feebly notched 'V' shaped, posterior margin slightly sinuate at medial, junction points of lateral and posterior margins cornered; median lobe longer than parameres, arms of median lobe more sclerotized than rest part, arms of median lobe thin, long, arcuate, exceeding ventral posterior



**Figures 25-28.** *Cardiophorus (s.str.) ruficruris*, *Cardiophorus (s.str.) sacratus*, *Cardiophorus (s.str.) vestigialis*, *Dicronychus adanensis*

margins of parameres, median lobe strongly narrowing from basal to medial, feebly narrowing from medial to apical, pointed at apex; outer lateral margins of parameres arcuate from basal to apical, pointed at apex, parameres heavily sclerotized, movable part slightly arched between basal and medial, medial-apical part wider than basal-medial part, with two hairs at apical, parameres without teeth.

***Cardiophorus (s.str.) vestigialis*** Erichson, 1840

**Male Genitalia (in dorsal view) (Figure 27):**

Basal piece wide, almost rounded, anterior margin 'U' shapedly notched, posterior margin rounded, corners of posterior margin without small triangular projection, feebly sclerotized except heavily sclerotized outer margins; median lobe slightly longer than parameres, arms of median lobe more sclerotized than rest part, arms of median lobe thin, long, sinuate, curved to inside at basal, exceeding ventral posterior margins, median lobe gradually narrowing from basal to distal, parallel sided from distal to apical, finger shaped at apex; outer lateral margins of parameres arcuate from basal to distal, slightly narrowing from distal to apical, apical part feebly curved, parameres heavily sclerotized, movable part triangular from basal to medial and wider than medial to apical part, with two hairs, parameres without apical teeth, apex feebly pointed.

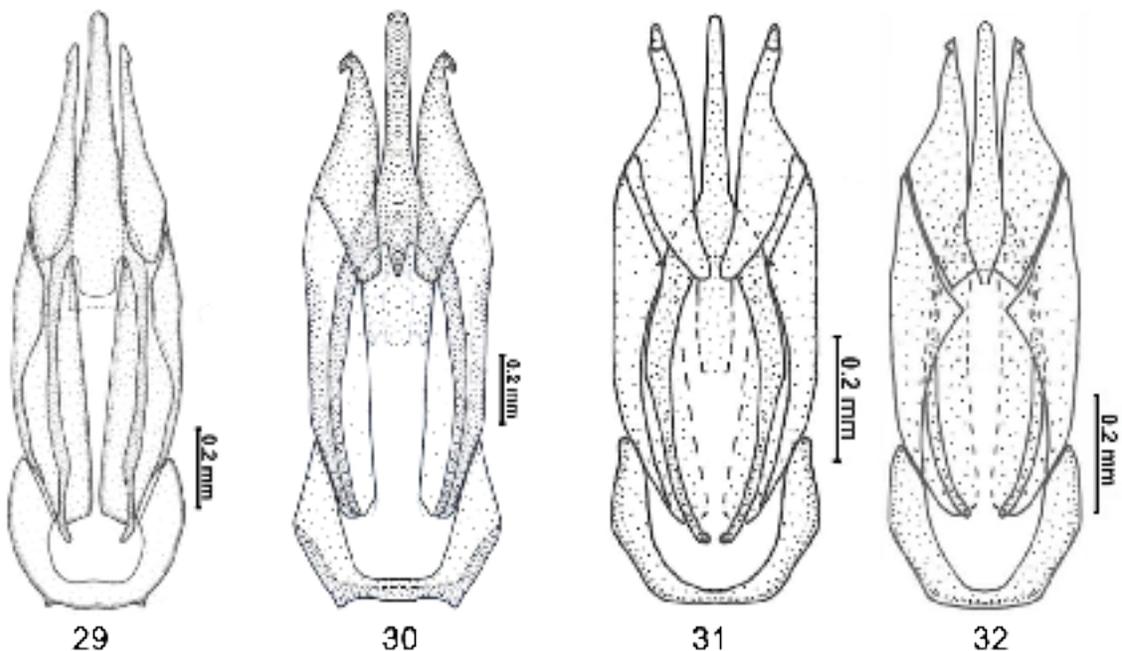
from basal to distal, gradually narrowing from distal to apical, divergent at apical and with ventrally situated teeth, movable part triangular shaped at inner part, pointed at apex, parameres with a hair at apical.

