Morphological characters of immature stages of Palaearctic species of *Cleopomiarus* and *Miarus* and their systematic value in Mecinini (Coleoptera, Curculionidae, Curculioninae)

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Academic editor: M. Alonso-Zarazaga | Received 4 July 2018 | Accepted 22 October 2018 | Published 18 December 2018

Citation: Skuhrovec J, Gosik R, Caldara R, Toševski I, Łętowski J, Szwaj E (2018) Morphological characters of immature stages of Palaearctic species of *Cleopomiarus* and *Miarus* and their systematic value in Mecinini (Coleoptera, Curculionidae, Curculioninae). ZooKeys 808: 23–92. https://doi.org/10.3897/zookeys.808.28172

Abstract

The relationship between the genera *Cleopomiarus* and *Miarus* of Mecinini (Curculionidae, Curculioninae) was tested on the basis of morphological characters from the immature stages. The mature larvae of five *Cleopomiarus* species (*C. distinctus* (Boheman, 1845), *C. graminis* (Gyllenhal, 1813), *C. longirostris* (Gyllenhal, 1838), *C. medius* (Desbrochers des Loges, 1893), and *C. meridionalis* (H. Brisout de Barneville, 1863)), three *Miarus* species (*M. abnormis* Solari, 1947, *M. ajugae* (Herbst, 1795), and *M. campanulae* (Linnaeus, 1767)), and the pupae of four *Cleopomiarus* species (*C. distinctus*, *C. graminis*, *C. longirostris*, and *C. medius*) and two *Miarus* species (*M. abnormis* and *M. ajugae*) are described in detail for the first time. To confirm the taxonomic identification of some larvae, DNA COI barcode was obtained and compared with those of adults. The immature stages of the species herein studied were compared with those known from other genera in tribe Mecinini. It is suggested that *Miarus* and *Cleopomiarus* may be monophyletic based on several shared distinctive characters. Larvae of *Miarus* have a characteristic maxil...
lary mala with six finger-like dms of two sizes (one or two dms very long and the rest of medium length), this feature being apparently unique among weevils. Other genus-specific character states are observed in the pupae, such as the length of setae on the head, rostrum and pronotum, including the number of r on the rostrum, d on pronotum, and finally the shape of the urogomphi. A key to the described larvae and pupae were respectively presented. New biological and distributional data on some species are reported.

**Keywords**
biology, Cleopomiarus, distribution, mature larva, Mecinini, Miarus, morphology, pupa

**Introduction**

The Mecinini is a tribe of the subfamily Curculioninae (Curculionidae) and comprises six genera: Cleopomiarus Pierce, 1919, Gymnetron Schoenherr, 1825, Mecinus Germar, 1821, Miarus Schoenherr, 1826, Rhinumiarus Caldara, 2001 and Rhinusa Stephens, 1829 (Caldara 2001; Caldara et al. 2014; Alonso-Zarazaga et al. 2017). Whereas Rhinumiarus is only found in South America, the other five genera are largely distributed in the Palaeartic region. Moreover, Cleopomiarus and Gymnetron are well known in the Afrotropical region, with many species, especially in South Africa (Caldara 2003, 2005). In the last twenty years, these genera were subjected to a careful taxonomic revision (not yet completed for Rhinusa) and a phylogenetic analysis based on adult morphology (Caldara 2001, 2003, 2005, 2007; Caldara et al. 2010, 2013; Caldara and Fogato 2013).

With regard to the biology, the larvae of Mecinini develop in roots, shoots, leaves and flowers, many of them causing the organs of the host plants to swell or develop into galls; moreover, some species of Rhinusa are inquilines in galls produced by other species of the same genus (Hoffmann 1958; Arzanov 2000; Caldara 2001, 2003, 2005, 2007; Korotyaev et al. 2005). The larvae are predominantly associated with the families Scrophulariaceae, Plantaginaceae, and Campanulaceae (sensu APG 2016). Mecinus species live on Plantaginaceae, while Gymnetron and Rhinusa species live on both Scrophulariaceae and Plantaginaceae, which are two closely related families placed together in the Order Lamiales (Olmstead et al. 2001; Albach et al. 2005; APG 2016). The Palaeartic species of Gymnetron live on Veronica (Caldara 2008), currently included in Plantaginaceae (Olmstead et al. 2001; Albach et al. 2005), while those in the Afrotropical region, where Plantaginaceae are poorly represented, appear to live on various genera of Scrophulariaceae distributed mainly in the southern hemisphere (Caldara 2003; Caldara et al. 2010). In contrast, the Palaeartic species of Miarus and Cleopomiarus are associated with the genera of Campanulaceae in the subfamily Campanuloideae (Campanula, Jasione, Phyteuma), whereas the Cleopomiarus species in South Africa and in the southern part of North America live on the genera of the subfamilies Campanuloideae (Roella, Wahlenbergia) and Lobelioideae (Lobelia) (Caldara 2005, 2007; Caldara and Legalov 2016; Prena and O’Brien 2017). However, it is noteworthy that the systematics of Campanulaceae, especially of Campanula s.l. and close genera is still highly unstable (see APG 2016). This plant family is less phylogenetically close to
Scrophulariaceae and Plantaginaceae and placed in Order Asterales (APG 2016). Cleopomiarus and Miarus are very closely related each other and morphologically somewhat far from the other mecine genera, as recent taxonomic revisions have shown (Caldara 2001, 2005, 2007; Caldara and Legalov 2016; Jiang et al. 2018).

The general habitus of the imagoes of all Cleopomiarus and Miarus species is very uniform, and there are few external characters allowing differentiation of many species. Species recognition is often possible only by the careful examination of male or female genitalia. The presence of a deep prosternal canal and free claws are two easily observed external characters that immediately allow the separation of Cleopomiarus and Miarus from other Mecinini. The shape of the penis and the sclerites of the endophallus, the slightly more pronounced convexity of the male pygidium, and the more globose femora distinguish Cleopomiarus from Miarus. Moreover, in many species of Cleopomiarus, meso- and metafemora are dentate, and the uncus of the male metatibiae is enlarged, whereas the fifth ventrite of Miarus often shows a median fovea and two teeth placed posterolaterally. Finally, both genera feed on Campanulaceae, a family of plants apparently not parasitized by any other weevil. Preliminary molecular studies appear to confirm the systematic separation of these two genera, whereas several species of Miarus, well identified on the basis of morphological characteristics, tend to have very similar DNA fragments on mitochondrial COI gene (Vahtera and Muona 2006; Hendrich et al. 2015; Horecka et al. 2017; Toševski, unpublished data). It is clear that more characters are required to separate these two genera from each other and from other Mecinini genera.

A detailed study of immatures might reveal more defining characters. To date, larvae of only 19 Mecinini species have been described (Gardner 1934; Emden 1938; Scherf 1964; Anderson 1973; Lee and Morimoto 1988; May 1993; Gosik 2010; Jiang and Zhang 2015), while descriptions of pupae are known for ten Mecinini species (Scherf 1964; Anderson 1973; Gosik 2010; Jiang and Zhang 2015). However, there are only four detailed descriptions of larvae and pupae that can be used for an adequate taxonomic comparison; these include immatures of three species of Gymnetron (Jiang and Zhang 2015) and one species of Rhinusa (Gosik 2010). In fact, the comparison with other previously described immatures, e.g., Gymnetron anagallis Marshall, 1933 (Gardner 1934; Emden 1938); Mecinus heydenii Wencker, 1866 (Emden 1938); M. janthinus Germar, 1821 (Scherf 1964); Gymnetron beccabungae (Linnaeus, 1760), G. villosulum Gyllenhal, 1838; Rhinusaa collina (Gyllenhal, 1813); R. linariae (Panzer, 1795); Cleopomiarus graminis, C. hispidulus (LeConte, 1876), and Miarus campanulae (Emden 1938; Scherf 1964; Anderson 1973) is somewhat problematic due to the missing details of the chaetotaxy and/or the absence of quality drawings.

Therefore, the purpose of this study was the following: 1) to describe larvae and pupae of Miarus and Cleopomiarus in detail for the first time, confirming when necessary the identity of the immatures by the study of the DNA COI barcode; 2) to find characters distinctive between these two genera and between the species; and 3) to investigate the relationships of these two genera with other genera of the same tribe and other tribes within Curculioninae.
**Materials and methods**

**Insect collection**

Immature specimens examined in this study came from material preserved at the British Museum of Natural History (London), the Department of Zoology University collection of Maria Curie-Skłodowska (Lublin) and from personal collections of the two authors (RC and IT) which are deposited in the collection of the Group Function of Invertebrate and Plant Biodiversity in Agro-Ecosystems of the Crop Research Institute (Prague, Czech Republic). In the last case, the specimens were collected and placed in tubes with 95% ethyl alcohol generally with a few adults. Since it is well known that more than one species of the complex *Miarus* + *Cleopomiarus* can be found on the same plant (Caldara 2007; Caldara and Legalov 2016), to be completely sure of the identification of some immatures, the DNA COI barcode of some specimens was also studied and compared with adults found in the same plant or with data already deposited in GenBank. The collectors identified the plants.

**Morphological descriptions**

Part of the larval and pupal material was preserved in Pampel fixation liquid (see Trnka et al. 2015) and used for the morphological descriptions. To prepare the slides, we followed May (1994): a larva was decapitated, and the head was cleared in a 10% potassium hydroxide (KOH) solution and then rinsed in distilled water. After clearing, the mouthparts were separated from the head capsule, and the head capsule and all mouthparts were mounted on permanent microscope slides in Euparal. All other body parts were mounted on temporary microscope slides in 10% glycerine.

The observations and measurements were conducted using a light microscope with calibrated oculars (Olympus BX 40 and Nikon Eclipse 80i). The following characters were measured for each larva: head width, body length (larvae fixed in a C-shape were measured in segments), and body width in the widest place (i.e., metathorax or abdominal segments I–IV). For the pupae, the length and width at the widest place were measured. The lengths of all setae are visible on Figures.

Drawings were created with a drawing tube on a light microscope and processed by a computer (Adobe Photoshop, Corel Photo-Paint 11, GIMP 2). The numbers of setae of the bilateral structures are given for one side.

We used the terms and abbreviations for the setae of the mature larvae and pupae found in Scherf (1964), May (1977, 1994), and Marvaldi (1998, 1999).

**Molecular analysis**

For molecular analysis, DNA was extracted from larvae and adults collected from seed capsules or flowers of plants belonging to the Campanulaceae. The barcoding region of
the mitochondrial cytochrome c oxidase subunit I gene (mtCOI) was used to confirm
the identity of the sampled larvae and the corresponding adults previously determined
by using morphological characteristics (Caldara 2007; Caldara and Legalov 2016).
Genomic DNA was extracted using the DNeasy Blood and Tissue Kit (Qiagen Inc.,
Valencia, CA) following the manufacturer’s instructions. The barcoding region of
the mtCOI gene was amplified using the de novo designed primer pair for Miarus and
Cleopomiarus species, MiaF (5’ CATGATCAGGAATACTMGGAAACATC 3’) and
MiaR (5’ GCTCGTGATCAACATCTATTCC 3’). The MiaF/MiaR primers ampli-
fied a mtCOI product of 838 bp, which consisted of 635 bp of the barcoding region
(Hebert et al. 2003).

Each PCR reaction was carried out in a volume of 20 μl [1 μl of DNA, 11.8 μl of
H2O, 2 μl of High Yield Reaction Buffer A (1 x 1.5 mM MgCl2), 1.8 μl of MgCl2
(2.25 mM), 1.2 μl of dNTP (0.6 mM), 1 μl of each primer of the pair MiaF/MiaR
(0.5 μM) and 0.2 μl of KAPATaq DNA polymerase (0.0375 U/μl) (Kapa Biosystems
Inc. USA)]. The PCR protocol consisted of an initial denaturation at 95 °C for 5 min;
35 cycles consisting of three steps, i.e., 1 min at 94 °C, 1 min at 54 °C and 1.5 min at
72 °C; and a final extension step at 72 °C for 7 min. After PCR amplification, the prod-
ucts were separated on a 1% agarose gel, stained with ethidium bromide, and visualized
under a UV transilluminator. The amplified products were sequenced by Macrogen
Inc. (Seoul, Korea). The sequence data were deposited in the NCBI GenBank database
(http://www.ncbi.nlm.nih.gov) under accession number MH558545–MH558548.

**Results**

**Morphology of immature stages**

*Description of the mature larva (L3)*

**Genus Cleopomiarus Pierce, 1919**

**Description.** *Measurements* (in mm). Body length: 2.20–8.70. Body width (metathorax or abdominal segments I–II) 0.73–2.44. Head width: 0.35–1.16.

*General.* Body elongated, slender, rounded in cross section.

*Colouration.* From yellow to pale brown head. All thoracic and abdominal seg-
ments from distinctly white to slightly yellow.

*Vestiture.* Setae on body thin, in different colouration, distinctly different in length;
piliform, often with some asperities.

