

New records of the family Dryinidae (Hymenoptera, Chrysidoidea) from Bulgaria with an updated checklist

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Abstract. This study presents new data and a checklist of the family Dryinidae (Hymenoptera, Chrysidoidea) from Bulgaria. The list comprises published and new records of 32 dryinid species from four subfamilies, including the first findings of seven species – *Echthrodelpax italicus* Olmi, 1984, *Gonatopus bicolor* (Haliday, 1828), *G. lycius* Olmi, 1989, *G. nearcticus* (Fenton, 1927), *G. pedestris* Dalman, 1818, *G. solidus* (Haupt, 1938) and *Neodryinus typhlocybae* (Ashmead, 1893). In addition, live colour photographs of six species are provided.

Key words: Dryinidae, Bulgaria, fauna, new records, invasive alien species.

The Dryinidae (Hymenoptera, Chrysidoidea) are a family of highly specialized parasitoids and predators of Auchenorrhynchos Hemiptera (Cicadomorpha and Fulgoromorpha). Worldwide, the family consists of over 1800 species belonging to 50 genera and 16 subfamilies (Olmi & Xu 2015, Tribull 2015). More than half of the described species of Dryinidae belong to three genera – *Anteon* Jurine, 1807, *Dryinus* Latreille, 1804 and *Gonatopus* Ljungh, 1810 (Olmi & Xu 2015, Tribull 2015). Approximately 100 species are currently recognised in Europe and 250 in the Palaearctic region (Macek 2007, Guglielmino et al. 2013).

Relatively few studies on the family Dryinidae in Bulgaria have been carried out. Currently, there are only 25 species known of four subfamilies (Burn 2011, Olmi 2011, Guglielmino et al. 2013, Olmi & Xu 2015). In comparison, 41 species are reported from the Czech Republic, and 41 from Slovakia (Macek 2007), 42 from Hungary (Szöllösi-Tóth & György 2009), 69 from Italy (Turrise & Olmi 2009), and 27 from Greece (Olmi 2013).

Parasitoids from the family Dryinidae in the current study were collected during the period 2014-2016 from different altitudes (0m to 1794m) and geographical regions in Bulgaria.

Dryinids were collected by "sweeping" with an entomological net; hence both adults wasps and parasitized hosts were captured. Insect hosts carrying dryinid larvae were recognised by noting the presence of a sac on the body surface. Live parasitized insects were placed in separate vials and plugged with cotton wool. A sprig of the host plant was added to maintain optimum humidity and survival of the host in order to allow for the maturation and the emergence of the parasite. Adult parasitoids were identified by one of the authors (Massimo Olmi).

Anteoninae R. Perkins, 1912

Anteon gaullei Kieffer, 1905

Locality: Western Stara Planina: Barziya, Kom peak, N43.1640 E23.0773, 1794 m, 12.08.2014: 1♀.

Known hosts: mainly on Cicadomorpha (Cicadellidae: *Macropsis* sp.) (Guglielmino et al. 2013).

Deinodryinus biroii (Olmi, 1984) (Fig. 1)

Locality: Eastern Rhodopes: Svirachi vill., N41.14733 E26.1083, 334 m, 02.06.2015: 1♀.

Hosts: unknown.



Figure 1. *Deinodryinus biroii* (Olmi, 1984).

Dryininae Kieffer, 1906

Dryinus saunderi Olmi, 1984

Localities: Upper Thracian Plain: Besapari hills, Novo selo vill., N42.0974 E24.4690, 330 m, 11.05.2014: 1♀, 1♂ ex larvae, host: *Bubastia josifovi* Dlabola, 1980 (Issidae).

Known hosts: exclusively on Issidae (*Hysteropterum schaefferi* Metcalf, *Issus coleoptratus* (Fabricius), *Latematium latifrons* (Fieber)) (Guglielmino et al. 2013). It is reported on *Latematium latifrons* (Fieber) in Bulgaria (Olmi 1984; Waloff & Jervis 1987). *Bubastia josifovi* Dlabola, 1980 is a new host for this species.

Gonatopodinae Kieffer, 1906

Echthrodelpax italicus Olmi, 1984 (Fig. 2)

Locality: Southern Black Sea coast: Pomorie, N42.6114 E27.6255, 5 m, 05.08.2016: 1♀.

Known hosts: Delphacidae (Guglielmino & Olmi 1997; Guglielmino et al. 2013).

New to the Bulgarian fauna.

Gonatopus bicolor (Haliday, 1828)

Locality: Central Stara Planina Mts: Skobelevo vill., N42.7360 E25.1585, 802 m, 09.08.2014: 1♀ ex larva, host: *Javesella dubia* (Kirschbaum) (Delphacidae).

Known hosts: a large number of species of Delphacidae (Guglielmino et al. 2013). *Javesella dubia* was reported as a

host of the species only from Italy (Guglielmino et al. 2013).

New to the Bulgarian fauna.

***Gonatopus clavipes* (Thunberg, 1827)**

Localities: Sakar Mt: Mihalich vill., N41.8504 E26.4248, 347 m, 22.10.2014: 1♀; Central Stara Planina Mts: Anton vill., Benkovski peak, N42.7673 E24.3504, 1741 m, 11.08.2014: 1♂.

Known hosts: very wide range of species of Cicadellidae (Guglielmino et al. 2013). It is reported from *Jassargus repletus* (Fieber) as a host from Bulgaria (Olm 1984; Waloff & Jervis 1987).

