

Dicopus minutissimus Enock (Hymenoptera: Mymaridae), representative of a genus and species new to Romania, with notes on other species

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Abstract. In this paper we review *Dicopus* Enock (Hymenoptera: Mymaridae), a genus new to the Romanian fauna. Only one European species has been identified in Romania: *Dicopus minutissimus* Enock. We present the genus *Dicopus* and add new characters for genus and species. We illustrate the species distribution and morphology of the wings, antennae, head, thorax and abdomen. The male genitalia is described and general biometry for females and males presented. The hind tibia has an apical tooth and the female clava has a distal emargination, two characters which are here recognized for the first time in the genus.

Key words: *Dicopus minutissimus*, Mymaridae, new genus and species record, Romania.

Introduction

Fourteen valid genera of mymarid egg parasitoids, known as fairy flies, are recognized from Romania (Pricop 2008a,b): *Alaptus* Westwood, *Anagrus* Haliday, *Anaphes* Haliday, *Arescon* Walker, *Campoplex* Foerster, *Cleruchus* Enock, *Erythmelus* Enock, *Gonatocerus* Nees, *Litus* Haliday, *Mymar* Curtis, *Ooctonus* Haliday, *Polynema* Haliday, *Stephanodes* Enock and *Stethynium* Enock. Here, we present the first record of the genus *Dicopus* Enock, 1909 (Hymenoptera: Mymaridae) in Romania, and the species *Dicopus minutissimus* on the European mainland.

Ten species have been described worldwide: *Dicopus minutissimus* Enock and *Dicopus cervus* Morley from the United Kingdom; *Dicopus citri* Mercet from Spain; *Dicopus halitus* Girault from Canada (Quebec); *Dicopus enocki* Doutt and *Dicopus pygmaeus* Doutt from the United States of America (California); *Dicopus longipes* (Subba Rao) from India; *Dicopus bidentiscapus* Girault from Australia (Victoria); *Dicopus psyche* Girault from Fiji and *Dicopus lilliput* Mathot from The Democratic Republic of Congo (Zaire); all species are listed in Noyes (2003).

The species described in 1930 by C. Morley as *D. cervus* obviously does not belong to the family Mymaridae (Ogloblin, 1956). Two species have been recorded from Europe: *D. minutissimus* and *D. citri* (Schauff, 1984).

This is the first time when the European species of *Dicopus* (females) are compared and the male of *D. minutissimus* is properly described and compared with the female.

Materials and methods

Specimens were collected during 2008–2009 from two different locations in North Eastern Romania (Fig. 1a, b): from Pietrosul Bistritei Mountain – Sunatorii stream dominated by *Picea abies* (L.) Karst (Fig. 1b, d), and Poiana Stampei Bog Reserve, where *Pinus sylvestris* L. var. *turfoasa* grows in addition to *P. abies* (Fig. 1b, c) (Suceava county). The specimens were collected using an entomological sweep net. All specimens of *D. minutissimus* are deposited in the personal collection of the first author.

All specimens were mounted in Faure's medium (30 g arabic gum, 50 g chloral hydrate, 20 ml glycerin, 50 ml distilled water). For accurate examination and measurements the appendages from one side of the body of some specimens were removed and slide mounted. Tips of the abdomens were dissected and genitalia removed and slide mounted. Photographs were taken using an Olympus digital camera attached to an Euromex optical microscope. Maps were made using ArcView GIS 3.1 software. All drawings were made by the first author using a camera lucida.

