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ULTRASTRUCTURES OF AEDEAGUS AND SPERMATHECA OF TWO SPECIES OF THE SUBGENUS *CHAETOCNEMA* (*PLECTROSCELIS*) CHEVROLAT IN DEJEAN, 1836 (CHRYSOMELIDAE: GALERUCINAE: ALTICINI) BY SCANNING ELECTRON MICROSCOPE

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ABSTRACT: The paper presents unknown ultrastructures of aedeagus and spermatheca of *Chaetocnema chlorophana* (Duftschmid, 1825) and *Chaetocnema coyei* (Allard, 1864) which is two of the species of the subgenus *Chaetocnema* (*Plectroscelis*) Chevrolat in Dejean, 1836 are studied and figured under both stereo microscope and Scanning Electron Microscope from Turkey for the first time. The studied specimens were collected from Ankara, Çankırı and Kayseri provinces in 2008, 2013, 2014, 2016, 2017 and 2018. Aedeagi and spermathecae so far were studied on the basis of only stereo microscopic studies within the genus *Chaetocnema* Stephens. Until now, there is no ultrastructural study with SEM on male and female genitalia of the species in the subgenus *Chaetocnema* (*Plectroscelis*) Chevrolat in Dejean, 1836, therefore, the present study is the first for these two species mentioned above. In accordance with this, to reveal and to obtain new diagnostic characters with ultrastructural and detailed investigations of aedeagus and spermatheca of the species *Chaetocnema chlorophana* (Duftschmid, 1825) and *Chaetocnema coyei* (Allard, 1864) are basically aimed with this study. It is revealed new diagnostic characters for both the aedeagus and spermatheca by investigations on ultrastructural morphologies in SEM.

KEY WORDS: Ultrastructure, aedeagus, spermatheca, SEM, *Chaetocnema chlorophana, Chaetocnema coyei,* Turkey

Chaetocnema Stephens, 1831, a member of the tribe Alticini Newman, 1835, is a cosmopolitan genus and includes a large number of species (about 500) that spread all over the world (Palaearctic, Nearctic, Neotropical, Oriental, Afrotropical, Madagascar and Australian regions). The genus is represented with a total of 27 species in Turkey that is in the Palaearctic region (Ekiz et al., 2013; Özdikmen, 2014, 2021; Çilbiroğlu Aslan & Bayram Partal, 2023; Bezdek & Sekerka, 2024). Species of the genus *Chaetocnema* Stephens are often divided into the subgenera *Chaetocnema* s. str. and *Tlanoma* Motschulsky, 1845, but according to White (1996), the nasal keel which is supposed to distinguish the

latter subgenus from the former is highly variable and therefore a poor character for grouping species. In addition, White (1996) argued that *Tlanoma* cannot be treated as a subgenus of *Chaetocnema* because both have the same type species (*C. concinna*). Consequently, subgeneric classification of the genus *Chaetocnema* Stephens was recently reviewed and arranged by Özdikmen (2021). He proposed a total of 13 subgenera for the genus *Chaetocnema* Stephens.

According to Konstantinov et al. (2011), *Chaetocnema* species are habitually very similar and cannot be separated only with external characters. Genitalic characters have been used traditionally and are diagnostically important. However, works on aedeagi and spermathecae of *Chaetocnema* species so far were studied on the basis of only stereo microscopic studies such as revisional studies of White (1996), Konstantinov et al. (2011), Ruan et al. (2019) and the others, for example, Ruan et al. (2014a,b), while ultrastructures of aedeagi and spermathecae of *Chaetocnema* species with SEM are currently very few.

As known, aedeagal morphology in the genus *Chaetocnema* Stephens, 1831, like in most genera of the tribe Alticini, seems to be diagnostic at the species level because of there are many new species described based on aedeagal structure. On the contrary of aedeagal morphology, spermathecal morphology seems to be not diagnostic at the species level because of there is no new species described only based on spermathecal structure. Even, it must be because of this, spermathecae of Nearctic species in revision of White (1996) did not studied.

In Chrysomeloidea, the spermatheca has been useful to define subfamilies, genera and species (Reid, 1989; Hernández, 1993; Biondi, 2001; Borowiec & Świętojańska, 2001, Borowiec & Skuza, 2004; Borowiec & Opalinska, 2007; Borowiec & Pomorska, 2009; Rodríguez-Mirón & Zaragoza-Caballero, 2017; Rodríguez-Mirón et al., 2017). According to Rodríguez-Mirón et al. (2017), the spermatheca provides characters to diagnose genera and subgenera, and also they stated that the spermatheca has a high taxonomic value for diagnosing taxa at various ranks.

The species *Chaetocnema chlorophana* (Duftschmid, 1825) and *Chaetocnema coyei* (Allard, 1864) have W-Palaearctic (Europeo-Mediterranean) and W-Palaearctic (Balkano-E-Mediterranean) chorotypes respectively. There is not much information available about the female and male genital structures of *Chaetocnema chlorophana* (Duftschmid, 1825) and *Chaetocnema coyei* (Allard, 1864), and with this study, the male and female genital structures of these species have been studied and presented in detail.

MATERIALS AND METHODS

The available specimens for the present work were collected in Ankara, Çankırı and Kayseri provinces from Turkey in 2008, 2013, 2014, 2016, 2017 and 2018. The specimens were deposited at Gazi University (Turkey, Ankara) and Nazife Tuatay Plant Protection Museum (Turkey, Ankara).

The aedeagi and spermathecae were dissected from the abdomen and the remaining tissue was removed with fine tweezers. After cleaning, the samples were placed in 70% ethanol and examined with Olympus SZX7 stereo microscope and Leica Z-16 APO stereo microscope for stereo microscopic examination. For scanning electron microscopy (SEM), the cleaned samples were dehydrated using an increasing series of ethanol (70%, 80%, 90% and 100%) and then air-dried.

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The samples were then mounted on SEM stubs using double-sided adhesive tape, coated with gold using Polaron SC 502 Sputter Coat and examined with JEOL JSM 6060 Scanning Electron Microscope (SEM) at 10 kV in Prof. Dr. Zekiye Suludere Electrone Microscopy Center at Gazi University. The main spermathecal and aedeagal terminologies used in the present study are given below.