*Head capsule.* Head oval or suboval, slightly or more flattened laterally, endocarinal
line present and very distinct, more than half the length of frons. Frontal sutures on the
head in different sizes, and ever extended to antennae. One or two stemmata (st), anter-
ior stemma in the form of a pigmented spot with convex cornea behind the antenna.
Dorsum of the epicranium with five setae; des3 located anteriorly on epicranium close
border with frontal suture. Frons with four setae; f52 absent; f51 and f35 subequal. Head
also with two les and two ves. Epicranial area with three pes and 2–3 sensilla.
Antennae located at the end of the frontal suture on each side, membranous and distinctly convex basal article bearing 3–4 sensilla and one conical sensorium, the later elongated, narrow.

Clypeus transverse-shaped, approximately 2.5–3 times as wide as long with two cls, and one sensillum (cls) between setae; all very close to margin with frons.

Mouthparts. Labrum with three piliform lms; anterior margin bisinuate. Epipharynx with three finger-like als; with 2–3 ams; and 0–1 mes; labral rods (lr) distinct, elongated. Mandibles distinctly broad, bifid, teeth of unequal height; slightly truncate; both setae piliform. Maxilla stipes with one stps, two pfs and one mbs and one sensillum; mala with six finger-like dms; five vms; all vms distinctly shorter than dms. Maxillary palpi with two palpomeres; basal palpomere with one short mxps and two sensilla; distal palpomere with one sensillum and a group of micro cuticular apical processes. Prelabium oval-shaped, with one prms; ligula with sinuate margin and 1–2 ligs; premental sclerite well sclerotized but without anterior and posterior extensions, U-shaped. Labial palpi with two palpomeres (partially appears as one palpomere); each of the palpomeres with one sensillum, distal palpomere with cuticular apical processes. Postlabium with three pms, all located laterally.

Thorax. Prothorax slightly smaller than meso- and metathorax. Spiracle bicameral, placed between the pro- and mesothorax (see, e.g., Skuhrovec et al. 2015). Prothorax with 9–10 prns; two ps; and one eus. Mesothorax with one prs, three pds; one as; two long and one short ss; one eps; one ps; and one eus. Chaetotaxy of metathorax almost identical to that of mesothorax. Each pedal area of thoracic segments well separated, with 5–6 pda.

Abdomen. Abdominal segments I–III of almost equal length, next abdominal segments decreasing gradually to the terminal parts of the body. Abdominal segment X reduced to four anal lobes of unequal size, the lateral lobes being distinctly the largest, the dorsal and the ventral lobes being very small. Anus located terminally. Eight spiracles, bicameral, all spiracles functional, close to the anterior margin. Abdominal segments I–VII with one prs; three pds, pds, the longest one; one long and one minute ss; two long eps; one ps; one lsts; and two eus. Abdominal segment VIII with one prs; 2–3 pds, if there are three setae, then pds, the longest one; one long and one minute ss; two long eps; one ps; one lsts; and two eus. Abdominal segment IX with four ds; 1–2 ps; and 1–2 lsts. Abdominal segment X with one minute seta present or absent.

Cleopomius distinctus (Boheman, 1845)
Figures 1–10

Material examined. 17 L3 larvae: 7 exx., 29.07.2010, Gródek ad Hrubieszów, CE Poland, leg. E. Szwaj, det. J. Łętowski; 10 exx., ex seed capsules of Campanula cervicaria L., 05.07.2017, Stara Planina, Babin Zub, east Serbia, leg. I. Toševski, all collected in association with adults det. R. Caldara. Accession numbers of sequenced specimens: MH558546.
Figure 1. *Cleopomiarus distinctus* mature larva habitus.

Figure 2. *Cleopomiarus distinctus* mature larva head, frontal view. Abbreviations: des – dorsal epicranial s., fs – frontal epicranial s., les – lateral epicranial s., pes – postepicranial s., ves – ventral s., at – antenna, st – stemmata.
Figures 3–4. *Cleopomiarus distinctus* mature larva. 3 Antenna 4 Right mandible. Abbreviation: *mds* – mandible dorsal s.

Figures 5–6. *Cleopomiarus distinctus* mature larva, mouthparts. 5 Labrum and clypeus 6 Epipharynx. Abbreviations: *als* – anteriolateral s., *ams* – anteromedial s., *cls* – clypeal s., *lms* – labral s., *mes* – median s., *clss* – clypeal sensillum, *lr* – labral rods.

**Description.** Measurements (in mm). Body length: 4.43–5.57 (mean 4.90). Body width (metathorax or abdominal segments I–II) up to 1.37. Head width: 0.70–0.84 (mean 0.71).

**General.** Body elongated, slender, curved, rounded in cross section (Fig. 1).

**Colouration.** Black head (Fig. 1). All thoracic and abdominal segments from distinctly white to slightly yellow (Fig. 1).

**Vestiture.** Setae on body thin, light yellow to greyish, distinctly different in length (minute to very long).

**Head capsule** (Fig. 2). Head oval, slightly flattened laterally. Frontal sutures distinct, seem as pallid stripes. Anterior sterna (st), in the form of a small pigmented spot. *Des*₁–₃ and *des*₄ long; *des*₅ short (Fig. 2). *F₃* long; *f₂* absent; *f₃* very short; *f₄* long; and long *f₅* (Fig. 2). *Les*₁ and *les*₂ as long as *des*₅; both *ves* medium to very short. Epicranial area with three *pes* and two sensilla in line with *des*₂.

**Antennae** bearing one relatively elongated conical sensorium; and basal membranous article with four sensilla equal in length, and two pores (Fig. 3).

**Clypeus** (Fig. 5) approximately three times as wide as long with two *cls* of medium size, equal in length, and one sensillum; anterior margin sinuate.

**Mouthparts.** Labrum (Fig. 5) almost two times as wide as long, with three piliform *lms*, almost equal in the length; all located more or less anteromedially, *lms*₂ and *lms*₃
distinctly reach labral margin. Epipharynx (Fig. 6) with three medium sized finger-like als, all similar in length; with two rather short, equal in length ams; and one medium size, finger-like mes; labral rods (lr) distinct, elongated, slightly convex. Mandibles (Fig. 4) bifid; cutting edge with a blunt tooth; bearing with two setae in medium size, piliform, and aligned longitudinally. Maxilla (Fig. 7) stipes with long stps and both pfs, minute mbs, and one sensillum close to mbs; mala with six medium sized finger-like dms; five vms, three medium size, two very short. Maxillary palpi: basal palpomere with one short mxps and two sensilla; distal palpomeres with medium, cuticular apical processes; length ratio of basal and distal palpomeres 1:1. Prelabium (Fig. 7) with one short prms; ligula with one minute ligs; premental sclerite narrow, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal palpomeres 1:1.2; each of the palpomeres with one sensillum, distal palpomeres with medium, cuticular apical processes. Postlabium (Fig. 7) with long pms₁ located basally, very long pms₂ located medially and long pms₃ located apically; membranous area basolaterally sparsely and finely asperate.

Thorax. Prothorax (Fig. 8) with nine very long prns, weakly pigmented dorsal sclerite present with six long prns, this sclerite subdivided in two triangular plates medially; two long ps; and one short eus. Meso- and metathorax (Fig. 8) with one medium prs, three long pds; one long as; two very long and one minute ss; one long

Figure 7. Cleopomiarus distinctus larval mouthparts, maxillolabial complex, ventral view right maxilla. Abbreviations: dms – dorsal malar s., vms – ventral malar s., mxps – maxillary palps s., mbs – basioventral s., pfs – palpiferal s., stps – stipital s., prms – premental s., pms – postmental s., ligs – ligular s.
Eps; one long ps; and one very short eus. Each pedal area of the thoracic segments with five very long pda.

Abdomen. Abdominal segments I–VII (Figs 9–10) with one medium prs; one long and two medium size pds (order: medium, long, medium); one very long and one minute ss; two very long eps; one medium ps; one medium lsts; and two very short eus.
Abdominal segment VIII (Fig. 10) with one very short to minute prs; one short and two long to relatively long pds (order: short, long, relatively long); one long and one minute ss; two very long eps; one medium ps; one medium lsts; and two very short eus. Abdominal segment IX (Fig. 10) with four short ds; one medium ps; and two short lsts. Abdominal segment X (Fig. 10) without seta.

**Biogly.** This species lives on various species of *Campanula* (C. *glomerata* L., C. *incurva* Auch., C. *latifolia* L., C. *persicifolia* L., C. *rapunculus* L., C. *rhomboidea* L., C. *thyrsoides* L., C. *trachelium* L.) in central Europe (Hoffmann 1958; Smreczyński 1976; Caldara and Legalov 2016). It was never reported to feed on C. *cervicaria* L., a species widely distributed in Europe. Larvae are seed feeders developing inside seed capsules.

**Remarks.** This is one of the most variable species and with the widest Palaearctic distribution in the genus (Europe and central and northern Asia to the Russian Far East) (Caldara and Legalov 2016; Jiang et al. 2018). The three most variable characters in adults are the colour of the dorsal vestiture, which varies from whitish grey to light brown, the density of the elytral scales, which sometimes completely cover the integument, and the length of the rostrum, especially in the female and Anatolian populations. It is clear that it would be very interesting to perform a detailed molecular study of these populations. Apart from the characters of the shape of the rostra, the uncus of the male metatibiae and that of the penis, this species differs from *C. graminis* and related species also by the more angulate shape of the elytral base. Also the immatures of *C. distinctus* can easily be separated from those of *C. graminis* by several characters in larvae: postlabium with medium size pms, and pms, a very long pms (Fig. 7) and a membranous area of postlabium basolaterally finely asperate as well as in pupae: Vs and sos absent (or as microsetae) (Fig. 82), pronotum with one sls (Fig. 83), and abdominal segments I–VII without ventral setae (Fig. 82). Finally, we could confirm that these two species are well separated molecularly as previously reported (Vahtera and Muona 2006; Hendrich et al. 2015; Horecka et al. 2017).

*Cleopomiarus graminis* (Gyllenhal, 1813)

Figures 11–20

**Material examined.** 11 L3 larvae: 6 exx., 18.07.2010, Wólka ad Lublin, CE Poland, leg. E. Szwaj, det. J. Łętowski; 5 exx., ex seed capsules of *Campanula macrostachya* Waldst. et Kit. ex Willd., Dobra, Iron Gate, east Serbia. 13.07.2015, leg. I. Toševski, all collected in association with adults, det. R. Caldara. Accession numbers of sequenced specimens: MH558545.

**Description.** *Measurements* (in mm). Body length: 3.75–6.27 (mean 4.80). Body width (metathorax or abdominal segments I–II) up to 1.63. Head width: 0.65–0.78 (mean 0.71).

**General.** Body elongated, slender, curved, rounded in cross section (Fig. 11).
Colouration. Pale brown head (Fig. 11). All thoracic and abdominal segments from distinctly white to slightly yellow (Fig. 11).

Vestiture. Setae on body thin, slightly from orange to pale brown, distinctly different in length (minute to very short or long to very long). Cuticle distinctly asperate.

Head capsule (Fig. 12). Head oval, slightly flattened laterally. Frontal sutures narrow, but distinct. Anterior stemma (st), in the form of a large pigmented spot. Des$_1$–$3$ and des$_5$ long; des$_4$ short to very short (Fig. 12). Fs$_1$ long; fs$_2$ absent; fs$_3$ very short; fs$_4$ long; and long fs$_5$ (Fig. 12). Les$_1$ and les$_2$ as long as des$_5$; both ves very short. Epicranial area with two sensilla and three minute pes in line with des$_5$.

Antennae bearing one medium size conical sensorium, and basal membranous article with three sensilla different in length, two behind conical sensorium, and one ahead of it (Fig. 13).

Clypeus (Fig. 15) approximately 2.5–3 times as wide as long with two short cls, cls$_1$ slightly shorter than cls$_2$, and one sensillum; anterior margin sinuate.

Mouthparts. Labrum (Fig. 15) less than two times as wide as long, with three piliform lms, different in the length; lms$_1$ located anteromedially, very close to margin of clypeus, lms$_2$ located in the middle, and lms$_3$ located anterolaterally; lms$_1$ and lms$_2$ of medium size, and lms$_3$ distinctly shorter than the previous two; only lms$_2$ distinctly reaches labral margin. Epipharynx (Fig. 16) with three long finger-like als, all of identical in length; with three als in different length, als$_1$ and als$_2$ piliform of medium size, finger-like short als$_3$ and enlarged in middle, and also located more close to lr; without mes; labral rods (lr) distinct, elongated, oval. Mandibles (Fig. 14)
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Figure 12. Cleopomiarus graminis mature larva head, frontal view. Abbreviations: des – dorsal epicranial s., fs – frontal epicranial s., les – lateral epicranial s., pes – postepicranial s., ves – ventral s., at – antenna, st – stemmata.