Abbreviations

Abd = abdomen; **Ant** = antenna; **Bd** = body; **Clv** = clava; **comb** = combined; **Cx** = coxa; **C/FWW** = longest marginal cilia of the fore wing/width of fore wing ratio; **Elv** = elevation; **Fem** = femur; **F1-F10** = funicular articles; **FLMC** = longest marginal cilia of fore wing; **FWL** = fore wing length; **FWW** = fore wing width; **Genit** = genitalia; **H** = height; **Hd** = head; **HLMC** = hind wing longest marginal cilia; **HWL** = hind wing length; **HWW** = hind wing wide; **I** = fore leg; **II** = mid leg; **III** = hind leg; **L** = length; **L/W** = length/width ratio of fore wing; **Lgs** = legs; **mm** = millimeters; **Mnd** = mandibles; **n°** = the number of specimens that were measured; **Ovip** = ovipositor; **O/FT** = ovipositor/fore tibia lengths ratio; **Ped** = pedicel; **Scp** = scape; **Trs** = tarsus; **Thx** = thorax; **Tib** = tibia; **Tch** = trochanter; **W** = wide; **Wgs** = wings; **µm** = micrometer.

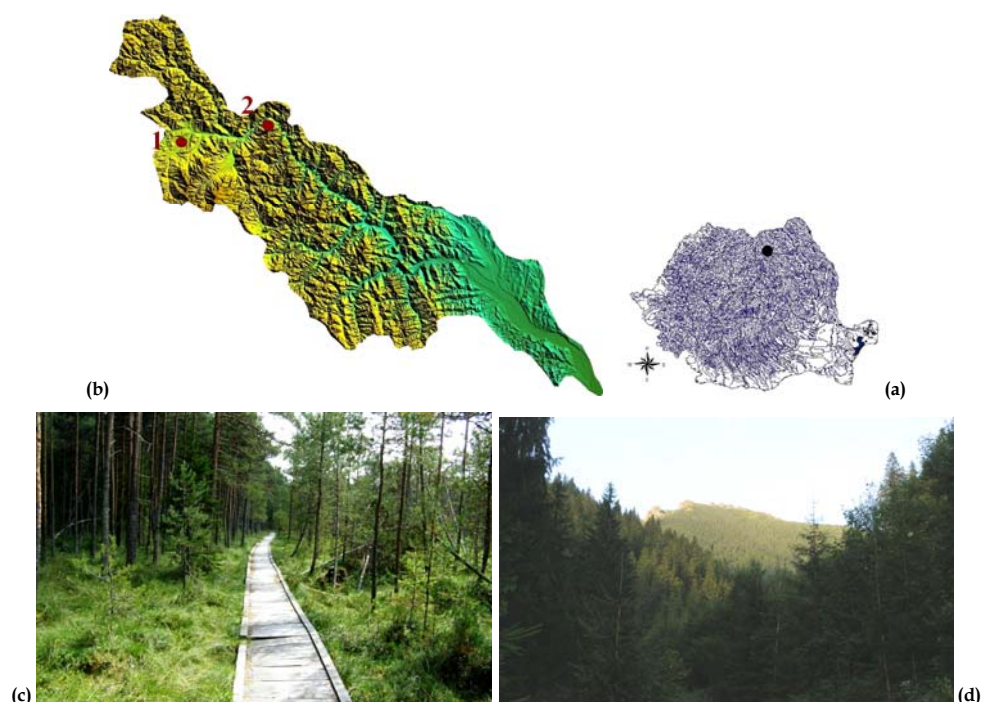


Figure 1. Distribution of *D. minutissimus*: (a) – Romania; (b) – Bistritei River Basin and the collecting sites; (c) – Poiana Stampei (1); (d) – Pietrosul Bistritei-Sunatori (2) (original)

Results and discussion

Genus *Dicopus* Enock 1909: Type species *Dicopus minutissimus* Enock, 1909; England, by monotypy.

Diagnosis: Tarsi five-segmented. Abdomen sessile, phragma projecting into gaster (Fig. 3l). Fore wing oar-shaped, being extremely narrow medially; posterior margin evenly curved, becoming straighter towards apex, oar-shaped (Fig. 3d). Scape with 2 or 3 setaceous teeth (Fig. 3a) (Girault 1929). Face beaklike (Fig. 3g), mandibles projecting downward and away from the head, triangular, not overlapping (Figs. 3e, g) (Lin et al. 2007, Schauff 1984, Yoshimoto 1990, Huber 1997, Albaracin et al. 2009).