RESULTS AND DISCUSSION

Genus *Chaetocnema* Stephens, 1831
Type sp.: *Chrysomela concinna* Marsham, 1802

Subgenus *Plectroscelis* Chevrolat in Dejean, 1836
Type sp.: *Altica dentipes* sensu Olivier (1808) (= *Haltica chlorophana* Duftschmid, 1825)

The cosmopolitan genus is represented with a total of 27 species of 6 *Chaetocnema* subgenera in Turkey that is in Palaearctic region (Ekiz et al., 2013; Özdikmen, 2014, 2021; Bezdek & Sekerka, 2024). According to the number of species, the subgenus *Chaetocnema* (*Plectroscelis*) Chevrolat in Dejean, 1836 includes only two species in Turkey (about 100% of the total species number in Turkey). These are; *Chaetocnema chlorophana* (Duftschmid, 1825) and *Chaetocnema coyei* (Allard, 1864) (Özdikmen, 2021).

Some external morphological characters for the subgenus: Frontal ridge between the antennal sockets is narrow and convex. Only relatively long setae are present on the lateral parts of the frons. The vertex is flat and approximately level with the orbit. The vertex surface is sparsely and irregularly punctuated; punctation is present not only around the eye but also in other areas. The punctures are approximately the same size as the punctures on the pronotum. The pronotal surface is regularly but relatively sparsely punctated. The punctures diameters on the pronotum are 2–4 times smaller than the distance between them or at most almost equal. The pronotal punctures are smaller than the elytral punctures. The row of punctures on the basal part of the pronotum is absent. The base of the pronotum has two well-developed longitudinal depressions, one near the basal margin and the other more anterior, or these depressions may be absent altogether. The elytra are laterally parallel. The elytral punctures, including the periscutellar rows, are regular (Özdikmen, 2021).

***Chaetocnema chlorophana* (Duftschmid, 1825)** (Figs. 1A-B, 2A-B)
chlorophana Duftschmid, 1825: 286 (*Haltica*)
amoena Weise, 1886: 756 (var.)
kolbei Weise, 1886: 756 (var.)
laeta Weise, 1886: 756 (var.)
syriaca Demaison, 1896: 13
bicolora Roubal, 1948: 125 (ab.) [IN]

Materyal examined: Çankırı prov.: Şabanözü, between Şabanözü and Eldivan road 3rd km, 40°28'48"N, 33°18'37"E, 1141 m, 24.IV.2013, 1 specimen; Central, Balıbağı plateau, 40°29'50"N, 33°52'42"E, 774 m, 25.IV.2014, 1 specimen; Central, between Pehlivanlı and Alaçatı villages, 40°34'19"N,

33˚52'18"E, 925 m, 26.IV.2014, 2 specimens; Central, between Ovacık and Kuzu villages, 40˚32'28"N, 33˚52'12"E, 920 m, 26.IV.2014, 4 specimens; Central, Danabaşı village, 40˚31'33"N, 34˚02'46"E, 724 m, 26.IV.2014, 3 specimens; Orta, Elden village, 40˚39'22"N, 32˚58'21"E, 1446 m, 21.V.2014, 1 specimen; Orta, entry of Derebayındır, 40˚34'56"N, 32˚59'50"E, 1389 m, 22.V.2014, 1 specimen; Central, between Bayındır and Hasakça, 40˚35'16,4"N, 33˚49'10,7"E, 1104 m, 13.VIII.2014, 1 specimen.

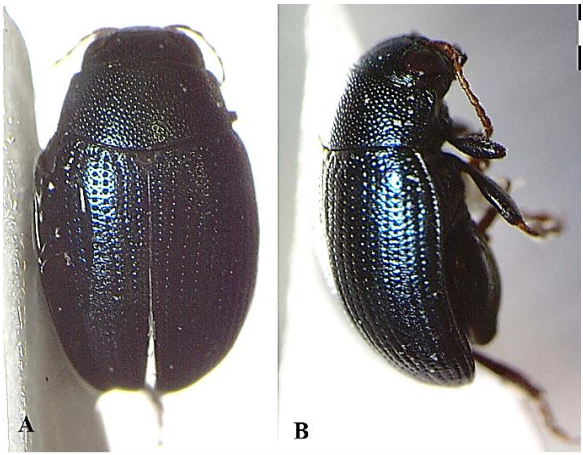

Figure 1. *Chaetocnema chlorophana* (Duftschmid, 1825): A. Dorsal, B. Lateral view (Stereo microscope).

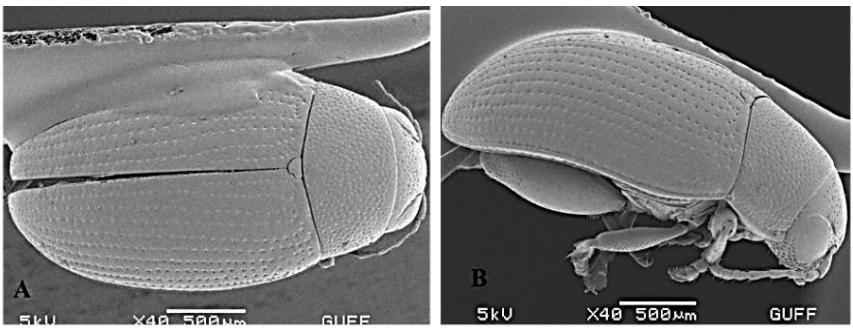

Figure 2. *Chaetocnema chlorophana* (Duftschmid, 1825): A. Dorsal, B. Lateral view (SEM).

The W Palaearctic (Europeo-Mediterranean) species is distributed in Europe (Albania, Austria, Belgium, Bulgaria, Crimea, Croatia, Czeck Republic, France, Germany, Greece, Hungary, Italy, Luxemburg, North Macedonia, Portugal, Romania, Russia (South European Territory), Serbia, Slovakia, Slovenia, Spain, Turkey, Ukraine), Asia (Azerbaijan, Iran, Iraq, Israel, Suria, Turkey), North Africa (Algeria, Morocco, Tunisia) (Bezdek & Sekerka, 2024).