**Genus: *Dicronychus*** Brullè, 1832

***Dicronychus adanensis*** (Pic, 1908)

**Male Genitalia (in dorsal view) (Figure 28):**

Basal piece wide, anterior margin 'U' shapedly notched, posterior margin feebly convex, corners of posterior margin with small triangular projections, lateral margins arcuate, feebly sclerotized except heavily sclerotized outer margins; median lobe slightly longer than parameres, arms of median lobe more sclerotized than rest part, arms of median lobe thin, long, sinuate, curved to inside at basal, exceeding ventral posterior margins, median lobe gradually narrowing from basal to distal, parallel sided from distal to apical, finger shaped at apex; outer lateral margins of parameres arcuate from basal to distal, slightly narrowing from distal to apical, apical part feebly curved, parameres heavily sclerotized, movable part triangular from basal to medial and wider than medial to apical part, with two hairs, parameres without apical teeth, apex feebly pointed.



**Figures 29-32.** *Dicronychus cinereus*, *Dicronychus iconiensis*, *Dicronychus obscuripennis*, *Dicronychus senaci*

*Dicronychus cinereus* (Herbst, 1784)**Male Genitalia (in dorsal view) (Figure 29):**

Basal piece wide, looks like half circle, anterior margin 'U' shapedly notched, posterior margins feebly sinuate, corners of posterior margin with small triangular projections, lateral margins arcuate, feebly sclerotized except heavily sclerotized outer margins; median lobe clearly longer than parameres, heavily sclerotized except medial part, arms of median lobe thin, long, sinuate, curved to inside at basal, exceeding ventral posterior margins, median lobe gradually narrowing from basal to proximal, parallel sided from proximal to medial, slightly narrowing from medial to apical, finger shaped at apex; parameres heavily sclerotized, outer lateral margins arcuate from basal to apical, movable part large and triangular, basal to medial short, large and medial to apical narrow and long, parameres with laterally situated teeth, pointed at apex.

*Dicronychus iconiensis* Pic, 1908**Male Genitalia (in dorsal view) (Figure 30):**

Basal piece wide, anterior margin 'U' shapedly notched, posterior margin straight, corners of posterior margin with small triangular projections; median lobe clearly longer than parameres, median lobe normally sclerotized except heavily sclerotized arms of median lobe, arms of median lobe slightly narrowing posteriorly, long, arcuate, not exceeding ventral posterior margins and not curved at basal, median lobe gradually narrowing from basal to medio-proximal, parallel sided from medio-proximal to apical, apex blunt; parameres heavily sclerotized, outer lateral margins arcuate from basal to apical, divergent at apical and curved outside at apex, movable part triangular from basal to medial, blunt at posterior and as wide as medial to apical part, pointed at apex.

*Dicronychus obscuripennis* (Pic, 1899)**Male Genitalia (in dorsal view) (Figure 31):**

Basal piece wide, anterior margin 'U' shapedly notched, posterior margin straight, corners of posterior margin without small triangular projections, lateral margins sinuately arcuate, outer margins heavily sclerotized thin and line like, rest of basal piece feebly sclerotized; median lobe feebly longer than parameres, median lobe normally sclerotized except heavily sclerotized

arms of median lobe, posterior half of arms of median lobe thick, anterior half thin, long and slightly arcuate, parameres exceeding ventral posterior margins of parameres and tips curved, median lobe strongly narrowing from basal to proximal, gradually narrowing from proximal to apical, apex rounded; parameres heavily sclerotized, outer lateral margins arcuate from basal to distal, divergent from distal to apical, parameres with vertical teeth at apex, movable part slightly sinuate from basal to medial and wider than its anterior part, feebly pointed at apex.