Figures 13–14. Cleopomiarus graminis mature larva. 13 Antenna 14 Right mandible. Abbreviation: mds – mandible dorsal s.

bifid; bearing with two setae in medium size, piliform, and aligned longitudinally, mds₁ located basally; mds₂ located distinctly apically. Maxilla (Fig. 17) stipes with very long stps and pfs₂, medium pfs₁, very short to minute mbs, and sensillum close to mbs; mala with six medium sized finger-like dms; five vms, different in length, three setae medium size, and two setae very short. Maxillary palpi: basal palpomere with one short mxps and two sensilla; distal palpomere with some cuticular apical processes; length ratio of basal and distal palpomeres 1:0.8. Prelabium (Fig. 17) with one short prms; ligula with two very short to minute ligs; premental sclerite broad, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal pal-
pomeres 1:0.8; each of the palpomeres with one sensillum, distal palpomere with cuticular apical processes. Postlabium (Fig. 17) with short \(pms_1\) located basally, very long \(pms_2\) located medially and short \(pms_3\) located apically; membranous area basolaterally distinctly asperate.

**Thorax.** Prothorax (Fig. 18) with nine very long and one very short to minute \(prns\), small pigmented dorsal sclerite present with five long \(prns\), this sclerite subdivided in two triangular plates medially; two very long to long \(ps\); and one short \(eus\). Meso- and metathorax (Fig. 18) with one long \(prs\), three very long \(pds\); one very long \(as\); two very

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**Figures 15–16.** *Cleopomiarus graminis* mature larva, mouthparts. 15 Labrum and clypeus 16 Epipharynx. Abbreviations: \(als\) – anteriolateral s., \(ams\) – anteromedial s., \(cls\) – clypeal s., \(lms\) – labral s., \(mes\) – median s., \(clss\) – clypeal sensillum, \(lr\) – labral rods.

**Figure 17.** *Cleopomiarus graminis* larval mouthparts, maxillolabial complex, ventral view right maxilla. Abbreviations: \(dms\) – dorsal malar s., \(vms\) – ventral malar s., \(mpxs\) – maxillary palps s., \(mbs\) – basioventral s., \(pfs\) – palpiferal s., \(stps\) – stipital s., \(prms\) – premental s., \(pms\) – postmental s., \(ligs\) – ligular s.
Figures 18–20. *Cleopomiarus graminis* mature larva, habitus. 18 Lateral view of thoracic segments 19 Lateral view of abdominal segment 1 20 Lateral view of abdominal segments VI–X. Abbreviations: *as* – alar s., *ds* – dorsal s., *eps* – epipleural s., *eus* – eusternal s., *lsts* – laterosternal s., *pda* – pedal s., *pds* – post-dorsal s., *prns* – pronotal s., *prs* – prodorsal s., *ss* – spiracular s., *ps* – pleural s., *sts* – sternal s., *ts* – terminal s., Th1–3 – number of thoracic segments, Ab1–10 – number of abdominal seg.

long and one very short to minute *ss*; one very long *eps*; one very long *ps*; and one short to very short *eus*. Each pedal area of the thoracic segments with 5–6 very long *pda*.

*Abdomen*. Abdominal segments I–VII (Figs 19–20) with one medium *prs*; one short and two very long to long *pds* (order: short, very long, long); one very long and one minute *ss*; two long *eps*; one very long *ps*; one long *lsts*; and two short to very short *eus*. Abdominal segment VIII (Fig. 20) with one very short to minute *prs*; one short and two long to relatively long *pds* (order: short, long, relatively long); one long and one minute *ss*; two very long *eps*; one long *ps*; one long *lsts*; and two short to very short
eus. Abdominal segment IX (Fig. 20) with three relatively long and one short to very short ds; one relatively long and sometimes one minute ps; and one relatively long to short and one short to very short sts. Abdominal segment X (Fig. 20) with one very short seta (ts).

**Biology.** Larvae were collected while feeding on the seeds of several species of *Campanula*, mainly *C. glomerata*, *C. persicifolia*, and *C. rotundifolia* L. (Hustache 1932; Hoffmann 1958; Smreczyński 1976; Lohse and Tischler 1983; Caldara and Legalov 2016) without producing galls. The species was not previously reported on *Campanula macrostachya* Waldst. and Kit. ex Willd., a taxon distributed from Ukraine along the Balkans until Anatolia. Pupae, as well as immatures of *M. ajugae*, were also collected on *Adenophora liliifolia* (L.) A. DC, although in another Serbian locality (see below). This genus, however, is very closely related to *Campanula* (Cano-Maqueda and Talavera 2011).

**Remarks.** This is a very common and variable species with a wide European and Asian distribution from the Iberian Peninsula to eastern China (Caldara and Legalov 2016; Jiang et al. 2018). The two most variable characters in adults are the colour of the dorsal vestiture, which varies from whitish grey to light brown, and the density of the elytral scales, sometimes completely covering the integument. The rostrum varies somewhat in length and curvature, especially in the female. *Cleopomiarus graminis* is very closely related to *C. longirostris* as demonstrated by our data on the molecular fragment COI (I Toševski, unpublished data). Therefore, the differences between these two taxa found in the study of the immature stages, especially in the larvae – antennae with a very long conical sensorium and three sensilla (Figs 13, 33), dorsal setae (except des4) long (Figs 12, 32), prothorax with nine very long and one very short to minute prns (Figs 18, 38) – are very important in order to confirm the specific rank of both taxa. On the other hand, the larva of *C. longirostris* is distinctly longer than the larva of *C. graminis*. With regard to the differences from *C. distinctus*, another widespread sympatric species sometimes confused with *C. graminis*, see the Remarks for the former taxon.

*Cleopomiarus longirostris* (Gyllenhal, 1838)

Figures 21–30

**Material examined.** 11 L3 larvae: south-eastern France, Menton, July 2007, ex capsules of *Campanula trachelium* L., leg. and det. R. Caldara, all determined by association with reared adults.

**Description.** **Measurements** (in mm). Body length: 6.60–8.70 (mean 8.3). Body width (abdominal segments I–III) up to 2.44. Head width: 1.05–1.16 (mean 1.10).

**General.** Body elongated, slender, curved, rounded in cross section (Fig. 21).

**Colouration.** Pale brown head with indistinct pattern around frontal sutures (Fig. 21). All thoracic and abdominal segments from distinctly white to slightly yellow (Fig. 21).

**Vestiture.** Setae on body thin, orange, distinctly different in length (minute to very short or long to very long). Cuticle slightly asperate.
Morphological characters of immature stages of Palaearctic species...

Figure 21. Cleopomiarus longirostris mature larva habitus.

Figure 22. Cleopomiarus longirostris mature larva head, frontal view. Abbreviations: des – dorsal epicranial s., fs – frontal epicranial s., les – lateral epicranial s., pes – postepicranial s., ves – ventral s., at – antenna, st – stellmata.
Head capsule (Fig. 22). Head oval, slightly flattened laterally. Frontal sutures medium width, distinct. Two pairs of stemmata (st), anterior one in the form of a large pigmented spot; and posterior one in form of a very small pigmented spot, located on each side close des. Des, long; des, short and des, long to very long (Fig. 22). Fís, long; fis, absent; fis, short; fis, long; and long fis, (Fig. 22). Les, and les, as long as des, both ves very short. Epicranial area with three pes and two sensilla in line with des.

Antennae bearing one medium size conical sensorium, and basal membranous article with four sensilla different in length, three behind conical sensorium, and one ahead of it (Fig. 23).

Clypeus (Fig. 25) approximately 2.5 times as wide as long with two short cls, cls, distinctly longer than cls, and one sensillum.

Mouthparts. Labrum (Fig. 25) less than 2.5 times as wide as long, with three pili-form lms, different in the length; lms, located anteromedially, close to margin, lms, located in the middle, and lms, located posterolaterally; lms, and lms, of medium size, and lms, distinctly shorter than the previous two; only lms, distinctly reaches labral margin. Epipharynx (Fig. 26) with three long finger-like als, two als of identical in

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**Figures 23–24.** Cleopomiarus longirostris mature larva. 23 Antenna 24 Right mandible. Abbreviation: mds – mandible dorsal s.

**Figures 25–26.** Cleopomiarus longirostris mature larva, mouthparts. 25 Labrum and clypeus 26 Epipharynx. Abbreviations: als – anteriolateral s., ams – anteromedial s., cls – clypeal s., lms – labral s., mes – median s., clss – clypeal sensillum, lr – labral rods.
length, and the third one distinctly shorter and also located more close to labral rods (lr); with three ams in different length, ams_1 and ams_2 piliform and short, finger-like ams_3 and enlarged in middle, and also located more close to lr; without mes; labral rods (lr) distinct, elongated, oval. Mandibles (Fig. 24) bifid; mds_1 relatively long, piliform, located basally; mds_2 medium size, piliform, located distinctly apically and laterally. Maxilla (Fig. 27) stipes with very long stps and both pfs; very short to minute mbs, and sensillum close to mbs; mala with six medium sized finger-like dms; five vms, different in length, three setae medium size, and two setae very short. Maxillary palpi: basal palpomere with one short mxps and two sensilla; distal palpomere with, cuticular apical processes; length ratio of basal and distal palpomeres 1:0.8. Prelabium (Fig. 27) with one relatively long prms; ligula with two very short to minute ligs; premental sclerite broad, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal palpomeres 1:0.8; each of the palpomeres with one sensillum, distal palpomere with short, cuticular apical processes. Postlabium (Fig. 27) with very short pms_1 located basally, very long pms_2 located medially and short to medium size pms_3 located apically; membranous area basolaterally distinctly asperate.

Thorax. Prothorax (Fig. 28) with eight very long to long and one very short to minute prns, small pigmented dorsal sclerite present with four long prns, this sclerite subdivided in two triangular plates medially; two very long to long ps; and one short to very short eus. Meso- and metathorax (Fig. 28) with one long prs, three medium to long pds; one very long to long as; two very long and one very short to minute ss; one
Figures 28–30. Cleopomiarus longirostris mature larva, habitus. 28 Lateral view of thoracic segments 29 Lateral view of abdominal segment I 30 Lateral view of abdominal segments VI–X. Abbreviations: as – alar s., ds – dorsal s., eps – epipleural s., eus – eusternal s., lsts – laterosternal s., pda – pedal s., pds – postdorsal s., prns – pronotal s.,prs – prodorsal s., ss – spiracular s., ps – pleural s., sts – sternal s., ts – terminal s., Th1–3 – number of thoracic segments, Ab1–10 – number of abdominal seg.

long eps; one long ps; and one short to very short eus. Each pedal area of the thoracic segments with 5–6 very long to long pda.

Abdomen. Abdominal segments I–VII (Figs 29–30) with one short prs; one long and two short to very short pds (order: short, long, short); one long and one minute ss; two very long to long eps; one relatively long ps; one short lsts; and two very short eus. Abdominal segment VIII (Fig. 30) with one very short to minute prs; one relatively long and two very short pds (order: very short, long, very short); one relatively long and
one minute \textit{ss}; two relatively long \textit{eps}; one short \textit{ps}; one short \textit{lsts}; and two very short \textit{eus}. Abdominal segment IX (Fig. 30) with three relatively long and one very short to minute \textit{ds}; one relatively long and sometimes one minute \textit{ps}; and two short to very short \textit{sts}. Abdominal segment X (Fig. 30) with one very short \textit{seta} (\textit{ts}).

**Biology.** We can confirm that larvae of this species feed on seed capsules of \textit{Campanula trachelium} L., where they pupate without producing galls. It is noteworthy that adults did not exit by making a hole in the capsules but remained inside with the rostrum folded in the ventral canal until these opened spontaneously and forcefully, blowing up the seeds. On the other hand, it would be impossible, especially for the female, to straighten up the very long rostrum inside the capsule due to the limited available space. This is a more advantageous behaviour and apparently opposite to that of \textit{Rhopalapion longirostre} (Olivier, 1807), another species where the female rostrum is more than twice as long as the stout male rostrum. In this species, Wilhelm et al. (2011) argued that the long rostrum is presumably an advantage for this weevil because its larvae can feed on plant parts with high energy density into buds (i.e., pollen grains) and that natural selection favours rostrum elongation. However, these authors reported that the elongated rostrum of females also bears a high risk when metamorphosed weevils attempt to leave their site of pupal development, which is the dry seed chambers, and therefore mortality during escaping may counteract selection for rostrum elongation, thus placing a limit on rostrum exaggeration. It is noteworthy that \textit{R. longirostre} does not possess a ventral canal, which allows it to retain the folded rostrum.

**Remarks.** This species is only known from France, Italy, and Switzerland, where it is quite common. The adult is very closely related to \textit{C. graminis}, as also supported by preliminary molecular studies (I Toševski, unpublished data), from which it differs only by the very long rostrum especially in the female and usually by the larger size (Caldara and Legalov 2016). Therefore, the larval differences between these two taxa, in \textit{C. longirostris} antennae bearing one medium size conical sensorium and four sensilla (Fig. 23), dorsal setae (except \textit{des}) extremely long (Fig. 22), prothorax with eight very long and one very short to minute \textit{prns} (Fig. 28), are very important since they allow easy separation of these two species.