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The flea beetle is a rather little-known species for Turkey and it has been recorded from 8 of 81 provinces and five of seven regions in Turkey until now as Adana, Çankırı, Erzurum, Gaziantep, İstanbul, Konya, Mersin provinces in Anatolia (Asian Turkey) and Kırklareli, Tekirdağ provinces in European Turkey (Thrace) (Ekiz et al., 2013; Özdikmen, 2014; the present study) (Fig. 3).

Figure 3. Provincial and regional distribution of *Chaetocnema chlorophana* (Duftschmid, 1825) in Turkey.

Classification systems have mainly based on the external morphological characters, however, most of these classifications change constantly because of homoplasy and symplesiomorphy within these character sets. To provide a more stable classification, therefore, taxonomists have studied internal and genital morphological features in combination with the external morphological characters (e.g. Kasap & Crowson, 1979; Mann & Crowson, 1983; Suzuki, 1988).

As known, the structures of aedeagus and spermatheca are taxonomically important. For this reason, to reveal more diagnostic characters than hitherto known, ultrastructural and detailed investigations of aedeagus and spermatheca of *Chaetocnema chlorophana* (Duftschmid, 1825) from Turkey were firstly studied with scanning electron microscope (SEM) and stereo microscope. Obtaining observations are presented below.

Aedeagus (Stereo microscope) (Figs. 4A-C)**:**

Under the stereo microscope, the apical third of the aedeagus is light brown, and the remaining parts are brown to dark brown or even blackish. The median lobe is more or less spear-shaped. When viewed from the ventral side, the two long lateral edges are thickened in the form of a collar on the inner side. The edges of the aedeagus run parallel to the tip and are distinctly narrowed at the tip, ending in a small tooth structure.

Figure 4. Aedeagus of *Chaetocnema chlorophana* (Duftschmid, 1825): A. Dorsal view in stereo microscope, B. Ventro-lateral view in stereo microscope, C. Lateral view in stereo microscope.

Aedeagus (SEM)

Ventral view (Figs. 5B, 7A)**:**

Except for a slight widening from the parallel middle part towards the apex at the base, the median lobe is almost completely parallel. The apical third of the median lobe is parallel. The width of the aedeagus from the distal to the basal aperture is almost equal to the width just before the apical slope. The apical part of the median lobe is slightly narrowed. The apex of the median lobe is almost circular except for the tooth-like structure. The apex of the apical tooth or median lobe is well differentiated, distinct, slightly projecting papilla, narrowed and rounded at the top. The surface of the median lobe is convex apically, medially and basally from the lateral part of the median groove. The median groove is wide in all parts, but more pronounced in the apical part. The median groove has the appearance of two separate grooves from the apical third of the median lobe towards the apex. There are no transverse wrinkles in the groove. The median foramen (basal aperture) is not completely circular. The upper edge is curved (indented and wavy towards the median lobe).

Lateral view (Figs. 5C, 6, 7C-E)**:**

The median lobe is almost equal and slightly curved towards the ventral side. The median lobe is typically longitudinally grooved along the apical part. The apex of the median lobe is slightly narrowed, not pointed, almost straight or slightly curved dorsally. The most curved part of the median lobe is the apical 2/3. All parts of the median lobe appear to have scattered and sparse ultrastructural sensilla. However, ultrastructural sensilla are denser and more numerous in the apical part than in the other parts. The integrated form of the aedeagus (when we place the lateral image oppositely and symmetrically, the image obtained is

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suboval in a wide upper and narrowed lower shape. Although the base parts of the aedeagus come together in the integrated form, there is a gap between the ends.

Dorsal view (Figs. 5A, 7B)**:**

The median lobe is almost equally convex except for the apical part. In the apical part, it is flattened towards the ventral side of the median lobe, so the median lobe is slightly curved towards the ventral side. The dorsal plate extends from the apical 1/3 of the median lobe towards the apex. The dorsal plate is narrowed at the base and apex and widened near the apex. At the same time, the apex of the dorsal plate is longer than the apex of the median lobe. The dorsal plate fuses at the base to the dorsal surface of the middle lobe and divides the orifice into two in the middle. The median lobe is depressed medially at the bases of the apical opening and the dorsal plate, The orifice is distinct but narrowed. It is basically U-shaped or obtuse-angled V-shaped.

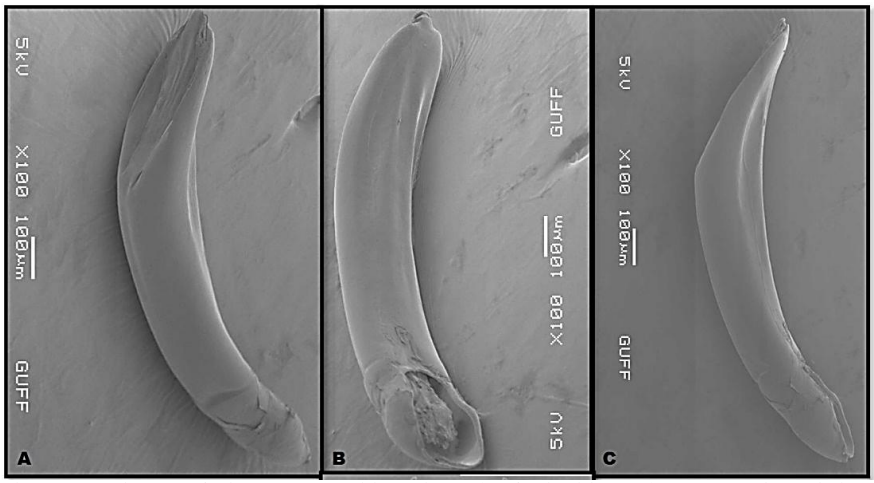

Figure 5. Aedeagus of *Chaetocnema chlorophana* (Duftschmid, 1825): A. Dorso-lateral view in SEM, B. Ventro-lateral view in SEM, C. Lateral view in SEM.

Figure 6. Integrated form of aedeagus.