*Dicronychus senaci* Desbrochers des Loges, 1870**Male Genitalia (in dorsal view) (Figure 32):**

Basal piece wide, anterior margin 'V' shapedly notched and flat at bottom, posterior margin almost straight, corners of posterior margin without small triangular projections, lateral margins cornered at medial, slightly sclerotized except heavily sclerotized outer margins; median lobe slightly longer than parameres, feebly sclerotized except heavily sclerotized arms of median lobe, arms of median lobe thin, long, arcuate, exceeding ventral posterior margins of parameres, median lobe strongly gradually narrowing from basal to proximal, almost parallel sided from medial to apical, finger shaped at apex; parameres heavily sclerotized, outer lateral margins arcuate from basal to distal, gradually narrowing from distal to apical, ventrally diverted teeth at apex, movable part truncated triangular shaped between basal to medial and wider than medial to apical, pointed at apex.

**DISCUSSION**

In this study, one of the examined subfamily is Dendrometrinae. Four genera, which are *Nothodes*, *Athous*, *Limonius* and *Limoniscus*, were examined from tribus Athouini in Dendrometrinae.

Male genital organ of *N. parvulus* was examined. We could compare our findings with other researchers findings [1,3,5]. According to that our findings are more similar to Leseigneur's findings [1] than findings of Platia [3] and Tarnawski [5] by

thicker arms of basal piece, more swollen apex of parameres and more pointed apex of median lobe. Due to the our findings and present literature, male genital organ morphology of genus *Nothodes* does not have distinct differences from other genera of tribus Athouini, however after examination of other species of *Nothodes* this estimation can be confirmed.

Another examined genus of Athouini is the genus *Athous*. Two species, which are from subgenera *Athous* and *Haplathous*, were detected from research area. Male genital organ of collected *A. (s.str.) haemorrhoidalis* is similar with present literature [1,3,5]. Male genital organ morphology of this species was compared with *A. (s.str.) nadoraz* and *A. (s.str.) vittatus* [1,3,6] According to basal piece shape and paramer distal teeth, *A. (s.str.) haemorrhoidalis* is more similar to *A. (s.str.) vittatus* than *A. (s.str.) nadoraz*. Due to morphology of median lobe, *A. (s.str.) nadoraz*, *A. (s.str.) vittatus* and *A. (s.str.) haemorrhoidalis* follow each other from thin to thick. Shape of distal teeth and median lobe are seen for diagnostic keys between three species. Considering findings of examined species in thesis and literature [1,3] on male genital structure, there is not any specific character for subgenus *Athous* and male genital organ morphology of this subgenus is very similar with other subgenera of genus *Athous*.

Male genital organ of one species, which is *A. (H.) subfuscus*, was examined from subgenus *Haplathous* Our findings are similar with Platia [3] but there are two differences. In our findings lateral margins of basal piece straight and anterior convex medially while lateral margins of basal piece cornered medially and anterior margin medially straight in Platia (3). These characters may be important for examined Central Anatolian population. According to examined species and present literature [1, 3, 7-19] especially 'U' shapedly basal piece, short arms of median lobe, almost equal length of median lobe and parameres and triangular median lobe can be considered as genus character for the genus *Athous*.

*Limoniscus* and *Limonius* are other examined genera from tribus Athouini. There are two species of *Limoniscus* in Turkey [6]. *L. elegans* was detected

and examined its male genital organ in this study. Our findings were compared with Platia and Gudenzi (1996a) and we detected that ours and Platia and Gudenzi's findings are very similar. In order to detect generic characters many species should be examined.

The genus *Limonius* have three species in Turkey [20]. In this study, only *L. minutus* was detected. Our findings about male genital organ of *L. minutus* were compared with findings about same species, *L. aeneoniger* (De Geer,1774) and *L. quercus* (Oliver, 1790) from literature [1,3]. For *L. minutus*, arms of basal piece are long and parallelly extending in examined specimens while arms of basal piece short and crescent shaped in Leseigneur [1] and Platia [3]. Other characters of male genital organ of *L. minutus* are same in our findings and literature. According to comparisons of *L. minutus* with *L. aeneoniger* and *L. quercus*, we detected that male genital organ of *L. aeneoniger* short and thick while male genital organs of *L. minutus* and *L. quercus* long and thin. In *L. minutus* teeth of parameres are distinct and pointed and median lobe is thick, while parameres are without teeth and median lobe is thin in *L. quercus*. After examination of male genital organ of these species, detecting generic characters seems to be difficult. Because, three species have not distinct shared characters on male genital organ and more species should be examined.