**Cleopomiarus medius** (Desbrochers des Loges, 1893)

*Figures 31–40*

**Material examined.** 13 L3 larvae, ex seed capsules of \textit{Campanula lingulata} Waldst. and Kit., 26.06.2017, Staničenje, Pirot, east Serbia, leg. I. Toševski, all collected in association with adults, det R. Caldara. Accession numbers of sequenced specimens: MH558547.

**Description.** *Measurements* (in mm). Body length: 5.10–7.30 (mean 5.67). Body width (metathorax or abdominal segments I–II) up to 2.02. Head width: 0.83–0.96 (mean 0.91).

*General.* Body elongated, slender, weakly curved, rounded in cross section (Fig. 31).
Figure 31. Cleopomiarus medius mature larva habitus.

Figure 32. Cleopomiarus medius mature larva head, frontal view. Abbreviations: des – dorsal epicranial s., fi – frontal epicranial s., les – lateral epicranial s., pes – postepicranial s., ves – ventral s., at – antenna, st – stemmata.
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Colouration. Pale brown or almost yellow head (Fig. 31). All thoracic and abdominal segments from white to slightly yellow (Fig. 31).

Vestiture. Setae on body thin, slightly from orange to brown, distinctly different in length (minute to very short or long). Cuticle distinctly asperate.

Head capsule (Fig. 32). Head suboval. Frontal sutures distinct. Endocarina distinctly widened in the middle of the length. Two small stemmata (st), located close to des, Des, and des, very long; des, medium size; des, short (Fig. 32). Fs, long; fs, absent; fs, medium; fs, long; and fs, very long (Fig. 32). Les, and les, as long as des,; both ves very short. Epicranial area with two sensilla and three pes in line with des,.

Antennae bearing one very long conical sensorium, and basal membranous article with three sensilla almost equal in length (Fig. 33).

Clypeus (Fig. 35) approximately 4.25 times as wide as long with two almost equal in length cls: cls, some longer than cls, and one sensillum; anterior margin sinuate.

Mouthparts. Labrum (Fig. 35) two times as wide as long, with three piliform lms, different in the length; lms, and lms, located medially, and lms, located anterolaterally; lms, very long and reaches distinctly the labrum margin, lms, long, and lms, short, three times as shorter than lms,.

Epipharynx (Fig. 36) with three medium sized finger-like als, and three medium to short ams in different shape; labral rods (lr) distinct,
Figure 37. *Cleopomiarus medius* larval mouthparts, maxillolabial complex, ventral view right maxilla. Abbreviations: *dms* – dorsal malar s., *vms* – ventral malar s., *mpxs* – maxillary palps s., *mbs* – basioventral s., *pfs* – palpiferal s., *stps* – stipital s., *prms* – premental s., *pms* – postmental s., *ligs* – ligular s.

elongated. Mandibles (Fig. 36) bifid; bearing with two setae in short to medium size, piliform, and aligned longitudinally, *mds*₁ located basally; *mds*₂, located distinctly apically. Maxilla (Fig. 34) stipes with long *stps* and equal in length *pfs*₁ and *pfs*₂, very short to minute *mbs*, and two sensilla close to *mbs*; mala with six medium sized finger-like *dms*; five *vms*, different in length, three setae medium size, and two setae very short. Maxillary palpi: basal palpomere with one short *mxps* and two sensilla; distal palpomere with cuticular apical processes; length ratio of basal and distal palpomeres 1:0.8. Prelabium (Fig. 37) with one short *prms*; ligula with two short *ligs*; premental sclerite broad, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal palpomeres 1:0.9; each of the palpomeres with one sensillum, distal palpomere with short, cuticular apical processes. Postlabium (Fig. 37) with short *pms*₁ located basally, very long *pms*₂ located medially and short *pms*₃ located apically; membranous area basolaterally distinctly asperate.

Thorax. Prothorax (Fig. 38) with nine long and one very short *prns*; two long *ps*; and one short *eus*. Meso- and metatorax (Fig. 38) with one short *prs*, three long *pds*; one long *as*; two long and one very short to minute *ss*; one long *eps*; one long *ps*; and one short *eus*. Each pedal area of the thoracic segments with six different in length *pda*.

Abdomen. Abdominal segments I–VII (Figs 39–40) with one very short *prs*; two short and one long *pds* (order: short, long, short); one long and one minute *ss*; two long *eps*; one long *ps*; one long *kts*; and two short *eus*. Abdominal segment VIII (Fig. 40)
Figures 38–40. Cleopomius medius mature larva, habitus. 38 Lateral view of thoracic segments 39 Lateral view of abdominal segment I 40 Lateral view of abdominal segments VI–X. Abbreviations: as – alar s., ds – dorsal s., eps – epipleural s., eus – eusternal s., lsts – laterosternal s., pda – pedal s., pds – postdorsal s., prns – pronotal s., prs – prodorsal s., ss – spiracular s., ps – pleural s., sts – sternal s., Th1–3 – number of thoracic segments, Ab1–10 – number of abdominal seg.

with one very short prs; three pds (order: short, long, short); one long and one minute ss; two long eps; one long ps; one long lsts; and two short eus. Abdominal segment IX (Fig. 40) with one medium long and three very short ds; two short ps; and two short sts. Abdominal segment X (Fig. 40) without seta.

Biology. Previously, the unique biological datum on this species was reported by Weill et al. (2011), who collected adults in Syria on Michauxia campanuloides L’Hér., a small genus of Campanulaceae distributed in the Middle East, possibly a synonym of Campanula (Crowl et al. 2014). Therefore, the observation that this species feeds on Campanula lingulata Waldst. and Kit. is unpublished. Moreover, adults were recently observed feeding on flowers of Campanula sibirica L. in eastern Serbia (I Toševski, pers. obs.), but larval development on this plant species is not confirmed. Like C. distinctus
and *C. graminis*, larvae are seed feeders inside capsules of the host plant without producing galls.

Remarks. This species was previously known from Anatolia, Syria and many countries of the Balkans but not from Serbia. The adults of this species are characterized by a very long rostrum in the females. This character, however, is not uncommon in the Palaearctic *Cleopomiarus*. For example, this character is shared with *C. longirostris* and *C. distinctus*, two other taxa presented in this paper. It is distinguishable from these species by the less globose and moderately elongate elytra, and moreover by the shape of the male and female genitalia (Caldara and Legalov 2016). Other characters of the immatures allow easy separation of *C. medius* from these two species as well as from *C. graminis* (see keys to larvae and pupae). There are also substantial molecular differences between *C. medius* and other species (I Toševski, unpublished data).

*Cleopomiarus meridionalis* (H. Brisout, 1863)

Figures 41–50

Material examined. 10 L3 larvae: south-eastern France, Castellar (Menton), Juin 2005, ex seed capsules of *Campanula rapunculus* L., leg. and det. R. Caldara all collected in association with adults.

Description. Measurements (in mm). Body length: 2.20–3.15 (mean 2.8). Body width (metathorax or abdominal segments I–II) up to 0.73. Head width: 0.35–0.51 (mean 0.45).

General. Body elongated, slender, curved, rounded in cross section (Fig. 41).

Colouration. Pale brown or almost yellow head (Fig. 41). All thoracic and abdominal segments from distinctly white to slightly yellow (Fig. 41).

Vestiture. Setae on body thin, slightly from orange to pale brown, distinctly different in length (minute to very short or long to very long). Cuticle distinctly asperate.

Head capsule (Fig. 42). Head suboval, distinctly flattened laterally. Frontal sutures narrow, but distinct. Two stemmata (st), anterior one in the form of a small pigmented spot; and posterior one in form of a very small pigmented spot, located on each side close *des*, *Des* and *des* very long; *des*, relatively long (Fig. 42). *Fs*, long to very long; *fs* absent; *fs* long medium, laterally to *fs*; *fs* very long; and *fs* very long (Fig. 42). *Les* and *des* as long as *des*; both *ves* medium size. Epicranial area with two sensilla and three *pes* in line with *des*. Antennae bearing one very long conical sensorium, and basal membranous article with three sensilla different in length, two behind conical sensorium, and one ahead of it (Fig. 43).

Clypeus (Fig. 45) approximately three times as wide as long with two medium size *cls*, *cls* distinctly longer than *cls* and one sensillum; anterior margin sinuate.

Mouthparts. Labrum (Fig. 45) less than 2.5 times as wide as long, with three pili-form *lms*, different in the length; *lms* located posteromedially, very close to margin
of clypeus, $lms_2$ located in the middle, and $lms_3$ located laterally; $lms_1$ very long and reaches distinctly the labrum margin, $lms_2$ long, and $lms_3$ medium size, more than twice times as short as $lms_1$. Epipharynx (Fig. 46) with three medium sized finger-like $als$, two $als$ of identical in length, and the third one distinctly shorter and also located close to labral rods (lr); with three short $ams$ in different shape, $ams$, and $ams_2$ piliform, finger-like $ams_3$, and enlarged in middle, and also located more close to lr; without $mes$; labral rods (lr) distinct, elongated, oval. Mandibles (Fig. 44) bifid; bearing with two setae in short to medium size, piliform, and aligned longitudinally., $mds_1$ located basally; $mds_2$ located distinctly apically. Maxilla (Fig. 47) stipes with very long $stp$s and $pfs_2$, medium size $pfs_1$, very short to minute $mbs$, and sensillum close to $mbs$; mala with six medium sized finger-like $dms$; five $vms$, different in length, four setae medium size, and one seta very short. Maxillary palpi: basal palpomere with one short $mxps$ and two sensilla; distal palpomere with short, cuticular apical processes; length ratio of basal and distal palpomeres 1:0.8. Prelabium (Fig. 47) with one very short $prms$; ligula with two very short to minute $lig$s; premental sclerite broad, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal palpomeres 1:0.9;
each of the palpomeres with one sensillum, distal palpomere with short, cuticular apical processes. Postlabium (Fig. 47) with short \( pms_1 \) located basally, long \( pms_2 \) located medially and short \( pms_3 \) located apically; membranous area basolaterally only a partly and finely asperate.

**Thorax.** Prothorax (Fig. 48) with nine very long and one very short to minute \( prns \), small pigmented dorsal sclerite present with four long \( prns \), this sclerite subdivided in two triangular plates medially; two very long to long \( ps \); and one short \( eus \). Meso- and metathorax (Fig. 48) with one long \( prs \), three very long to long \( pds \); one
Figures 45–46. *Cleopomiliarus meridionalis* mature larva, mouthparts. 45 Labrum and clypeus 46 Epipharynx. Abbreviations: *als* – anteriolateral s., *ams* – anteromedial s., *cls* – clypeal s., *lms* – labral s., *mes* – median s., *clss* – clypeal sensillum, *lr* – labral rods.

Figure 47. *Cleopomiliarus meridionalis* larval mouthparts, maxillolabial complex, ventral view right maxilla. Abbreviations: *dms* – dorsal malar s., *vms* – ventral malar s., *mpxs* – maxillary palps s., *mbs* – basioventral s., *pfs* – palpiferal s., *stps* – stipital s., *prms* – premental s., *pms* – postmental s., *ligs* – ligular s. long *as*; two very long and one very short to minute *ss*; one long *eps*; one very long to long *ps*; and one short to very short *eus*. Each pedal area of the thoracic segments with 5–6 very long *pda*.

**Abdomen.** Abdominal segments I–VII (Figs 49–50) with one long *prs*; two relatively long to short and one very long to long *pds* (order: relatively long, very long, short); one very long to long and one minute *ss*; two very long *eps*; one very long to long *ps*; one relatively long to short *lsts*; and one short to very short and one relatively long *eus*. Abdominal segment VIII (Fig. 50) with sometimes one very short to minute
Figures 48–50. Cleopomiarus meridionalis mature larva, habitus. 48 Lateral view of thoracic segments 49 Lateral view of abdominal segment I 50 Lateral view of abdominal segments VI–X. Abbreviations: as – alar s., ds – dorsal s., eps – epipleural s., eus – eusternal s., lsts – laterosternal s., pda – pedal s., pds – postdorsal s., prns – pronotal s., prs – prodorsal s., ss – spiracular s., ps – pleural s., sts – sternal s., ts – terminal s., Th1–3 – number of thoracic segments, Ab1–10 – number of abdominal seg.

prs; one short and one long to relatively long pds (order: short, long); one long and one minute ss; two very long eps; one very long to long ps; one relatively long to short lsts; and one short to very short and one relatively long eus. Abdominal segment IX (Fig. 50) with two relatively long and two short to very short ds; one relatively long and one minute ps; and one relatively long sts. Abdominal segment X (Fig. 50) with one very short seta (ts).

Biology. Adults of this species are usually collected on the flowers of Campanula rapunculus L., and we can confirm that larvae feed on seeds of this plant as previously reported by Hoffmann (1958).
Remarks and comparative notes. This species is widely distributed and common in southern Europe, whereas it appears rare in North Africa and the Middle East. Adults can be confused with some related species such as *C. plantarum* (Ger- mar, 1823), *C. micros* (Germar, 1821) and *C. reitteri* (Caldara & Legalov, 2016), from which they differ by some external characters and the shape of their genitalia (Caldara and Legalov 2016). In contrast, this species is poorly related morphologically to the other species of *Cleopomiarus* studied here. This difference is confirmed also by the larval morphology, which differs from all of the other species mainly by a longer $f_3$ that is almost as long as $f_4$.