The genus *Dicopus* is poorly known (Schauff 1984). It belongs to the *Alaptus* group, containing five genera: *Alaptus* Westwood 1839, *Dicopomorpha* Ogloblin 1956, *Dicopus* Enock 1909, *Kikiki* Huber & Beardsley 2000 and *Mimalaptus* Noyes & Valentine 1989. These genera are grouped by at least one apomorphy: in both sexes the anterior scutellum is separated from the posterior scutellum by a transverse suture that sometimes divides the scutellum into two completely separate sclerites. Schauff

(1984), Viggiani (1988), and Noyes & Valentine (1989) all agree on this well defined group (Lin et al. 2007). A key to the group is given by Huber (2009).

Dicopus is characterized by the following combination of characters: body minute, bullet-shaped, without apparent constriction between mesosoma and metasoma; mesophragma projecting well into gaster (Fig. 3l); mandible with 2 teeth (Fig. 3e); funicle 5- to 7-segmented, clava not segmented (Figs. 2b, 3b, k); scutellum divided by transverse suture into distinctly separate, strongly transverse anterior and posterior sclerites (Fig. 3l). Noyes & Valentine (1989), also mentions: scape moderately long; wings fully developed; fore wing at least about 7.5–10× as long as broad; venation reaching about one quarter along wing; marginal fringe long; hind wing at least about 20× as long as broad. Males are generally very similar to females, but antenna (Fig 3c, f) with 10- segmented flagellum, 2nd segment longer than broad, but often shorter than either 1st or 3rd segment. Like *Alaptus*, members of *Dicopus* are extremely small (0.2–0.3mm), and easily overlooked when collecting (Schauff 1984).

Additional characters in the genus *Dicopus*, that have not been mentioned previously, are: a distal emargination of the antennal clava, wearing a modified trichoid sensilla (Schauff 1984) in the middle of the emargination (Figs. 2b, 3j, k); a propodeal carina appearing as an inverse "Y" (Fig. 3h, l); and an apical tooth or curved projection on the distal part of hind tibia that is 10 µm in size (Fig. 3i). Schauff (1984) mentioned this apical tooth (curved projection) only from the fore-tibia of *Litrus* Haliday 1833.

Generic distribution: Worldwide (Yoshimoto 1990, Lin et al. 2007).

Biology: Schauff (1984), Noyes & Valentine (1989) and Lin et al. (2007) mentioned that the hosts and biology of *Dicopus* are unknown, but the genus has been cited as parasitoid of *Unaspis euonymi* (Comstock) and *Fiorinia florinae* (Targ.-Tozz.) (both Homoptera: Diaspididae) (Huber 1986, Baquero & Jordana 2002). *Dicopus citri* is associated with *Parlatoria pergandei* Comstock (Homoptera: Diaspididae) from branches of orange trees in Valencia, Spain (Mercet 1912), and with scale insects on citrus trees in the Maltese islands (Farrugia 1998).

Dicopus minutissimus is here reported for the first time from Romania. Previously, this species was known only from the type material, collected by Enock from Woking, England. Enock (1909) differentiated *D. minutissimus* with a very important character, that the club is equal in length to antennal segments 6–9 combined, a character that is found in our specimens (Table 1, Fig. 2b, 3b). Mercet (1912) noted that the species *D. citri* has

wider wings (Table 1), compared with *D. minutissimus*, a species with very narrow wings (Table 1) and also the last three segments of the female antenna have different proportions between the two species.

The taxonomic status of the specimen belonging to *Dicopus*, found by Baquero & Jordana (2002) in Spain should be confirmed in relation to *D. minutissimus* as the clava and the last funicle segments are longer and thinner than that of Enock's original description.

Descriptive remarks on *Dicopus minutissimus*:

Head: Similar in females and males (Fig. 3g, l), setae as in Fig. 3g, l. Face with four pairs of setae and a single seta near the middle of the toruli; mandibles with setae also; the occipital region with three pairs of setae, one pair above the occipital foramen, one pair on the lateral margin of the head near the middle of the compound eyes and one pair on the inner side of lateral ocelli.