Hemicrepidiini is another examined tribus of Dendrometrinae subfamily. *Hemicrepidius* is only detected genus of this tribus from research area. Due to Mertlik and Platia [20], there are 7 species in Turkey and 2 species, which are *H. hirtus* and *H. nigrutilus*, were detected from Central Anatolian region. After examination of male genital organs of these species, it can be possible to differentiate two species by some characters. Basal piece is narrow in *H. hirtus*, while it is large in *H. nigrutilus*. Arms of median lobe thick and blunt in *H. hirtus*, while it is thin and finger shaped in *H. nigrutilus*. Apex of parameres are almost rounded in *H. nigrutilus*, while they are pointed in *H. hirtus*. Our findings on *H. hirtus* were compared with Platia's [3] findings and we detected that they matched each other except small differences about arms of median lobe and basal piece in our findings. In addition

to examined species, findings about male genital organs of *H. niger* (Linnaeus,1758), *H. rufangulus* (Miwa, 1928), *H. schneideri* (Kiesenwetter, 1878) and *H. vulpeculus* (Reitter, 1890) were examined from present literature [2,3,5,21]. As a result of that, short arms of median lobe, strong distal teeth of parameres and thin median lobe may be a generic characters for the genus *Hemicrepidius*.

The male genital organs of two species of genera *Selatosomus* and *Prosternon* of tribus Ctenicerini were examined in thesis study. Findings on examined specimens of *S. (s.str.) latus* were compared with findings of Platia [3] and Tarnawski [5,22]. According to that, findings on examined specimens of Central Anatolian population are matched with literature except absence of hairs of parameres. Because of preparation, hairs of parameres may be absent. After comparison, *S. (s.str.) latus* is separated from other species of genus *Selatosomus* from Platia [3] by pointed apex of basal piece, almost straight basally outer lateral margins of parameres, narrow distal part of parameres, short and pointed distal teeth, widely 'V' shaped inner margins of parameres, slightly sinuate arms of median lobe; *S. (s.str.) latus* is similar to *S. (s.str.) aeneus* (Linnaeus, 1758) by morphology of anterior of median lobe and length comparison of median lobe and parameres. According to examined species, it is not possible to detect generic characters, however, studies of Gurjeva [23] and Tarnawski [22] show that large basal piece, almost always thick median lobe, short arms of median lobe and weak distal teeth of parameres may be generic characters.

Male genital organ of *P. syriacum* was examined and compared with *P. tesellatum* from literature [3,5]. According to that, posterior margin of basal piece is straight, arms of median lobe are short and not exceeding ventral posterior margins of parameres and apex of median lobe is clearly narrow in *P. syriacum*, while posterior margin of basal piece is slightly concave, arms of median lobe are long and exceeding ventral posterior margins of parameres and apex of median lobe is feebly narrow in *P. tesellatum* (Linnaeus, 1758). After examination of *P. admirabile* (Gurjeva, 1984) and *P. crysocomum* (Germar, 1843) from research of Gurjeva [24] generic characters of genus *Prosternon* can be

stated. As a result of that, narrow morphology anterior part of parameres can be considered as generic characters, however other species of this genus and species of closely related genera should be examined to decide accurately.

Another examined subfamily is **Negastriinae**. The male genital organs of five species of genera *Quasimus* and *Zoroachros* were examined. Male genital organ of *Quasimus (s.str.) minutissimus*, which is only one *Quasimus* species distributing in Turkey, was examined. Morphology of basal piece median lobe and parameres of this species were examined as other species of family. As a result of that, small basal piece, short and thin arms of median lobe are seem typical for this species. In order to detect generic characters, studies of Dolin [25,26,27] were also inspected. However, detailed character evaluation could not be done because of superficial findings of literature.