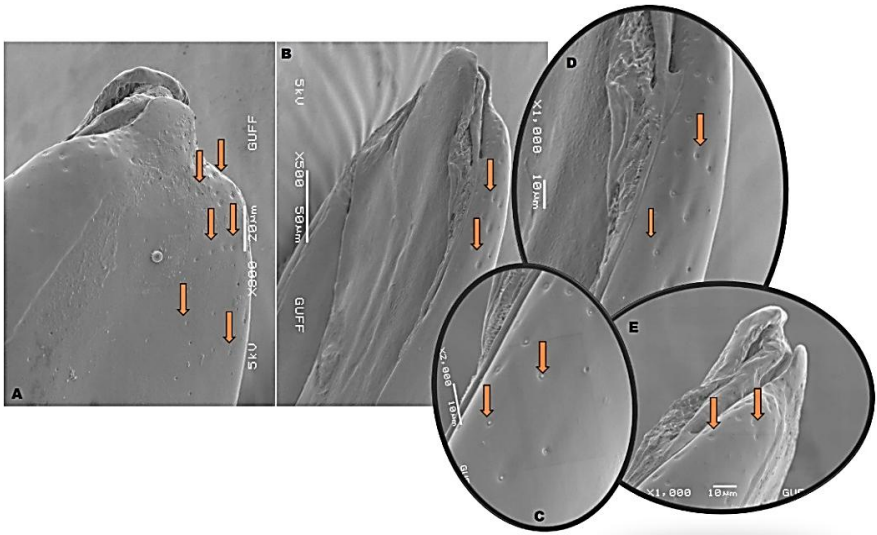

Figure 7. Aedeagus of *Chaetocnema chlorophana* (Duftschmid, 1825): A. Sensillar structure and density on the apical part of the ventral surface of the median lobe, B. Sensillar structure and density on the apical part of the dorsal surface of the median lobe, C-D. Sensillar structure and density on the apical part of the lateral surface of the median lobe, E. Sensillar structure and density on the apical part of the lateral surface of the median lobe (SEM).

Spermatheca (Stereo microscope) (Fig. 8B)**:**

The spermatheca has a pear-shaped structure in general appearance. The spermathecal receptacle is wider at the base and narrows distally, and in lateral view there is a distinct depression near the middle. The spermathecal pump is light brown; the spermathecal receptacle and spermathecal canal are dark brown. The spermathecal pump is long and is as long as the spermathecal receptacle or slightly shorter, at least always longer than half of the receptacle.

Spermatheca (SEM) (Figs. 8A, 9A-D)**:**

The spermatheca is more or less oval or pear-shaped in general appearance. The apex of the spermathecal pump is more or less cylindrical or round. There is a vaguely flattened skin protrusion at the tip of the spermathecal pump. The spermathecal pump is connected to the middle of the narrowed apical part of the receptacle. The spermathecal pump is bent ventrally in the part close to the middle. There are fine wrinkles on the surface of the spermathecal pump.

The spermathecal receptacle is shortened, widened, pyriform and dorso-medially depressed. The maximum width of the chamber is located in its middle part. In the apical part, the spermathecal receptacle gradually narrows towards the tip. Therefore, the base of the receptacle is wider than the apical part and the minimum width of the receptacle is located apically. The spermathecal canal is considerably shorter than the receptacle; it is about 1/3 of its length. The duct arises from the ventro-lateral middle part of the receptacle and extends almost to

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the apical third of the receptacle. The spermathecal duct is straight at the base and bifurcates at the point where the gland emerges and has a noticeable knob-like swelling. The spermathecal gland is also connected to the apical third of the spermathecal duct.

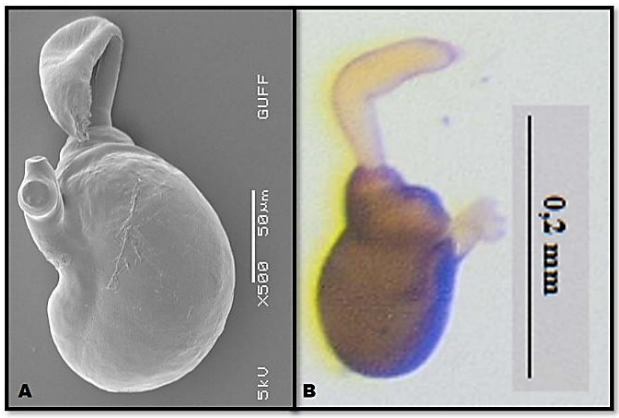

Figure 8. *Chaetocnema chlorophana* (Duftschmid, 1825): A. Spermatheca in SEM, B. Spermatheca in stereo microscope.

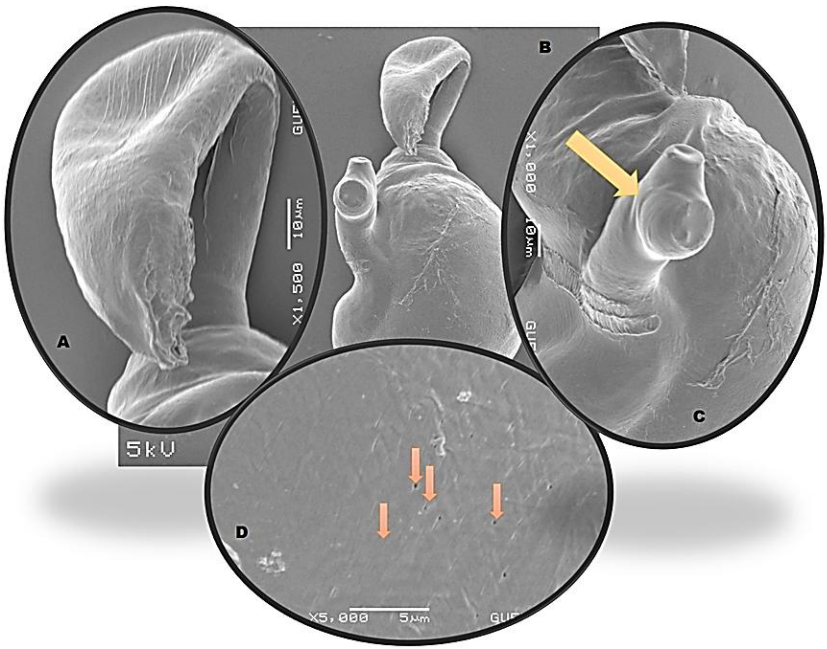

Figure 9. *Chaetocnema chlorophana* (Duftschmid, 1825): A. Spermathecal pump part, B. Spermathecal structure in lateral view, C. Spermathecal duct and spermathecal gland connection, D. Sensillar structure and density on the spermathecal receptacle (SEM).