Genus *Miarius* Schoenherr, 1826

Description. Measurements (in mm). Body length: 3.80–8.39. Body width (metathorax or abdominal segments I–II) 1.55–2.04. Head width: 0.57–0.83.

General. Body slender, C-curved, rounded in cross section.

Colouration. From black to dark brown head. All thoracic and abdominal segments yellowish, with some asperities.

Vestiture. Setae on body thin, in different colouration, distinctly different in length; piliform.

Head capsule. Head almost rounded, sometimes slightly flattened laterally, endocarinal line present and distinct, more than half the length of frons. Frontal sutures on the head narrow and loosened, but distinct, and ever extended to the antennae. One stemma (st), in the form of a pigmented spot with convex cornea. Dorsum of the epicranium with four or five setae; $d_{3}$ located anteriorly on epicranium close border with frontal suture. Frons with three or four setae; $f_{2}$ absent. Head also with two $les$ and two $ves$. Epicranial area with two or three $pes$ and more or without sensilla.

Antennae located at the end of the frontal suture on each side, membranous and distinctly convex basal article bearing one very long conical sensorium; basal membranous article with 1–4 sensilla.

Clypeus transverse-shaped, approximately 2.5–3.5 times as wide as long with two $cls$, and one sensillum (clss) between setae; all very close to margin with frons.

Mouthparts. Labrum with three piliform $lms$; anterior margin bisinuate. Epipharynx with three finger-like $als$; with two $ams$; and 0–2 $mes$; labral rods (lr) elongated. Mandibles distinctly broad, bifid, teeth of unequal height; slightly truncate; both setae piliform and located apically. Maxilla stipes with one $stps$, two $pfs$ and one $mbs$ and one sensillum; mala with six finger-like $dms$, in two sizes, first or first and second $dms$ very long as $pfs$, next medium length; five $vms$; all $vms$ distinctly shorter than $dms$. Maxillary palpi with two palpomeres; basal palpomere with one short $mxps$ and two sensilla; distal palpomere with one sensillum and a group of micro cuticular apical processes. Prelabium oval-shaped, with one $prms$; ligula with sinuate margin and 2–3 $ligs$; pre-
mental sclerite feebly visible. Labial palpi with two palpomeres; each of the palpomeres with one sensillum, distal palpomere with cuticular apical processes. Postlabium with three pms, all located laterally.

**Thorax.** Prothorax slightly smaller than meso- and metathorax. Spiracle bicameral, placed between the pro- and mesothorax (see, e.g., Skuhrovec et al. 2015). Prothorax with ten prns; two ps; and one eus. Mesothorax with one prs, three pds; one as; two long and one short ss; one eps; one ps; and one eus. Chaetotaxy of metathorax almost identical to that of mesothorax. Each pedal area of the thoracic segments well separated, with 5–6 pda.

**Abdomen.** Abdominal segments I–III of almost equal length, next abdominal segments decreasing gradually to the terminal parts of the body. Abdominal segment X reduced to four anal lobes of unequal size, the lateral lobes being distinctly the largest, the dorsal and the ventral lobe very small. Anus located terminally. Eight spiracles, bicameral, all spiracles placed medially or anteromedially and functional. Abdominal segments I–VIII with one prs (sometimes abdominal segment VIII without); three pds, $pds_2$, the longest one; one long and one minute ss; two long eps; one ps; one lsts; and two eus. Abdominal segment IX with 3–4 ds; 1–3 ps; and two sts. Abdominal segment X with one minute seta present or absent.

*Miarus abnormis* Solari, 1947

Figures 51–60

**Material examined.** 5 L3 larvae: north-eastern Italy, Venezia Giulia, Duino (Trieste), Rilke path, August 2017, ex galls on capsules of *Campanula pyramidalis* L., leg. E. Tomasi, all collected in association with adults, det. R. Caldara.

**Description.** **Measurements** (in mm). Body length: 3.50–4.75 (mean 3.9). Body width (abdominal segment II) up to 1.65. Head width: 0.57–0.65 (mean 0.60).

**General.** Body moderately elongated, rather stout, curved, rounded in cross section (Fig. 51).

**Colouration.** Almost black head (Fig. 51). All thoracic and abdominal segments from greyish-white to yellowish; prodorsum with brownish dorsal sclerite; all abdominal segments covered with fine spiculation (Fig. 51).

**Vestiture.** Setae on body thin, brown, rather short or minute, piliform.

**Head capsule** (Fig. 52). Head oval, slightly flattened laterally. Endocarinal line present and very distinct. Stemma placed below $des_1$, $Des_{1,3}$ and $des_3$, long; $des_4$, medium size (Fig. 52). $Fs_1$, long; $Fs_2$, absent; $fs_3$ and $fs_4$, medium size; and $fs_5$, long (Fig. 52). $Les_1$ and $les_2$, as long as $des_1$; one ves very short. Epicranial area with three pes (in line with $des_2$), and also two sensilla.

**Antennae** located at the end of the frontal suture on each side, membranous and distinctly convex basal article bearing one conical sensorium, relatively elongated; basal membranous article with four sensilla (styroconica) equal in length, and one (ampul-laeae) (Fig. 53).
Clypeus (Fig. 55) trapezium-shaped, approximately 3.3 times as wide as long with two medium size, equal in length cls, and one sensillum (clss) between setae; all very close to margin with frons; anterior margin of clypeus rounded to inside.
Figures 53–54. *Miarus abnormis* mature larva. 53 Antenna 54 Right mandible. Abbreviation: 
*mds* – mandible dorsal s.

Figures 55–56. *Miarus abnormis* mature larva, mouthparts. 55 Labrum and clypeus 56 Epipharynx. Abbreviations: *Als* – anteriolateral s., *ams* – anteromedial s., *cls* – clypeal s., *lms* – labral s., *mes* – median s., *clss* – clypeal sensillum, *lr* – labral rods.

*Mouthparts.* Labrum (Fig. 55) 2.5 times as wide as long, with three piliform *lms*, *lms*₁ twice longer than (equal in the length) *lms*₂ and *lms*₃; all located more or less anteromedially, all reach labral margin; anterior margin double sinuate. Epipharynx (Fig. 56) with three medium sized finger-like *als*, all similar in length; with two rather short, different in length *ams*; and one medium size, finger-like *mes*; labral rods (lr) distinct, kidney-shaped. Mandibles (Fig. 54) distinctly broad, bifid, teeth of unequal height; slightly truncate; cutting edge with a blunt tooth; bearing with two setae in short size, piliform, and aligned longitudinally. Maxilla (Fig. 57): stipes with long *stps*, two long *pfs*, one minute *mbs* and two sensillae close to *mbs*; mala with six finger-like *dms* (first and second elongated, forth to sixth medium size); five *vms* (two medium size and three very short); all *vms* shorter than *dms*. Maxillary palpi with two palpomeres; basal palpomere with one short *mxps* and two sensilla; length ratio of basal and distal palpomeres almost 1:1; distal palpomere with one sensillum and a group of microcuticular processes apically. Prelabium (Fig. 57) oval-shaped, with one medium *prms*; ligula with sinuate margin and three minute *ligs*; premental sclerite narrow, ring-shaped, well visible. Labial palpi with one palpomere (partially seems as two palpomere); palpomere with one sensillum and medium, cuticular apical processes. Postlabium (Fig. 57) with
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three $pms$, all located laterally; $pms_1$ and $pms_3$ short, $pms_2$ medium size; membranous area basolaterally finely asperate.

Thorax. Prothorax smaller than meso- and metathorax. Spiracle bicameral, placed between the pro- and mesothorax. Prothorax (Fig. 58) with ten prns (two minute and eight long), well pigmented dorsal sclerite with four long prns; two medium $ps$; and one short $eus$. Meso- and metathorax (Fig. 58) with one short $prs$, three medium $pds$; one medium $as$; two medium and one minute $ss$; one medium $eps$; one medium $ps$; and one very short $eus$. Chaetotaxy of metathorax (Fig. 58) almost identical to that of mesothorax. Each pedal area of the thoracic segments with six medium length $pda$ (four of them placed on well-separated pedal areas, next two setae outside).

Abdomen. Abdominal segments I–VII (Figs 59, 60) with one short $prs$; three medium size $pds$ (equal in length); one medium and one minute $ss$; two medium $eps$; one medium $ps$; one medium $lsts$; and two very short $eus$. Abdominal segment VIII (Fig. 60) without $prs$; three medium $pds$; one medium and one minute $ss$ (sometimes absent); two medium $eps$; one medium $ps$; one medium $lsts$; and two very short $eus$. Abdominal segment IX (Fig. 60) with three medium $ds$; one relatively long $ps$; and two short $sts$. Abdominal segment X (Fig. 60) without seta.

Biology. The only detailed biological data are reported by Tomasi (2002), who observed that this species lives in Friuli-Venezia Giulia (Italy) on Campanula pyramidalis L., where larvae cause a distinct swelling of the calix of the flowers, which remain closed.
Figures 58–60. *Miarus abnormis* mature larva, habitus. 58 Lateral view of thoracic segments 59 Lateral view of abdominal segment I 60 Lateral view of abdominal segments VII–X. Abbreviations: *as* – alar s., *ds* – dorsal s., *eps* – epipleural s., *eus* – eusternal s., *lbs* – laterosternal s., *pda* – pedal s., *pds* – postdorsal s., *prns* – pronotal s., *prs* – prodorsal s., *ss* – spiracular s., *ps* – pleural s., *sts* – sternal s., *ts* – terminal s., *Th1–3* – number of thoracic segments, *Ab1–10* – number of abdominal seg.

**Remarks.** This species has a well-delimited distribution (south-eastern Poland, Austria, north-eastern Italy, Slovenia, Croatia, Serbia, Montenegro, Macedonia). It is easily distinguishable from all other species of *Miarus* by the shape of the body of the penis, which is characterized by the presence of two lateral flanges at its apex. However, for the external morphology, the *M. abnormis* adults are very similar to several other species, such as *M. ajugae* and *M. campanulae*, from which they can be distinguished only by the characters of the male ventrite five (fovea less deep, teeth less robust). Unfortunately, the females of these three species appear not to be distinguishable (Caldara 2007), and the molecular fragment COI poorly differentiates these species. Therefore, the differences between the immatures of these species are much important for the
separation of these three species. According to the larval morphology, *M. abnormis* appears more closely related to *M. ajugae* than to *M. campanulae* due to several features (mala with six finger-like *dms*, different in length: two setae elongated, and four setae of medium length; epipharynx with 1–2 *mes*, and finally *des* and *fs* present), confirming what was suggested by the adult morphology (Caldara 2007). Moreover, larvae of *M. abnormis* differ from other *Miarus* species here studied mainly by an epipharynx with one finger-like *mes*.

*Miarus ajugae* (Herbst, 1795)
Figures 61–70

**Material examined.** 26 L3 larvae: 9 exx., 12.07.2009, Bychawa ad Lublin, CE Poland, leg. E. Szwaj, det. J. Łętowski; 12 exx, ex galls on capsules of *Adenophora liliifolia*, 30.06.2017, Kaludjerske Bare, Mt. Tara, Central Serbia, leg. I. Toševski, det. R. Caldara; 5 exx, ex galls on capsules of *Campanula bononiensis* L., 14.07.2017, Zavojsko jezero, Pirot, east Serbia, leg. I. Toševski, all collected in association with adults, det. R. Caldara. Accession numbers of sequenced specimens: MH558548.

**Description.** Measurements (in mm). Body length: 4.50–8.39 (mean 5.70). Body width (metathorax or abdominal segments I–II) up to 2.04. Head width: 0.68–0.83 (mean 0.70).

**General.** Body slender, C-curved, rounded in cross section (Fig. 61).

**Colouration.** Head dark brown to black (Fig. 61). All thoracic and abdominal segments yellowish with fine speculation, with clearly separated dark pigmented pedal areas (Fig. 61).

**Vestiture.** Setae on body very thin, piliform, distinctly different in length (minute to very short or long to very long).

**Head capsule** (Fig. 62). Head almost rounded. Frontal sutures narrow and loosened, but distinct. One stemma (*st*), in the form of a large pigmented spot. *Des* and *des* † long; *des* † very short (Fig. 62). *Fs* 1 long; *fs* 2 absent; *fs* 3 short; *fs* 4 and *fs* 5 long (Fig. 62). *Les* 1 and *les* 2 as long as *des* †; both *ves* very short. Epicranial area with three very short *pes* and also three sensilla.

**Antennae** bearing one very long conical sensorium, and basal membranous article with three sensilla and one pore (Fig. 63).

**Clypeus** (Fig. 65) approximately 3.5 times as wide as long with two short, almost equal in length *cls*, and one sensillum between them; anterior margin sinuate.