The ventral part of antennal scape in females and males always has three lateral projections (ventral 'teeth') (Fig. 3a), each with a seta, the dorsal part has two setae. Funicle (F1–F7) in female without sensory ridges (Figs. 2b, 3b), but with many variable trichoid sensilla; antennal clava with four sensory ridges—the two ventral ones are longer than those of dorsal side, few sensilla placodea and many trichoid sensilla are present (Fig. 3b, k). In male antenna the scape and pedicel are just as in the female (Kryger 1950). The male antenna of *D. minutissimus* is composed of 12 segments (Fig. 3c, f), F2 being the smallest; trichoid sensilla are present on each antennal segment,

Tab. 1 Differential characters between females of *Dicopus minutissimus* and *D. citri*.

No.	Characters of:	<i>D. minutissimus</i> Enock	<i>D. citri</i> Mercet
1	Antennae	Clv. L equal to F4, F5, F6 and F7 comb. (Fig. 2b, 3b)	Clv. L equal to F5, F6 and F7 comb. (Fig. 2a)
2	Fore wings	Fore wings narrow, L/W = 7.5–8; C/FWW = 4.1–4.6 (Fig. 3d)	Fore wings a little wider; C/FWW = 2.8

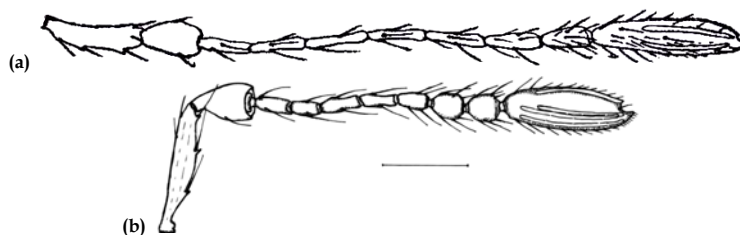


Figure 2. *Dicopus* spp. – ♀ antennae: (a) – *D. citri* (from Mercet, 1912); (b) – *D. minutissimus* (scale = 50 µm) (original)