***Chaetocnema coyei* (Allard, 1864)** (Figs. 9A-C, 10A-B)
coyei Allard, 1864: 659 (*Plectroscelis*)
metallica Weise, 1886: 751 (var.)
delagrangei Pic, 1909: 138

Materyal examined: Ankara prov.: between Yenikent and Ayaş, exit of Yenikent 7th km, 3 km to Aysantı pass, 01.V.2008, 1 specimen; **Çankırı prov.:** Eldivan, Akçalı Çukuroz return, 40˚36'31"N, 33˚28'21"E, 1068 m, 23.IV.2013, 1 specimen; Şabanözü, between Şabanözü and Eldivan road 3rd km, 40˚28'48"N, 33˚18'37"E, 1141 m, 24.IV.2013, 2 specimens; Çerkeş, Kışla-Beymelik-Taşanlar-Tohumlar villages return, 40˚54'33"N, 32˚48'36"E, 1000 m, 26.VIII.2013, 1 specimen; Kızılırmak, Karallı village return 2nd km, 40˚18'30"N, 33˚56'36"E, 606 m, 25.IV.2014, 2 specimens; Kızılırmak, between Bostancı and Hacılar villages, 40˚19'58"N, 33˚51'51"E, 565 m, 25.IV.2014, 1 specimen; Central, between Pehlivanlı and Alaçatı villages, 40˚34'19"N, 33˚52'18"E, 925 m, 26.IV.2014, 1 specimen; Kurşunlu, Dağören village road, 40˚46'54"N, 33˚14'27"E, 1283 m, 21.V.2014, 7 specimens; Kurşunlu, between Sünürlü and Sakaeli, 40˚42'01"N, 33˚08'53"E, 1415 m, 21.V.2014, 1 specimen; Orta, Kayıören return 2nd km, 40˚34'21"N, 32˚57'52"E, 1602 m, 22.V.2014, 1 specimen; Şabanözü, entry of Büyükyakalı village, 40˚28'38"N, 33˚14'25"E, 1091 m, 23.V.2014, 1 specimen; Orta, between Bulduk and Yenice, 40˚33'21"N, 33˚12'03"E, 1400 m, 24.V.2014, 1 specimen; Orta, Buğören, 40˚38'60,6"N, 32˚59'45,3"E, 1378 m, 10.VII.2014, 1 specimen; Orta, Ortabayındır, 40˚34'35,7"N, 32˚59'44,3"E, 1359 m, 10.VII.2014, 2 specimens; Çerkeş, Yeşilören village, 40˚48'41"N, 32˚36'38"E, 1381 m, 28.VIII.2013, 1 specimen; Eldivan, entry of Central, 40˚32'23"N, 33˚30'15,7"E, 931 m, 11.VII.2014, 1 specimen; Kızılırmak, between Tımarlı and Hacılar, 40˚20'21,3"N, 33˚53'27,4"E, 562 m, 12.VII.2014, 1 specimen; Ilgaz, entry of Belsöğüt village, 40˚56'51,6"N, 33˚36'13"E, 1019 m, 17.VII.2014, 1 specimen; Çerkeş, entry of Yalıözü, 40˚45'49,6"N, 32˚59'19,6"E, 1186 m, 20.VIII.2014, 1 specimen; Bayramören, entry of Çakırbağ, 40˚58'17,3"N, 33˚04'01,0"E, 1457 m, 21.VIII.2014, 1 specimen; **Kayseri prov.:** Akkışla, Alevkışla, 39°0‟29"N, 36°5‟56"E, 14.VII.2016, 1278 m, 1 specimen; Yahyalı, Dikme, 38°1‟14"N, 35°31‟56"E, 14.IX.2017, 1385-1418 m, 20 specimens; Yahyalı, Yeşilköy, 37°53‟37"N, 35°30‟46"E, 06.V.2018, 824 m, 1 specimen; Felahiye, Kepiç, 39°6‟16"N, 35°29‟45"E, 30.VII.2018, 1212 m, 8 specimens; Sarız, Yaylacı, 38°30‟17"N, 36°30‟47"E, 05.IX.2018, 1600 m, 9 specimens; Develi, Güney Yukarı, 38°21‟5"N, 35°29‟52"E, 06.IX.2018, 1358 m, 1 specimen.

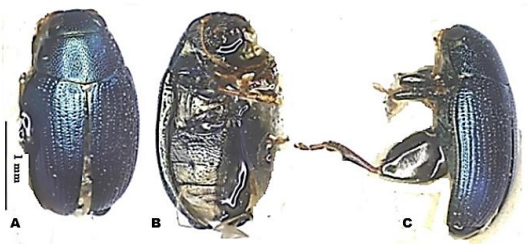

Figure 9. *Chaetocnema coyei* (Allard, 1864): A. Dorsal, B. Ventral, C. Lateral view (Stereo microscope).

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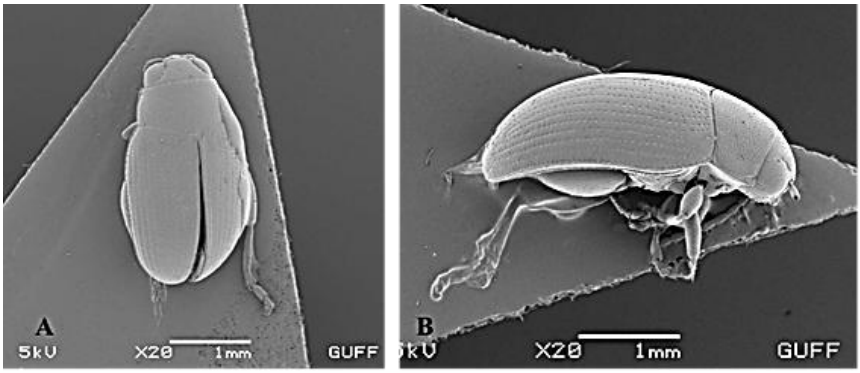

Figure 10. *Chaetocnema coyei* (Allard, 1864): A. Dorsal, B. Lateral view (SEM).