**Mouthparts.** Labrum (Fig. 65) 1.6 times as wide as long, with three piliform *lms*, rather equal in length; *lms* 1 located medially, *lms* 2 located anteromedially, and *lms* 3 located anterolaterally; all of them reaches labral margin. Epipharynx (Fig. 66) with three long finger-like *als*, all of identical in length; with two medium size *ams*; and two *mes*, first finger-like, second sharp and more slender; labral rods (lr) elongated, broad, slightly convergent posteriorly. Mandibles (Fig. 64) bifid; cutting edge with small blunt tooth; bearing with two setae in medium to long size, piliform, located apically and aligned longitudinally. Maxilla (Fig. 67) stipes with long *stps* and both *pfs,*
very short to minute mbs, and one sensillum close to mbs; mala with six finger-like dms, different in length: first and second very long, forth to sixth medium size; five vms, different in length, three setae medium size, and two setae very short. Maxillary palpi:

Figure 61. *Miarus ajugae* mature larva habitus.

Figure 62. *Miarus ajugae* mature larva head, frontal view. Abbreviations: des – dorsal epicranial s., fs – frontal epicranial s., les – lateral epicranial s., pes – postepicranial s., ves – ventral s., at – antenna, st – stemmata.
basal palpomere with one short $mxps$ and two sensilla; distal palpomere with cuticular apical processes; length ratio of basal and distal palpomeres 1:0.9. Prelabium (Fig. 67) with one medium $prms$; ligula with two minute $ligs$; premental sclerite narrow, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal palpomeres 1:0.7; each of the palpomeres with one sensillum, distal palpomere with cuticular apical processes. Postlabium (Fig. 67) with short $pms_1$ located basally, long $pms_2$ located medially and short $pms_3$ located apically; membranous area without any asperities.

Thorax. Prothorax (Fig. 68) with ten $prns$ (nine very long and one minute), small pigmented dorsal sclerite present with five long $prns$, this sclerite subdivided in two triangular plates medially; two long $ps$; and one short $eus$. Meso- and metathorax (Fig. 68) with one medium $prs$, three long $pds$; one very long $as$; two long and one minute $ss$; one long $eps$; one long $ps$; and one short $eus$. Chaetotaxy of metathorax (Fig. 68) almost identical to that of mesothorax. Each pedal area of the thoracic segments with six very long $pda$.

Abdomen. Abdominal segments I–VII (Figs 69–70) with one medium $prs$; two medium and one long to very long $pds$ (order: medium, very long, medium); one very long and one minute $ss$; two long $eps$; one medium $ps$; one medium $lst$s; and two short
eus. Abdominal segment VIII (Fig. 70) with one short prs; two short and one long pds (order: short, long, short); one long and one minute ss; two medium eps; one medium ps; one medium lsts; and two short eus. Abdominal segment IX (Fig. 70) with two relatively long and two short ds; two different in length ps; and two short sts. Abdominal segment X (Fig. 70) with one very short seta (ts).

Biology. Miarus ajugae was collected on various species of the genus Campanula (C. carpathica Jacq., C. glomerata L., C. latifolia L., C. macrorrhiza Gay ex DC, C. media L., C. patula L., C. persicifolia L., C. rapunculoides L., C. rapunculus L., C. rhomboidalis L., C. rotundifolia L., C. trachelium L.) and Phyteuma (P. orbiculare L., P. spicatum L.) (Caldara 2007). However, it was never reported previously to feed on Campanula bononiensis L. and Adenophora liliifolia (L.) A. DC. (see also Biology of C. graminis).

Remarks. This species with large Palaearctic distribution (from France and north-western Africa along all Europe to the Far East) is very closely related to M. campanulae, from which it differs mainly by the shape of the apex of the body of the penis (Caldara 2007). Unfortunately, molecular studies on the fragment COI revealed poor differences between these two species (Vahtera and Muona 2006; Hendrich et al. 2015, I. Toševski, unpublished data). Therefore, the consistent differences which we found in larval morphology between C. ajugae and C. campanulae are very important in order to confirm the validity of these two taxa at species level. Larvae of M. ajugae differ from all other species mainly by an epipharynx with two mes, first finger-like, second sharp and slender.
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Figures 68–70. Miarus ajugae mature larva, habitus. 68 Lateral view of thoracic segments 69 Lateral view of abdominal segment I 70 Lateral view of abdominal segments VII–X. Abbreviations: as – alar s., ds – dorsal s., eps – epipleural s., eus – eusternal s., lsts – laterosternal s., pda – pedal s., pds – postdorsal s., prns – pronotal s., prs – prodorsal s., ss – spiracular s., ps – pleural s., sts – sternal s., ts – terminal s., Th1–3 – number of thoracic segments, Ab1–10 – number of abdominal seg.

Miarus campanulae (Linnaeus, 1767)
Figures 71–80

Material examined. 9 L3 larvae: 30.07.1939, ex Campanula, Store Dyrehave, Denmark, leg. J.P. Kryger, collected in association with adults, det. Van Emden, coll. British Museum of Natural History (London).
**Figure 71.** *Miarus campanulae* mature larva habitus.

**Figure 72.** *Miarus campanulae* mature larva head, frontal view. Abbreviations: *des* – dorsal epicranial s., *fi* – frontal epicranial s., *les* – lateral epicranial s., *pes* – postepicranial s., *ves* – ventral s., *at* – antenna, *st* – stemmata.
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**Description.** Measurements (in mm). Body length: 3.80–5.96 (mean 5.20). Body width (metathorax or abdominal segments I–II) up to 1.61. Head width: 0.58–0.64 (mean 0.61).

**General.** Body slender, C-curved, rounded in cross section (Fig. 71).

**Colouration.** Brown to dark brown head (Fig. 71). All thoracic and abdominal segments yellowish with distinct asperation (Fig. 71).

**Vestiture.** Setae on body thin, slightly from dark orange to brown, distinctly different in length (minute to very short or long to very long) distinct asperate.

**Head capsule** (Fig. 72). Head almost round, very slightly flattened laterally. Frontal sutures narrow and loosened, but distinct. One stemma (st), in the form of a large pigmented spot. Des\textsubscript{1-3} and des\textsubscript{5} long; des\textsubscript{4} absent (Fig. 72). F\textsubscript{3} long; f\textsubscript{2} and f\textsubscript{3} absent; f\textsubscript{4} and f\textsubscript{5} long (Fig. 72). Les\textsubscript{1} and le\textsubscript{2} as long as des\textsubscript{5}; both ves short. Epicranial area with two pes.

**Figures 73–74.** *Miarus campanulae* mature larva. 73 Antenna 74 Right mandible. Abbreviation: mds – mandible dorsal s.

**Figures 75–76.** *Miarus campanulae* mature larva, mouthparts. 75 Labrum and clypeus 76 Epipharynx. Abbreviations: als – anteriolateral s., am\textsubscript{s} – anteromedial s., cl\textsubscript{s} – clypeal s., lms – labral s., mes – median s., c\textsubscript{ls} – clypeal sensillum, lr – labral rods.
Figure 77. Miarus campanulae larval mouthparts, maxillolabial complex, ventral view right maxilla. Abbreviations: *dms* – dorsal malar s., *vms* – ventral malar s., *mpxs* – maxillary palps s., *mbs* – basioventral s., *pfs* – palpiferal s., *stps* – stipital s., *prms* – premental s., *pms* – postmental s., *ligs* – ligular s.

Antennae bearing one very long conical sensorium, and basal membranous article with four sensilla different in length, three behind conical sensorium, and one ahead of it (Fig. 73).

Clypeus (Fig. 75) approximately 2.5–3 times as wide as long with two short to very short *cls*, localized posterolaterally, *cls*₁ slightly longer than *cls*₂, and one sensillum between them; anterior margin sinuate.

Mouthparts. Labrum (Fig. 75) less than two times as wide as long, with three piliform *lms*, different in the length; *lms*₁ located medially, *lms*₂ located anteromedially, and *lms*₃ located anterolaterally; *lms*₁ long, *lms*₂ medium size, and *lms*₃ distinctly shorter than the previous two; no one distinctly reaches labral margin. Epipharynx (Fig. 76) with three long finger-like *als*, all of identical in length; with two *ams* in different length, *ams*₁ piliform of medium size, and finger-like short *ams*₂; without *mes*; labral rods (lr) indistinct, slightly elongated, oval. Mandibles (Fig. 74) bifid; bearing with two setae of medium to long size, piliform, both located apically. Maxilla (Fig. 77) stipes with very long *stps* and *pfs*₁, long *pfs*₂, very short to minute *mbs*, and one sensillum close to *mbs*; mala with six finger-like *dms*, different in lengths: first very long (as long as *pfs*₂), next medium size; five *vms*, different in length, two setae medium size, and three setae very short. Maxillary palpi: basal palpomere with one short *mxps* and two sensilla; distal palpomere with short, cuticular apical processes; length ratio of basal and distal palpomeres 1:0.9. Prelabium (Fig. 77) with one short *prms*; ligula with two very short to minute *ligs*; premental sclerite narrow, ring-shaped. Labial palpi with two palpomeres; length ratio of basal and distal palpomeres 1:0.8; each of the palpomeres with one sensillum, distal palpomere with short, cuticular apical processes. Postlabium
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(Fig. 77) with short *pms*$_1$ located basally, long *pms*$_2$ located medially and short *pms*$_3$ located apically; membranous area without any asperities.

**Thorax.** Prothorax (Fig. 78) with nine very long and one very short to minute *prns*, small pigmented dorsal sclerite present with seven long *prns*, this sclerite subdivided in two triangular plates medially; two very long to long *ps*; and one medium *eus*. Meso- and metathorax (Fig. 78) with one medium *prs*, three very long *pds*; one very long...
as; two very long and one very short to minute ss; one long eps; one long ps; and one medium to long eus. Each pedal area of the thoracic segments with 5–6 very long pda.

**Abdomen.** Abdominal segments I–VII (Figs 79–80) with one medium to long prs; two medium to short and one very long to long pds (order: medium/short, very long, medium); one very long and one minute ss; two long eps; one medium to short ps; one medium to short lsts; and one medium to short and one very short to minute eus. Abdominal segment VIII (Fig. 80) with one very short prs; two short and one long to relatively long pds (order: short, long, short); one long and one minute ss; two very long eps; one medium to short ps; one medium to short lsts; and one medium to short and one very short to minute eus. Abdominal segment IX (Fig. 80) with two relatively long and two short to very short ds; two relatively long and sometimes one minute ps; and one relatively long to short and one short to very short lsts. Abdominal segment X (Fig. 80) with one very short seta (ts).

**Biology.** Larvae live and pupate in the capsules of several species of *Campanula* (C. *cochleariifolia* Lam., C. *patula* L., C. *persicifolia* L., C. *rapunculoides* L., C. *rapunculus* L., C. *rotundifolia* L., C. *scheuchzeri* Vill., C. *trachelium* L.), and *Phyteuma spicata* L. where they cause distinct swelling (Hoffmann 1958; Buhr 1964)

**Remarks.** This species has a wide European distribution and is very similar to *M. ajugae*. Only the examination of the penis allows easy separation of these two taxa. Therefore, as reported in the Remarks of *C. ajugae*, the discovery of clearly distinctive characters between the larvae of these two species is extremely important. Moreover, larvae of *M. campanulae* differ from the two other species studied mainly by an epipharynx without mes, and des_4 and fs_3 absent.

**Key to larvae (mature larva, L3)**

The following key is based on the larvae of five *Cleopomiarus* and three *Miarus* species described in this paper. Unfortunately, the previous description of *Cleopomiarus hispidulus* (Anderson 1973) cannot be included due to missing details about the chaetotaxy used in our key.