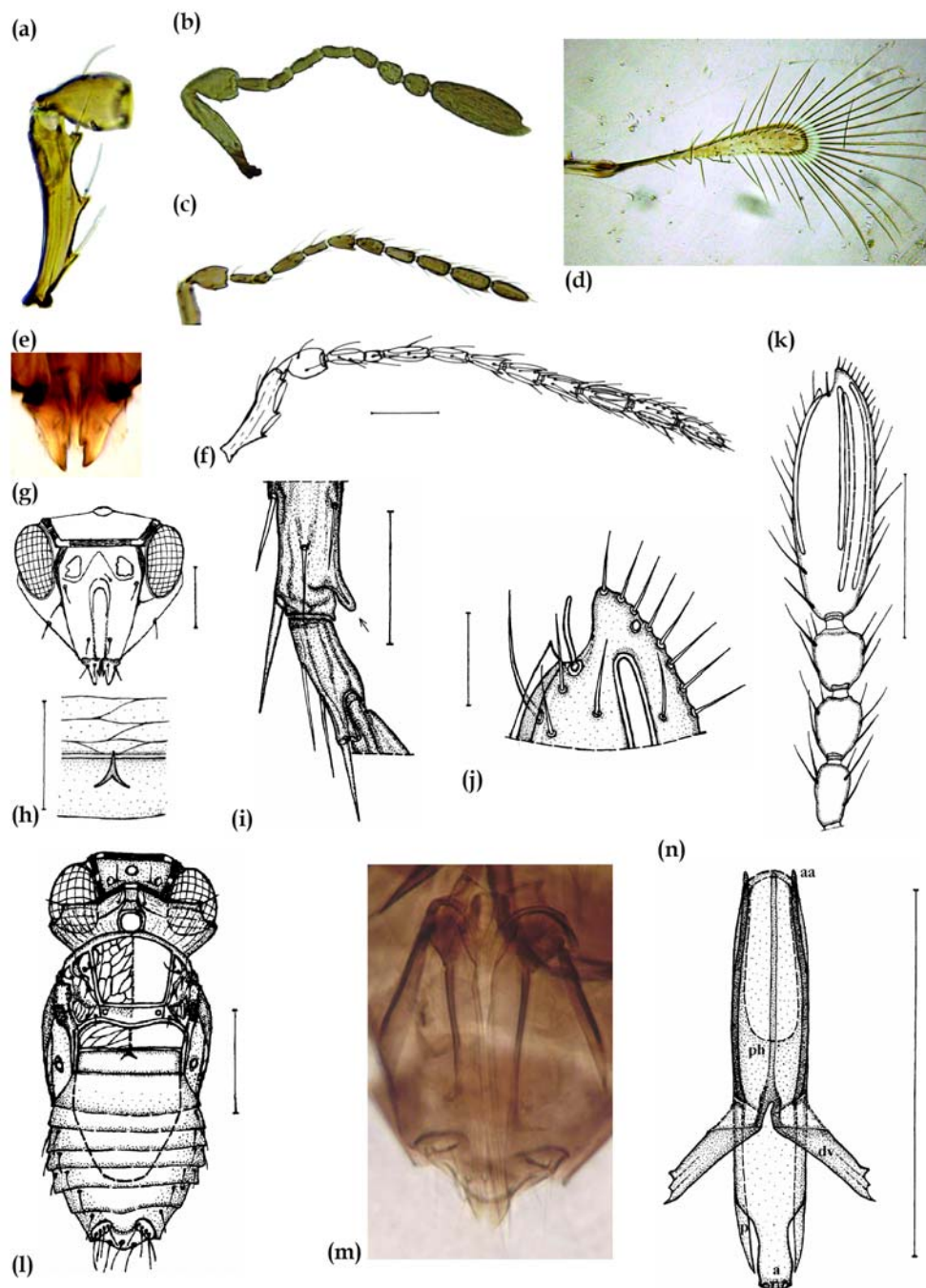


Figure 3. *D. minutissimus*: (a) - ♂ scape; (b) - ♀ antenna; (c, f) - ♂ antenna (scale = 50 µm); (d) - ♂ fore wing; (e) - mandibles; (g) - head (scale = 50 µm); (h) - propodeal carina (scale = 10 µm); (i) - hind tibia showing apical tooth (scale = 50 µm); (j) - distal end of antennal clava (scale = 10 µm); (k) - F5 to F7 and clava (scale = 50 µm); (l) - ♂ head and thorax (scale = 100 µm); (m) - ovipositor; (n) - ♂ genitalia (a - aedeagus, aa - aedeagal apodemes, dv - digitus volsellaris, p - parameres, ph - phallobase) (scale = 50 µm) (original)

sensory ridges are present as follows: F1(2); F2(0); F3(2); F4(0-2); F5-F7(2); F8-F10(3).

Thorax: In males of *D. minutissimus* the thorax as in Fig. 3l, scutum and posterior scutellum reticulated, central lobe of mesoscutum without setae, the lateral lobes of the scutum each with 3-4 setae; anterior scutellum with a pair of placoid sensilla, a setae is present laterally from each sensilla (Fig. 3l). A propodeal carina appearing as an inverse "Y" is always present. In females L/W of the fore wing (mean) = 7.5; C/FWW (mean) = 4.2. Analyzing Enock's measurements we find: fore wing L/W = 8 and C/FWW = 4.6. Fimbria of the fore wing with 33-35 cilia in females, males with 36-41 (Fig. 3d). Fimbria of the hind wing with 22-24 cilia in females, males with 23-28. The fore wing disk in females and males has three rows of cilia (Fig. 3d) (additional to the usual row of submarginal cilia); in female the anterior row: 8 cilia, middle row: 8-9 cilia, hind row: 8 cilia; in males the anterior row: 8-9 cilia, middle row: 8-10 cilia, hind row: 7-9 cilia. The males have larger wings compared with the females and the fringe is longer. The legs are also longer in males than in females.