The W Palaearctic (Balkano-E-Mediterranean) species is distributed in Europe (Albania, Bulgaria, Crimea, Croatia, Greece, Romania, Russia (South European Territory), Serbia, Turkey, Ukraine), Asia (Armenia, Azerbaijan, Cyprus, Iran, Iraq, Israel, Jordan, Syria, Turkey) (Bezdek & Sekerka, 2024).

The flea beetle is a rather widely distributed species for Turkey and it has been recorded from 11 of 81 provinces and five of seven regions in Turkey until now as Adana, Ankara, Çankırı, Erzurum, Gaziantep, İstanbul, Kayseri, Konya, Mersin provinces in Anatolia (Asian Turkey) and Kırklareli, Tekirdağ provinces in European Turkey (Thrace) (Ekiz et al., 2013; Özdikmen, 2014; the present study) (Fig. 11).

Figure 11. Provincial and regional distribution of *Chaetocnema coyei* (Allard, 1864) in Turkey.

As known, the structures of aedeagus and spermatheca are taxonomically important. For this reason, to reveal more diagnostic characters than hitherto known, ultrastructural and detailed investigations of aedeagus and spermatheca of *Chaetocnema coyei* (Allard, 1864) from Turkey were firstly studied with scanning electron microscope (SEM) and stereo microscope. Obtaining observations are presented below.

Aedeagus (Stereo microscope) (Figs. 12A-C)**:**

Under the stereo microscope, the aedeagus is dark brown laterally, but completely brown dorsally and ventrally. The median lobe is almost parallel to each other when viewed from the dorsum and ventral. The distal width of the aedeagus relative to the basal aperture is equal to the width just before the apical slope. The tooth at the apex of the median lobe is broad and blunt at the base when viewed from the dorsum and ventral, and narrows towards the tip when viewed from the laterally, and ends sharply at the tip. The aedeagus is in the form of an arch bent ventrally when viewed from the lateral, but the slope of the median lobe is in the part close to the base. The apex of the median lobe ends with a tooth structure in the form of an elongated tongue from the orifice.

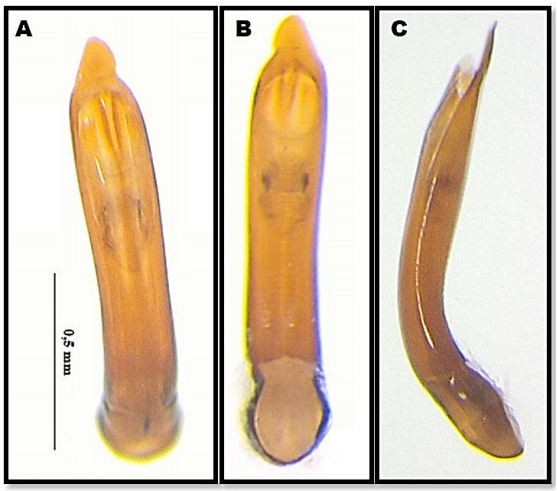

Figure 12. Aedeagus of *Chaetocnema coyei* (Allard, 1864): A. Dorsal view in stereo microscope, B. Ventral view in stereo microscope, C. Lateral view in stereo microscope.

Aedeagus (SEM)

Ventral view (Figs. 13B, 15A,B)**:**

The median lobe is almost completely parallel except for being slightly widened laterally from the middle to the apex. The apical part of the aedeagus gradually narrows towards the apex, but has a wide, narrowing towards the tip, blunt ending and tongue-like tooth structure at the base located at the apex. The width of the aedeagus is almost equal to the width just before the apical slope

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from the distal to the basal aperture. When the median lobe is viewed from the dorsum and ventral, both sides are parallel to each other. The surface of the median lobe is convex apically, medially and basally from the lateral to the median groove. However, the part where the median lobe is maximally inclined is closer to the base. The median groove starts from the base and ends by narrowing towards the 1/3rd part. There are transverse wrinkles starting from the part close to the base of the median lobe to the apex. The median foramen (basal aperture) is completely circular. Its upper edge is curved (indented towards the median lobe). When viewed from the ventral side, the median lobe has rare and irregularly distributed sensilla in the apical part and in the tooth-shaped protrusion at the end.

Lateral view (Figs. 13C, 14, 15C,D)**:**
The median lobe is curved towards the ventral side and in a way that is more obvious in the part closer to the base. The apex of the median lobe is quite narrow and pointed. The median lobe gradually narrows from the 2/3rd part towards the apex to the apex. A transverse depression is seen between the basal opening of the median lobe and the middle part (approximately 1/4 part close to the base). It is seen that all parts of the median lobe have increasingly scattered and sparse ultrastructural sensilla (sensory receptors) from the base to the apical part. The part where the sensilla are densest is the apex of the median lobe, especially lateral to the protrusion-shaped tooth structure. The integrated form of the aedeagus (when we place the lateral image in a reciprocal and symmetrical manner, the image obtained is a suboval (oval-like, thin oval) structure, narrow at the top and widened at the bottom. Although the end parts of the aedeagus come together in the integrated form, there is very little space between the base parts.

Dorsal view (Figs. 13A, 15E)**:**
The median lobe is almost completely parallel. The median lobe is convex towards the ventral, more pronounced at the base. The apical part of the aedeagus is gradually narrowed towards the apex, but the base located at the apex is wide, narrows towards the tip, has a blunt ending and tongue-like tooth structure. The dorsal plate has a 3-piece structure. While the parts on the sides extend from the apical 1/3 of the median lobe to the apex, the single piece in the middle, the dorsal plate, starts from almost 1/2 of the median lobe and is almost equally wide at the base, widens towards the apical part and extends in the form of a tongue, and its tip is inward is curved toward the right. The dorsal plate fuses at the base to the dorsal surface of the middle lobe and divides the orifice into four. The orifice is distinct but narrowed. It is basically U-shaped or obtuse-angled V-shaped.