1 Mala with 6 finger-like dms, all more or less in equal length (Figs 7, 17, 27, 37, 47)................................. *Cleopomiarus 2*
   - Mala with 6 finger-like dms, in two sizes; 1 or 2 dms very long and rest of them in medium length (Figs 57, 67, 77) ................................................. *Miarus 6*
2 Fs_3 long, almost as long as fs_4 (Fig. 42)............................. *C. meridionalis*
   - Fs_3 short or very short, always distinctly shorter than fs_4 (Figs 2, 12, 22, 32)3
3 Postlabium with medium size pms, and pms_3, and very long pms_2 (Fig. 7). Membranous area of postlabium basolaterally finely asperate (Fig. 7)..... *C. distinctus*
   - Postlabium with short pms, and pms_3, and very long pms_2 (Figs 17, 27, 37). Membranous area of postlabium basolaterally sparsely and distinctly asperate (Figs 17, 27, 37) ................................................. 4
Antennae bearing one medium size conical sensorium, and 4 sensilla (Fig. 23). Dorsal setae (except des₄) extremely long (Fig. 22). Head width over 1.05 mm. Prothorax with 8 very long and 1 very short to minute prns (Fig. 28). Body length over 6.60 mm .................................................. C. longirostris
– Antennae with very long conical sensorium, and 3 sensilla (Figs 13, 33). Dorsal setae (except des) long (Figs 12, 32). Head width under 0.80 mm. Prothorax with 9 very long and 1 very short to minute prns (Figs 18, 38). Body length under 6.30 mm .................................................. C. medius
Cyprinus (Fig. 35) broad, approximately 4.25 times as wide as long; labrum 2.0 times as wide as long ............................................... C. graminis
– Clypeus (Fig. 15) narrow, 2.5–3 times as wide as long ............................................... C. graminis
Mala with 6 finger-like dms, different in length: 1 seta very long as pfs₁, and 5 setae in medium length (Fig. 77). Epipharynx (Fig. 76) without mes. Des₄ and f₃ absent (Fig. 72) .................................................. M. campanulae
– Mala with 6 finger-like dms, different in length: 2 setae elongated, and 4 setae in medium length (Figs 57, 67). Epipharynx (Figs 56, 66) with 1–2 mes. Des₄ and f₃ present (Figs 52, 62) .................................................. M. ajugae
– Epipharynx (Fig. 66) with 2 mes, first finger-like, second sharp and slender. Antennae with very long conical sensorium (Fig. 63) ............................................... M. abnormis

**Description of pupae**

**Genus Cleopomiarus** Pierce, 1919

**Description.** Measurements (in mm). Body length: 3.00–6.50. Body width: 1.50–3.80. Head width: 0.65–1.10.

Body moderately slender or stout. Smooth, dark brown or black spotted cuticle. Rostrum long or very long, from four to five times as long as wide, reached up to meso- or metacoxae. Antennae elongated. Pronotum from 2.2 up to 2.9 times as wide as long. Mesonotum distinctly shorter than metanotum. Abdominal segments I–V of equal length; abdominal segments VI and VII diminish gradually; abdominal segment VIII almost semicircle; abdomen segment IX distinctly reduced. Spiracles on abdominal segments placed dorsolaterally: on abdominal segments I–V functional; and on segment VI atrophic on next ones invisible. Urogomphi (ur) stout and short, conical, each of them with sclerotized apex.

*Chaetotaxy*: setae piliform, in a different size. Head capsule with 0–1 vs, 0–1 sos, and two os. Rostrum with 0–1 pas and one rs (placed medially and apically). Pronotum with: two as, one ds, 1–2 sls, 0–1 ls and three pls. Setae on head, rostrum and pronotum
very thin, light and relatively short. Dorsal parts of meso- and metathorax with 2–3 setae placed medially. Apex of each femora with one fes. Abdominal segments I–VIII with two setae laterally and sometimes 2–3 short setae ventrally. Dorsal parts of abdominal segments I–VII with 4–5 setae, and abdominal segment VIII with 3–4 setae dorsally. Abdominal segment IX with 2–4 micro-setae ventrally.

_Cleopomius distinctus_ (Boheman, 1845)
Figures 81–84

**Material examined.** 12 specimens: 2 ♂; 2 ♀, 03.08.2010, Gródek ad Hrubieszów, CE Poland, leg. E. Szwaj, det. J. Łętowski; 2 ♂; 6 ♀, ex seed capsules of *Campanula cervicaria* L., 05.07.2017, Stara Planina, east Serbia, leg. I. Toševski, det. R. Caldara.

**Description. Measurements** (in mm). Body length: 3.00–4.10 (mean 3.20). Body width: 1.50–2.60 (mean 1.80). Head width: 0.65–0.77 (mean 0.67).

*Body* moderately slender (Figs 81–84). Rostrum long, approximately 4.0 times as long as wide, reached up to mesocoxae. Antennae moderately elongated. Pronotum 2.2 times as wide as long. Urogomphi (ur) stout (Figs 81–84).

*Chaetotaxy:* setae very thin, greyish, piliform, medium size to short. Head capsule with only two os of different in length (second pair placed on eye spots). Rostrum with one pas and one rs (Figs 82, 83). Pronotum with: two as, one ds, one sls, and three pls (Figs 83, 84). All setae of prothorax almost equal in length (Fig. 83). Dorsal parts of meso- and metathorax with three setae placed medially. Apex of each femora with one fes (Figs 82–84). Abdominal segments I–VIII with two setae laterally. Dorsal parts of abdominal segments I–VII with four setae: d1–3 placed postero-medially, d4 postero-laterally, abdominal segment VIII with only three setae dorsally. Abdominal segment IX with two micro-setae ventrally.

_Cleopomius graminis_ (Gyllenhal, 1813)
Figures 85–88

**Material examined.** 15 specimens: 2 ♂, 3 ♀, 27.07.2010, Wólka ad Lublin, CE Poland, leg. E. Szwaj, det. J. Łętowski; 4 ♂, 2 ♀, ex seed pods of *Adenophora liliifolia*, Dobra, Iron Gate, east Serbia, leg. I. Toševski, det. R. Caldara; 4 ♀, ex seed pods of *Campanula macrostachya*, 13.07.2015, Dobra, Iron Gate, east Serbia, leg. I. Toševski, det. R. Caldara.

**Description. Measurements** (in mm). Body length: 3.60–4.10 (mean 3.70). Body width: 2.10–2.25 (mean 2.15). Head width: 0.65–0.70 (mean 0.67).

*Body* moderately slender (Figs 85–88). Rostrum long, approximately four times as long as wide, reached up to mesocoxae. Antennae slender and elongated. Pronotum 2.9 times as wide as long. Urogomphi (ur) moderately stout (Figs 85–88).
**Figure 81.** *Cleopomiarus distinctus* pupa habitus, ventral view.

Chaetotaxy: setae very thin, greyish, piliform, medium size to short. Head capsule with one *vs*, one *sos*, and two *os* of different length (second pair placed on eye spots). Rostrum with one *pas* and one *rs* (Figs 86, 87). Pronotum with: two *as*, one *ds*, two *sls*, one *ls*, and three *pls* (Figs 87, 88). All setae of prothorax equal in length (Fig. 88). Dorsal parts of meso- and metathorax with three setae placed medially. Apex of each femora with one *fes* (Figs 86, 87). Abdominal segments I–VIII with
**Figures 82–84.** *Cleopomiarus distinctus* pupa habitus and chaetotaxy. 82 Ventral view 83 Lateral view 84 Dorsal view. Abbreviations: *d* – dorsal s., *ds* – discal s., *fes* – femoral s., *l* – lateral s., *os* – orbital s., *pas* – postantennal s., *pls* – posterolateral s., *rs* – rostral s., *sls* – super lateral s., *v* – ventral s., *ur* – urogomphi.
two setae laterally and three micro setae ventrally. Dorsal parts of abdominal segments I–VII with four setae: $d_{1-3}$ postero-medially, and $d_4$ postero-laterally. Abdominal segment VIII with four setae dorsally. Abdominal segment IX with four micro-setae ventrally.

Figure 85. Cleopomiarus graminis pupa habitus, ventral view.
Figures 86–88. *Cleopomiarus graminis* pupa habitus. 86 Ventral view 87 Lateral view 88 Dorsal view. Abbreviations: \(d\) – dorsal s., \(ds\) – discal s., \(fes\) – femoral s., \(ls\) – lateral s., \(os\) – orbital s., \(pas\) – postantennal s., \(pls\) – posterolateral s., \(rs\) – rostral s., \(sls\) – super lateral s., \(sor\) – super orbital s., \(v\) – ventral s., \(vs\) – vertical s., \(ur\) – urogomphi.


*Cleopomiarus longirostris* (Gyllenhal, 1838)

Figures 89–92

**Material examined.** 18 specimens: 8 ♂, 10 ♀, south eastern France, Menton, July 2007, ex seed capsules of *Campanula trachelium* L., leg. and det. R. Caldara

**Description.** *Measurements* (in mm). Body length: 5.20–6.50 (mean 5.60). Body width: 3.00–3.80 (mean 3.30). Head width: 0.90–1.10 (mean 1.00).

*Body* stout (Figs 89–92). Rostrum very long, almost five times as long as wide, reached almost up to metacoxae. Antennae slender and moderately elongated. *Pronotum* 2.5 times as wide as long. Urogomphi (ur) short (Figs 90–92).

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**Figure 89.** *Cleopomiarus longirostris* pupa habitus, ventral view.
Figures 90–92. Cleopomiarus longirostris pupa habitus. 90 Ventral view 91 Lateral view 92 Dorsal view. Abbreviations: d – dorsal s., ds – discal s., es – epistomal s., fes – femoral s., ls – lateral s., os – orbital s., pas – postantennal s., pls – posterolateral s., rs – rostral s., sls – super lateral s., sos – super orbital s., v – ventral s., vs – vertical s., ur – urogomphi.
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**Chaetotaxy:** sparse, setae very thin, short, piliform. Head capsule with one vs, one sos, and two os of different length (second pair placed on eye spots). Rostrum with one rs and one es (Figs 90, 91). Pronotum with: two as, one ds, one ls, one sls, and three pls (Figs 91, 92). All setae of prothorax equal in length (Fig. 92). Dorsal parts of meso- and metathorax with two setae placed medially. Apex of each femora with one fes (Figs 90–92). Abdominal segments I–VIII with two setae laterally and three medium long setae ventrally. Dorsal parts of abdominal segments I–VII with five setae: d₁ placed antero-medially, d₂–₄ postero-medially, d₅ postero-laterally. Abdominal segment VIII with only three setae dorsally. Abdominal segment IX with two micro-setae ventrally.

*Cleopomiarus medius* (Desbrochers des Loges, 1893)

Figures 93–96

**Material examined.** 4 specimens: 2 ♂, 2 ♀, ex seed capsules of *Campanula lingulata* Waldst. and Kit., 26.06.2017, Staničenje, Pirot, east Serbia, leg. I. Toševski, det R. Caldara.

**Description.** *Measurements* (in mm). Body length: 4.40–4.60. Body width: 2.40–2.50. Head width: 0.70–0.80.

*Body* moderately stout (Figs 93–96). Rostrum very long, approximately 4.5 times as long as wide, reached beyond mesocoxae. Antennae slender and moderately elongated. Pronotum 2.4 times as wide as long. Urogomphi (ur) stout (Figs 94–96).

**Chaetotaxy:** sparse, setae short to very short, light, piliform. Head capsule with one very short vs, and two os of different length, both placed between eye spots. Rostrum with one rs (Figs 94, 95). Pronotum with: two as, one ds, two sls, one ls and three pls (Figs 95, 96). All setae of prothorax equal in length (Fig. 96). Dorsal parts of meso- and metathorax with three setae placed medially. Apex of each femora with one fes (Figs 94, 95). Abdominal segments I–VIII with two setae laterally and three medium long setae ventrally. Dorsal parts of abdominal segments I–VII with four setae: d₁,₃ postero-medially, d₄ postero-laterally. Abdominal segment VIII with only three setae dorsally. Abdominal segment IX with four micro-setae ventrally.

**Genus Miarius** Schoenherr, 1826

**Description.** *Measurements* (in mm). Body length: 3.20–4.00. Body width: 1.90–2.70. Head width: 0.55–0.70.

*Body* moderately slender or stout. Smooth, dark brown or black spotted cuticle. Rostrum long or very long, from 2.3 up to 3.5 times as long as wide, reached up to meso- or metacoxae. Antennae elongated. Pronotum from 2.1 up to 2.5 times as wide as long. Mesonotum distinctly shorter than metanotum. Abdominal segments I–V of equal length; abdominal segments VI and VII diminish gradually; abdominal segment VIII almost semicircle; abdomen segment IX distinctly reduced. Spiracles on abdomi-
nal segments placed dorsolaterally: on abdominal segments I–V functional; and on segment VI atrophic on next ones invisible. Urogomphi (ur) slender and elongated, conical, each of them with sclerotized apex.

Chaetotaxy: setae piliform, in a different size. Head capsule with one vs, one sos, and 3–4 os. Rostrum with one pas and three rs (placed medially and apically). Prono-
Figures 94–96. Cleopomiaurus medius pupa habitus. 94 Ventral view 95 Lateral view 96 Dorsal view. Abbreviations: d – dorsal s., ds – discal s., fes – femoral s., ls – lateral s., os – orbital s., pas – postantennal s., pls – posterolateral s., rs – rostral s., sls – super lateral s., v – ventral s., vs – vertical s., ur – urogomphi.
tum with: two as, two ds, two sls, one ls and three pls. All setae of prothorax almost equal in length. Dorsal parts of meso- and metathorax with three setae placed medially. Apex of each femora with one fes. Abdominal segments I–VIII with two setae laterally and sometimes 3–4 short setae ventrally. Dorsal parts of abdominal segments I–VII with 4–5 setae, and abdominal segment VIII with 3–4 setae dorsally. Abdominal segment IX with 4–6 micro-setae ventrally.

Miarus abnormis Sollari, 1947
Figures 97–100

Material examined. 3 specimens: 1 ♂, 2 ♀, north-eastern Italy, Venezia Giulia, Duino (Trieste), Rilke path, August 2017, ex galls on capsules of *Campanula pyramidalis* L., leg. E. Tomasi, det. R. Caldara.

Description. Measurements (in mm). Body length: 3.55–3.60. Body width: 1.90–2.00. Head width: 0.55–0.60.