Abdomen: In females and males the abdominal tergites have 1-2 setae on each lateral margin (Fig. 3l), each cercal plate with 4-5 setae (Fig. 3l). The ovipositor is shorter than the abdomen, only slightly projecting (Fig. 3m), the postphragma overlaps with the ovipositor.

The male genitalia is long, almost cylindrical, narrowed proximally and distally, phallobase united to aedeagus, not strongly sclerotized, with long parameres and with long, strongly sclerotized volsellar digiti, each with three hooklets (Fig. 3n).

Measurements for *D. minutissimus* (micrometers):

Female—Bd L: 356-364; **Hd L:** 42-44, **Hd H:** 155-156; **Hd W:** 131-134; **Mnd L:** 28-29; **Thx L:** 126-131; **Thx W:** 128; **Abd L:** 150-155; **Abd W:** 130; **Ovip L:** 108; **O/FT** = 1.14; **Ant L:** *Scp*: 75-76, *Ped*: 37, *F1*: 23, *F2*: 20, *F3*: 24, *F4*: 21-22, *F5*: 19-20, *F6*: 18, *F7*: 18, *Clv*: 75; **Wgs:** *FWL*: 329-338 (mean = 333), *FWW*: 42-47 (mean = 44), *FWL/FWW* : 7.5 (mean), *C/FWW*: 4.2, *FLMC*: 178-197 (mean = 187), *HWL*: 306-308, *HWW*: 16-18, *HLMC*: 112-122; **Lgs:** *Cx I*: 47-49, *Tch I*: 23, *Fem I*: 94, *Tib I*: 94, *Trs I*: 103; *Cx II*: 42-43, *Tch II*: 26, *Fem II*: 94, *Tib II*: 108, *Trs II*:

98; *Cx III*: 56, *Tch III*: 42, *Fem III*: 117, *Tib III*: 136, *Trs III*: 98-99. **n°** = 2.

Male—Bd L: 305-319; **Hd L:** 43-55; **Hd H:** 156-158; **Hd W:** 130-141; **Mnd L:** 28-30; **Thx L:** 122-145; **Thx W:** 140-145; **Abd L:** 123-127; **Abd W:** 140-142; **Genit L:** 56-57; **Ant L:** *Scp*: 75-79, *Ped*: 37-42, *F1*: 23-24, *F2*: 14, *F3*: 35-37, *F4*: 23-24, *F5*: 26-28, *F6*: 28, *F7*: 30-31, *F8*: 32-33, *F9*: 37-38, *F10*: 36-38; **Wgs:** *FWL*: 366-376 (mean = 370), *FWW*: 47-51 (mean = 49), *FWL/FWW*: 7.5 (mean), *C/FWW*: 4.1, *FLMC*: 183-220 (mean = 202), *HWL*: 339-343, *HWW*: 16-17, *HLMC*: 131-141; **Lgs:** *Cx I*: 70-71, *Tch I*: 23-24, *Fem I*: 121-123, *Tib I*: 122-123, *Trs I*: 126-127; *Cx II*: 56-57, *Tch II*: 37-38, *Fem II*: 117-118, *Tib II*: 141, *Trs II*: 126-127, *Cx III*: 65-66, *Trch III*: 39-40, *Fem III*: 131-132, *Tib III*: 155-156, *Trs III*: 126-127. **n°** = 3.

Material examined: From Pietrosul Bistritei Mountain - Sunatori, Elv: 1050m; 47° 22' 50.08" N, 25° 30' 41.56" E; 2♀ and 4♂ - 6.X.2008 (Pricop leg.) and Poiana Stampei Bog Reserve, Elv: 824m; 47° 17' 54.90" N, 25° 06' 55.51" E; 1♂ - 25.VIII.2009 (Pricop leg.), Suceava county.

Conclusions

Dicopus minutissimus Enock is here reported for the first time from the European mainland. In Romania, this species is rarely collected and belongs to the forest ecosystem, currently only found on Pietrosul Bistritei and Poiana Stampei (Suceava county). The males are captured more often than the females. The species distribution sites are situated above the 45° N parallel.

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