Male genital organs of three species of the the genera *Zoroachros*, which are *Z. dermestoides*, *Z. georgicus* and *Z. heyrovskyi*, were examined. These three species can be separated by some characters. *Z. heyrovskyi* is separated from *Z. dermestoides* and *Z. georgicus* by thin basal piece, cornered outer lateral margins of parameres at medio-proximal, thick median lobe and roof shaped apex of median lobe. *Z. dermestoides* and *Z. georgicus* could be separated by some characters. In *Z. georgicus*, outer lateral margins of parameres are cornered medially, arms of median lobe are not exceeding ventral posterior margins of parameres and anterior margin of basal piece, posterior margin of median lobe is feebly roof like; while outer lateral margins of parameres are parallel sided, arms of median lobe are exceeding ventral posterior margins of parameres and anterior margin of basal piece, posterior margin of median lobe is pointed thick triangular shaped in *Z. dermestoides*. In order to detect generic characters, other species were examined from literature [28,29,30,31] however we could not detect those characters because of their lackness of detail.

One species, which is *A. crenicollis*, were examined from genus *Agrypnus* of subfamily Agrypninae. As a result of comparison our findings

and literature on male genital organ of *A. crenicollis* [3], we detected some differences, which are long and thicker arms of median lobe until medial part, located angled basal piece. *A. crenicollis* were compared with *A. murinus* (Linnaeus, 1758) from literature (3). According to that, median lobe and parameres are thinner, hairs of parameres are located after distal teeth in *A. murinus*, while median lobe and parameres thicker, hairs of parameres are located before and after distal teeth in *A. crenicollis*. Due to the present findings it is not possible to detect generic characters for the genus *Agrypnus*.

One species each were examined from *Drasterius*, *Aeoloderma* and *Aeolosomus* of Oophorini tribus. Male genital organs of these three species are very similar to each other. Arms of median lobe long and they are clearly exceeding ventral posterior margins of parameres in *D. bimaculatus*, while arms of median lobe are short and they are not or slightly exceeding ventral posterior margins of parameres in *Aeoloderma crucifer* and *Aeolosomus rossi*. According to length of median lobe as compared with parameres, in *Aeoloderma crucifer* and *D. bimaculatus* median lobe is more or less longer than parameres, while median lobe is shorter than *Aeolosomus rossi*. Our findings matched Platia's [3] research except longer arms of median lobe, angled situated basal piece for *Aeoloderma crucifer* and *D. bimaculatus* and swollen apex of parameres for *D. bimaculatus* in examined specimens. As a result of examined species of these genera and some species of *Aeoloides* (Schwarz, 1906) [32] and *Heteroderes* (Latreille, 1834) [1] from literature, lack of parameres teeth, short and rigid spines are detected as tribus characters in accordance to Laibner's [4] study.

Male genital organs of 12 species of genus *Cardiophorus* and 5 species of genus *Dicronychus* were examined from the subfamily **Cardiophorinae**.

Male genital organs of 12 species of the genus *Cardiophorus* were examined and discussed systematically. As a result of examination, *C. nigratissimus* can be easily differentiated from other species with atrophied dorsal part of parameres, clearly pointed apex of parameres and thick median lobe. Due to Platia and Gudenzi [33] male genital organ of this species very similar to *C. proprius*. Examined specimens of *C. nigratissimus* are only