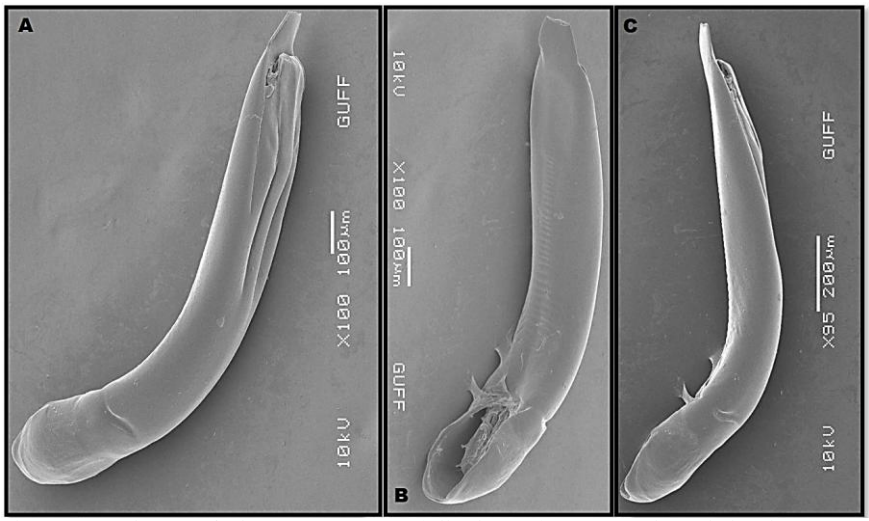

Figure 13. Aedeagus of *Chaetocnema coyei* (Allard, 1864): A. Dorso-lateral view in SEM, B. Ventro-lateral view in SEM, C. Lateral view in SEM.

Figure 14. Integrated form of aedeagus.

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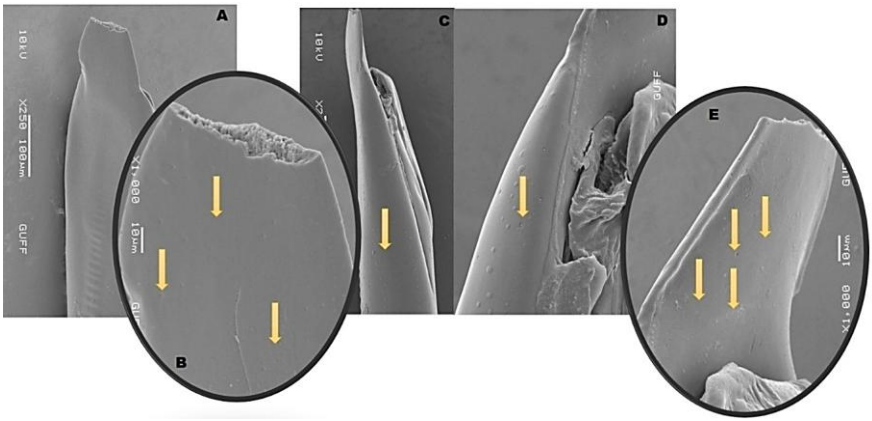

Figure 15. Aedeagus of *Chaetocnema coyei* (Allard, 1864): A-B. Sensillar structure and density on the apical part of the ventral surface of the median lobe, C-D. Sensillar structure and density on the apical part of the lateral surface of the median lobe, E. Sensillar structure and density on the apical part of the dorsal surface of the median lobe (SEM).

Spermatheca (Stereo microscope) (Fig. 16B)**:**

The spermatheca has a pear-shaped structure in general appearance. The spermathecal receptacle is wider at the base and narrows distally, and in lateral view there is a distinct depression near the middle. The spermathecal pump is light brown; the spermathecal receptacle and spermathecal canal are dark brown. The spermathecal pump is long and is as long as the spermathecal receptacle or slightly shorter, at least always longer than half of the receptacle.

Spermatheca (SEM) (Figs. 16A, 17A-C)**:**

The spermatheca is more or less oval or pear-shaped in general appearance. The apex of the spermathecal pump is more or less cylindrical or round. There is a vaguely flattened skin protrusion at the tip of the spermathecal pump. The spermathecal pump is connected to the middle of the narrowed apical part of the receptacle. The spermathecal pump is bent ventrally in the part close to the middle. There are fine wrinkles on the surface of the spermathecal pump.

The spermathecal receptacle is shortened, widened, piriform (pear-shaped) and dorso-medially depressed. The maximum width of the receptacle is located in its middle part. In the apical part, the spermathecal receptacle gradually narrows towards the tip. Therefore, the base of the receptacle is wider than the apical part and the minimum width of the receptacle is located apically. The spermathecal canal is considerably shorter than the receptacle; it is about 1/3 of its length. The canal originates from the latero-median part of the receptacle and extends almost to the apical third of the receptacle. The spermathecal duct is straight at the base and is bifurcated at the point where the gland emerges and has a noticeable tuber-like swelling. The spermathecal gland is also connected to the apical third of the spermathecal duct.

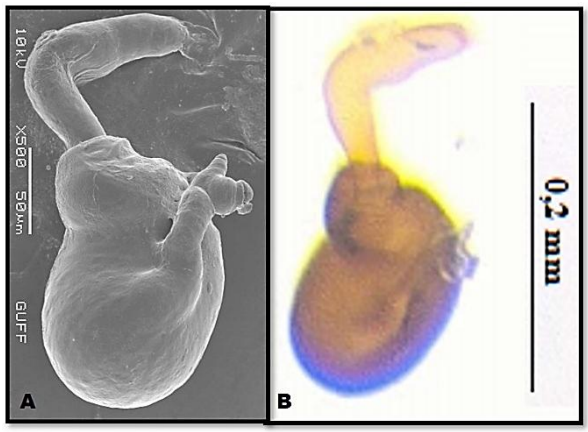

Figure 16. *Chaetocnema coyei* (Allard, 1864): A. Spermatheca in SEM, B. Spermatheca in stereo microscope.