Body moderately slender (Figs 97–100). The cuticle densely covered with asperities. Rostrum medium length, approximately 2.3 times as long as wide, reached up to mesocoxa. Antennae moderately elongated. Pronotum 2.1 times as wide as long. Urogomphi (ur) slender and elongated, conical, each of them with sclerotized apex (Figs 98–100).

Chaetotaxy: setae brownish to dark brown, piliform, short to medium size. Head capsule with one vs, one sos, and three os of equal length; rostrum with three rs (rs₁ and rs₂ placed medially, rs₃ more apically) and one es (Figs 98, 99). Pronotum with: two as, two ds, two sls, one ls and three pls (Figs 99, 100). Setae on head and rostrum slightly shorter than those on prothorax. All setae of prothorax almost equal in length (Fig. 100). Mesothorax with three setae placed medially; metathorax with three setae placed laterally. Apex of each femora with one fes (Figs 98–100). Abdominal segments I–VIII with two short, thin setae laterally and three short setae ventrally. Dorsal parts of each abdominal segments I–VIII with four setae: d₁–₃ placed postero-medially, d₄ postero-laterally. Abdominal segment IX with six micro-setae ventrally.

Miarus ajugae (Herbst, 1795)
Figures 101–104

Material examined. 12 specimens: 2 ♂, 1 ♀, 24.08.2009, Ciechanki, CE Poland, leg. E. Szwaj, det. J. Łętowski; 3 ♂, 2 ♀, 30.06.2017, ex galls on capsules of *Adenophora liliifolia*, 30.06.2017, Kaludjerske Bare, Mt. Tara, Central Serbia, leg. I. Toševski, det. R. Caldara; 3 ♂, 1 ♀, ex galls on capsules of *Campanula bononiensis*, 14.07.2017, Zavojsko jezero, Pirot, east Serbia, leg. I. Toševski, det. R. Caldara.

Description. Measurements (in mm). Body length: 3.20–4.00 (mean 3.40). Body width: 1.90–2.70 (mean 2.10). Head width: 0.65–0.70 (mean 0.65).
Body rather stout (Figs 101–104). Rostrum moderately elongated, approximately 3.5 times as long as wide, reached almost up to metacoxae. Antennae rather stout and moderately elongated. Pronotum 2.5 times as wide as long. Urogomphi (ur) slender and elongated (Figs 102–104).

Chaetotaxy: setae piliform, greyish to dark brown, different in length, short to medium size. Head capsule with one rs, one sos, and four os of different length (fourth placed on eye spots). Rostrum with one pas, and three rs (rs₁ and rs₂ placed medially, rs₃ more apically) and one es (Figs 102, 103). Pronotum with: two as, two ds, one ls, two sls, and three pls (Figs 103, 104). All setae of prothorax equal in length (Fig. 104). Dorsal parts of meso- and metathorax with three setae placed medi ally. Apex of each femora with one fes (Figs 102, 103). Abdominal segments I–VIII with two setae laterally and four medium
Figures 98–100. Miarus abnormis pupa habitus. 98 Ventral view 99 Lateral view 100 Dorsal view. Abbreviations: d – dorsal s., ds – discal s., es – epistomal s., fes – femoral s., l, ls – lateral s., os – orbital s., pas – postantennal s., pls – posterolateral s., rs – rostral s., sls – super lateral s., sos – super orbital s., v – ventral s., vs – vertical s., ur – urogomphi.
long setae ventrally. Dorsal parts of abdominal segments I–VII with five setae: $d_1$ placed antero-medially, $d_{2-4}$ postero-medially, $d_5$ postero-laterally, and abdominal segment VIII with only three setae dorsally. Abdominal segment IX with four micro-setae ventrally.
Figures 102–104. *Miarus ajugae* pupa habitus. 102 Ventral view 103 Lateral view 104 Dorsal view. Abbreviations: d – dorsal s., ds – discal s., es – epistomal s., fes – femoral s., l, ls – lateral s., os – orbital s., pas – postantennal s., pls – posterolateral s., rs – rostral s., sls – super lateral s., sos – super orbital s., v – ventral s., vs – vertical s., ur – urogomphi.
Key to pupae

The following key is based on pupae of four *Cleopomiarus* and two *Miarus* species described in this paper. Unfortunately, the description of *Cleopomiarus hispidulus* published previously (Anderson 1973) could not be included due to missing details about the chaetotaxy used in our key.

1 Rostrum with 1 *rs* (Figs 82, 86, 90, 94). Setae on head, rostrum and pronotum very thin, light and relatively short (Figs 83, 87, 91, 95). Pronotum with 1 *ds* (Figs 84, 88, 92, 96). Urogomphi stout and short (Figs 82, 86, 90, 94) ........ 2 *Cleopomiarus*

– Rostrum with 3 *rs* (Figs 98, 102). Setae on head, rostrum and pronotum brown, prominent and relatively long (Figs 99, 103). Pronotum with 2 *ds* (Figs 100, 104). Urogomphi relatively slender and elongated (Figs 100, 104) ................. 5 *Miarus*

2 Rostrum extremely elongated (at least 4.5 times as long as wide) (Figs 89, 93). Head with 2 *os* (Figs 90, 94)................................. 3

– Rostrum elongated (ca. 4.0 times as long as wide) (Figs 81, 85). Head with 3 *os* (Figs 82, 86)................................................................. 4

3 Body length over 5.20 mm; head width over 0.90 mm. Pronotum with 1 *sls; es* present (Fig. 91) .................................................. *Cleopomiarus longirostris*

– Body length under 4.60 mm; head width under 0.80 mm. Pronotum with 2 *sls; es* absent (Fig. 95) .................................................. *C. medius*

4 *Vs* and *sos* present (as long as other setae on head) (Fig. 86). Pronotum with 2 *sls* (Fig. 87). Abdominal segments I–VII with 3 ventral setae (Fig. 87).............. 6 *C. graminis*

– *Vs* and *sos* absent (or as microsetae) (Fig. 82). Pronotum with 1 *sls* (Fig. 83). Abdominal segments I–VII without ventral setae (Fig. 82) ...... *C. distinctus*

5 Body length usually over 3.60 mm (Fig. 101). Head width over 0.65 mm. Head with 4 *os* (Fig. 102)................................................. *Miarus ajugae*

– Body length usually under 3.50 mm (Fig. 97). Head width under 0.60 mm. Head with 3 *os* (Fig. 98)................................................. *M. abnormis*

Discussion

Comparison with immature stages of known Mecinini

Presently, it is somewhat difficult to compare the immatures of *Cleopomiarus* and *Miarus*, which we have just described, with those of other genera of the Mecinini. As above reported, the description of most of the 19 species previously described is somewhat problematic because of missing details about the chaetotaxy and/or absence of quality drawings. Only the recent descriptions of three species of *Gymnetron* (Jiang and
Zhang 2015) and one species of *Rhinusa* (Gosik 2010) are useful for a comparison with our data, although some categorizations of setae in the former paper are very disputable (e.g., thoracic and abdominal dorsal setae) and create an unfounded differential diagnosis, precluding the construction of a key to the tribe. Having said this, we think that there are important but still disputable character states within the tribe Mecinini.

The most important morphological character of larvae in this tribe is probably the count of palpomeres on the labial palpi. The basal state in weevils is the presence of two palpomeres on labial palpi (Marvaldi 1997), but it is known that *Gymnetron* species has only one palpomere (May 1993; Jiang and Zhang 2015). The count of these palpomeres in some descriptions in this paper, mainly in *Cleopomiarus*, is disputable. There is not a distinct separation of basal palpomere from the labium, which can appear to be only one palpomere. This state in *Cleopomiarus* and partially in *Miarus* could be an intermediate stage in the reduction in the *Gymnetron* species; however, this should be compared with other Mecinini genera such as *Rhinusa* and *Mecinus* and discussed only within the whole tribe.

Another crucial genus-specific character in Mecinini larvae is the state of the thoracic and abdominal spiracles. All known larvae of *Cleopomiarus* and *Miarus* species have bicameral spiracles on the thorax and abdomen, but other groups within tribe have only unicameral spiracles (*Gymnetron* species; Jiang and Zhang 2015) or thoracic spiracle bicameral and abdominal spiracles unicameral (some *Rhinusa* and *Mecinus*; Anderson 1973; May 1993).

The count of some setae on the epipharynx (especially *ams* and *mes*) in Curculionidae has not been completely resolved, but this has been discussed in previous papers (e.g., Tychiini: Skuhrovec et al. 2014, 2015; Gosik et al. 2017). According to Marvaldi (1998, 1999), the standard status of the epipharyngeal setae in weevils is two *ams* and three *mes*, but when the position of the distal *mes* is very close to the anterior margin, it appears as *ams*. There are also situations with some out of line positions of the *als* where the position is very close to the tormae (then it appears to be a *mes*) or close to the *ams*. The final decision about the count of each seta is important, but not crucial, and the comparison between groups/genera should be done together for all three of these epipharyngeal setae in order to make fewer mistakes in the creation of a differential diagnosis of genera in the tribe.

The last observed important characteristic within the Mecinini tribe is the vestiture of the body with distinct asperities; however, this feature can be variable within each genus due to specific environmental conditions within plant tissues. This feature will possibly be discussed after other detailed descriptions within the Mecinini tribe.

**Comparison of the immature stages of Cleopomiarus and Miarus**

Before this study, larvae of only two *Cleopomiarus* species (*C. graminis* and *C. hispidulus*) and one *Miarus* species (*M. campanulae*) had been described (Emden 1938; Scherf 1964; Anderson 1973), while a description of the pupae was available for *C. hispidulus* (Anderson 1973). Therefore, a detailed redescription of the two species, *Cleopomiarus graminis* and *Miarus campanulae*, has been necessary for their incorporation into the key. The previous descriptions were almost without the chaetotaxy with a few excep-
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Urban’s study revealed the importance of examining both larvae and pupae to ensure accurate identification (Urban 2002). This is because the number of characters that can be observed is higher in pupae than in larvae. For example, the male of C. longirostris has one or two very long dms, whereas M. ajugae has six finger-like dms of two sizes. However, these differences are less distinctive in the larvae, where the number of characters that can be observed is lower. Therefore, the comparison of immatures is essential for the study of weevil diversity and taxonomy.

Our study shows that all the species considered can be identified by the examination of larvae and pupae based on at least one character state. This is noteworthy because several taxa examined only by the study of imagos were difficult to separate. Therefore, finding distinctive supplementary characters is welcome. This is true especially for C. longirostris vs C. graminis and especially M. ajugae vs M. campanulae. The latter case is particularly emblematic. In these two taxa the adults may be separated by the shape of the apical part of the penis. On the contrary they seem indistinguishable on the basis of barcoding (Vahtera and Muona 2006; Hendrich et al. 2015).

Importance of molecular data

We have confirmed that a molecular study of immatures is very important in cases where it is necessary to be sure on the identity of a species as already demonstrated by Horecka et al. (2017) just for Miarus and Cleopomiarus. This is true especially when it is known that more than one related species can live on the same plant or when imagos are not available or finally when one has to study specimens not personally collected and preserved in a museum. It is noteworthy that the data filed on GenBank or BOLD are becoming larger and larger and therefore more and more useful for such an adequate comparison. Therefore, it is also important to continue to implement these data. In this regard, it is noteworthy that we reported the barcode of C. medius for the first time.
Biological considerations

It is obvious that only a careful search of immature and a careful study of their biological cycle can distinguish true host plants from those used only as a refuge or adult food when the host plants are not yet or no longer available. Our observations confirm that the species of both genera *Cleopomiarus* and *Miarus* are monophagous, although never strictly monophagous, to oligophagous (Bernays and Chapman 1994). Moreover, our data show that the larvae of *Miarus* are gall-inducers as previously reported (Buhr 1964; Tomasi 2002) but that the *Cleopomiarus* species do not form galls. However, this apparently different biological behaviour requires confirmation, since it is well known that several closely related species of Mecinini, especially in the genera *Gymnetron* and *Rhinusa*, do not have the same behaviour with regard to induction of galls (Caldara 2008; Caldara et al. 2010).

Conclusions

Our data show that detailed descriptions of the immature stages of the Mecinini species are important for further studies of generic taxonomic relationships within the Mecinini group. The detailed descriptions of larvae and pupae of five *Cleopomiarus* and three *Miarus* species are reported in this study. Although the number remains low in comparison with the total number of species of *Cleopomiarus* and *Miarus*, these results demonstrate the possibility of identifying the immature stages in these species, as was done in other groups of weevils (see Skuhrovec et al. 2014, 2015). This is our first paper about the Mecinini group. Detailed descriptions of the genera *Gymnetron*, *Rhinusa*, and *Mecinus* and a tribe overview will be published soon.

Acknowledgements

The study was supported by a grant from the Czech Ministry of Agriculture (Mze ČR) RO0418 to J. Skuhrovec and a grant from the Ministry of Education, Science and Technological Development of the Republic of Serbia III43001 to I. Toševski. The language was corrected by American Journal Experts company.

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