different from Platia and Gudenzi's [33] findings by thinner basal piece. *C. megathorax* is another easily differentiated species from rest. Although, many parts of male genital organ of *C. megathorax* are very similar with other species, it can be differentiated by swollen apex of median lobe and finger shaped apex of parameres. Rest 10 species were examined in two groups according to arms of median lobe exceeding ventral posterior margins of parameres (*C. dolini*, *C. impressiventris*, *C. parvulus*, *C. ruficruris* and *C. sacratus*) or not exceeding (*C. frequens*, *C. kindermanni*, *C. miniaticollis* and *C. vestigialis*). In first group, species show difference in accordance with thick and triangular median lobe (*C. frequens* and *C. miniaticollis*) or thin and cylindrical median lobe (*C. kindermanni* and *C. vestigialis*). In thin and cylindrical shaped median lobe group, median lobe is clearly longer than parameres and arms of median lobe strongly arcuate in *C. kindermanni*, while it is slightly longer than parameres and arms of median lobe feebly arcuate in *C. vestigialis*. In thick and triangular shaped median lobe group, *C. frequens* and *C. miniaticollis* are differentiated by some characters. Outer lateral margins of parameres are clearly gradually broadening from basal to proximal, slightly broadening from proximal to distal, strongly narrowing from distal to apical, feebly narrowing at apical, basal piece is large, movable parts of parameres are large and their posterior parts are knife shaped in *C. frequens*, while outer lateral margins of parameres are arcuate from basal to medio-distal, almost parallel sided from medio-distal to apical, basal piece is small, movable parts of parameres are small and their posterior parts are not knife shaped in *C. miniaticollis*. In second group (*C. dolini*, *C. impressiventris*, *C. parvulus*, *C. ruficruris* and *C. sacratus*), species can be separated in two groups by some characters, which are arms of median lobe clearly exceeding ventral posterior margins of parameres and uniting margins of basal piece without corners (*C. parvulus* and *C. ruficruris*) or arms of median lobe feebly exceeding ventral posterior margins of parameres and uniting margins of basal piece with corners (*C. dolini*, *C. impressiventris* and *C. sacratus*). In first group, *C. parvulus* and *C. ruficruris* are separated by some characters. Movable part of parameres' basal part is thick and apex of parameres are blunt, while movable part of parameres' basal part thin and apex of parameres are pointed in *C. parvulus*. In second

group, *C. impressiventris* is separated from *C. dolini* and *C. sacratus*. In *C. dolini* and *C. sacratus*, basal piece is distinctly cornered, arms of median lobe connect to median lobe without corners and apex of parameres are strongly pointed, while basal piece is feebly cornered, arms of median lobe connect to median lobe with corners and apex of parameres are slightly pointed in *C. impressiventris*. Anterior margin of basal piece is 'U' shapedly notched, arms of median lobe is curved inside at basal, parameres outer margins are parallel sided between proximal to distal in *C. dolini*, while anterior margin of basal piece is 'V' shapedly notched, arms of median lobe is straight at basal, parameres outer margins are arcuate between proximal to distal in *C. sacratus*.

Another examined genus is *Dicronychus* from subfamily Cardiophorinae. In thesis study, male genital organs of 5 species, which are *D. adanensis*, *D. cinereus*, *D. iconiensis*, *D. obscuripennis* and *D. senaci*, were examined. *D. adanensis* is easily separated from other species by lack of distal teeth but it is similar to *D. cinereus* with general morphology of median lobe and exceeding ventral posterior margin of parameres of sinutae arms of median lobe. After examination of rest 4 species, *D. obscuripennis* is separated from other species by ventrally situated teeth of parameres, apically divergent parameres and arms of median lobe very closeto each other. *D. cinereus* and *D. senaci* are more similar to each other by small teeth of parameres than *D. iconiensis*. However, due to not exceeding ventral posterior margins of arms of median lobe *D. iconiensis* and *D. senaci* are more similar each other than *D. cinereus*. In addition to examined species, findings about other species were examined from literature [1,3,4,35, 36, 37] As a result of that, male genital organ morphology of genus *Dicronychus* is seem to be very similar to genus *Cardiophorus*'s. Because of that detecting generic characters seems to be very difficult. After examining species of *Cardiophorus*, *Craspedostethus* (Schwarz, 1898), *Dicronychus*, *Paracardiophorus* (Schwarz, 1898) and *Ryukyucardiophorus* (Ohira, 1973) from literature [1,3,4,12,33-39] small basal piece, thin and long arms of median lobe and well developed parameres seem to be common characters between these genera and they also may be family characters of Cardiophorinae.

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