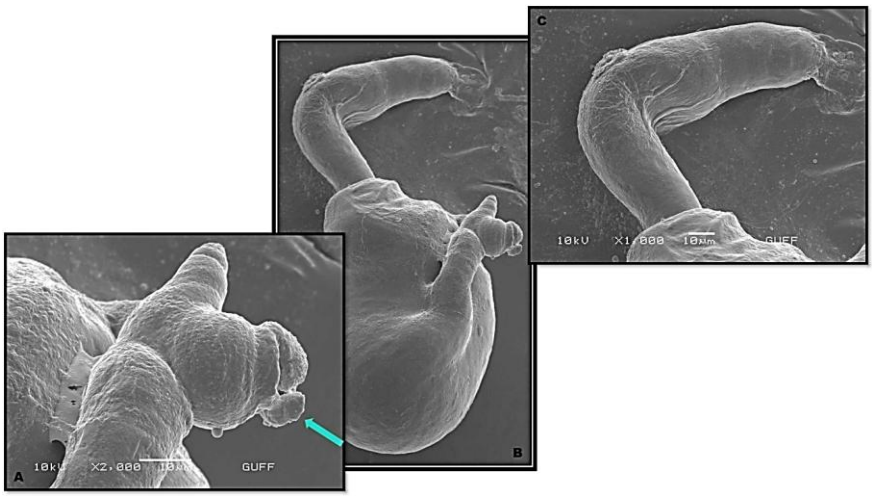

Figure 17. *Chaetocnema coyei* (Allard, 1864): A. Spermathecal gland connection, B. Spermathecal structure in lateral view, C. Spermathecal pump part (SEM).

SEM images of aedeagi and spermathecae of *Chaetocnema chlorophana* (Duftschmid, 1825) and *Chaetocnema coyei* (Allard, 1864) are presented to the scientific world with the present study for the first time. When diagnosing specimens belonging to the genus *Chaetocnema* Stephens, 1831, the useful characters in the structure of the aedeagus are general form of aedeagus and apical part of the median lobe chiefly.

As a result of the SEM images obtained with the present study, some new diagnostic characters have been added to these characters: for aedeagus: Dorsal plate in apical part of the median lobe, the structure and density of the sensillae on the median lobe and chitinization rate of aedeagus and the integrated form of

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the aedeagus (when we place the lateral image mutually and symmetrically), for spermatheca: General form of spermatheca, attaching points to spermathecal receptacle of spermathecal pump and spermathecal duct, and chitinization rate of spermatheca mainly. As a result of all these, the findings of the present study fully confirm and support the subgeneric arrangement of the genus *Chaetocnema* by Özdikmen (2021) and the subgenus *Chaetocnema* (*Plectroscelis*) Chevrolat in Dejean, 1836 (Figs. 18, 19).

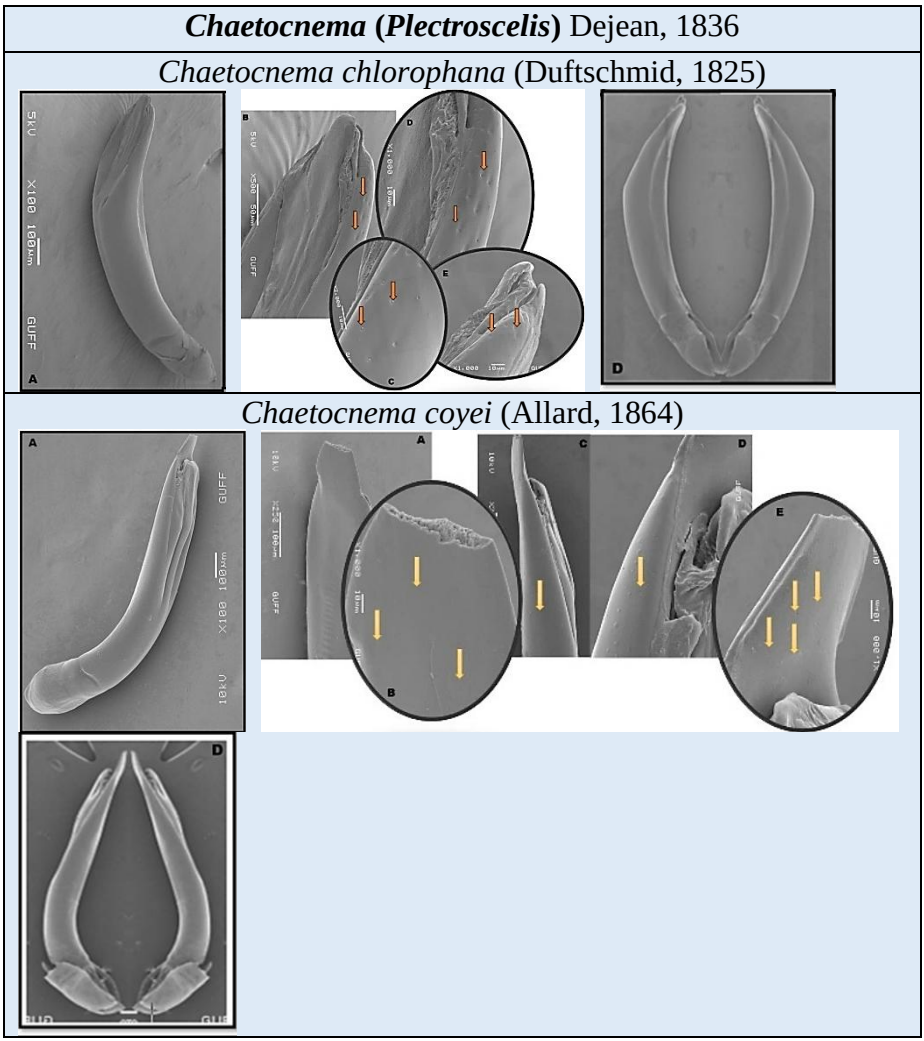


Figure 18. Some distinctive characters of aedeagal structure in studied *Chaetocnema* (*Plectroscelis*) Chevrolat in Dejean, 1836 species.

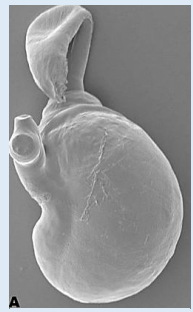
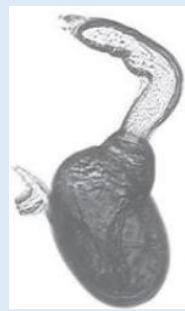
***Chaetocnema* (*Plectroscelis*)** Dejean, 1836		
Chaetocnema chlorophana (Duftschmid, 1825)		
Chaetocnema coyei (Allard, 1864)		

Figure 19. Some distinctive characters of spermathecal structure in studied *Chaetocnema* (*Plectroscelis*) Chevrolat in Dejean, 1836 species.

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