***Gonatopus formicarius* Ljungh, 1810**

Localities: Lozen Mt.: N42.5818 E23.5109, 1038 m, 22.05.2014: 1♀ ex larva, host: *Psammotettix* sp. (Dahlbom) (Cicadellidae); Western Rhodopes Mts: Gozdevitsa vill., N41.4517 E24.6583, 1110 m, 27.05.2014: 1♀.

Known hosts: various species of Cicadellidae (Guglielmino et al. 2013). The *Psammotettix* species are well known as hosts of this species from different areas in the Palaearctic.

***Gonatopus horvathi* Kieffer, 1906**

Localities: Osogovo Mt.: Trite buki hut, N42.1732 E22.6282, 1535 m, 27.07.2014: 1♂ ex larva, host: *Balclutha punctata* (Fabricius) (Cicadellidae); Western Rhodopes Mts.: Trigrad, Chairski ezera, N41.5922 E24.4489, 1400 m, 13.09.2014: 1♀.

Known hosts: *Balclutha* gr. *punctata* (Fabricius), *Psammotettix alienus* (Dahlbom) (Cicadellidae) (Guglielmino et al. 2013). Until now hosts from *Balclutha punctata*-group are given for *Gonatopus horvathi* from France only (Guglielmino et al. 2013).

***Gonatopus lycius* Olmi, 1989**

Locality: Pirin Mt: Zlatolist vill., N41.4878 E23.4190, 314 m, 19.08.2014: 1♀.

Known hosts: various species of Cicadellidae (Guglielmino et al. 2013). It is known only from Turkey and Italy.

New to the Bulgarian fauna.

***Gonatopus lunatus* Klug, 1810** (Fig. 3)

Locality: Northern Black Sea coast: Shkorpilovtzi vill., N42.9723 E27.8924, 0 m, 25.06.2014: 1♀; Dobrudzha, Dobrina vill., N43.1885 E27.4746, 255 m, 07.08.2016

Known hosts: larvae of *Ommatidiotus inconspicuus* Stål (Caliscelidae) and adults and larvae of a large number of different species of Cicadellidae (Guglielmino et al. 2013).

***Gonatopus nearcticus* (Fenton, 1927)** (Fig. 4)

Locality: Sredna gora Mt.: Bajlovo vill., N42.6402 E23.8561, 787 m, 10.08.2016: 1♀.

Known hosts: various species of Cicadellidae (Guglielmino et al. 2013).

New to the Bulgarian fauna.

***Gonatopus pedestris* Dalman, 1818**

Locality: Southern Black Sea coast: Burgas salt, N42.5523 E27.4786, 0 m, 25.06.2014: 1♀ ex larva, host: Deltocephalinae gen. sp. (Cicadellidae).

Known hosts: various species of Cicadellidae (Guglielmino et al. 2013).

New to the Bulgarian fauna.

***Gonatopus solidus* (Haupt, 1938)**

Locality: Sakar Mt: Studena vill., N41.9035 E26.4072, 276 m, 21.11.2014: 1♀.

Known hosts: *Laodelphax striatella* (Fallén), *Megadelphax*



Figure 2. *Echthrodelphax italicus* Olmi, 1984.



Figure 3. *Gonatopus lunatus* Klug, 1810.

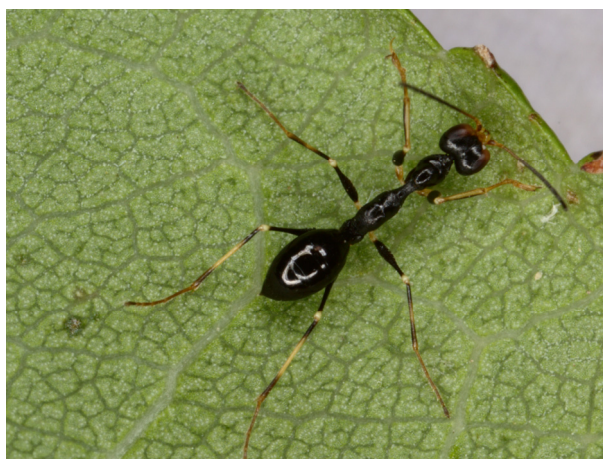


Figure 4. *Gonatopus nearcticus* (Fenton, 1927).

sp., *Muirodelphax aubei* (Perris) (Delphacidae) (Guglielmino et al. 2013).

New to the Bulgarian fauna.

***Gonatopus spectrum* (Snellen van Vollenhoven, 1874)**

Locality: Pirin Mt: Harsovo vill, N41.4742 E23.3920, 253 m, 16.08.2014: 2♀♀.

Known hosts: species from Cicadellidae (Guglielmino et al. 2013).



Figure 5. *Neodryinus typhlocybae* (Ashmead, 1893) – lateral view.



Figure 6. *Neodryinus typhlocybae* (Ashmead, 1893) – dorsal view.

***Neodryinus typhlocybae* (Ashmead, 1893) (Fig. 5, 6)**

Locality: Varna, Seaside Garden, N43.2089 E27.9318, 30 m, 04.08.2016: 2♀♀; Varna, St. Konstantin and Elena, N43.2357 E28.0030, 55 m, 11.07.2016: 4♂♂ ex larvae, host: *Metcalfa pruinosa* Say (Flatidae), leg. O. Iliev.

Known hosts: In Europe only *Metcalfa pruinosa* (Say, 1830) (Flatidae). In North America various species of family Flatidae. This species is introduced to Europe for biological control of *M. pruinosa*.

New to the Bulgarian fauna.

Checklist of the family Dryinidae from Bulgaria (the first report from Bulgaria is given):

Aphelopinae

- Aphelopus atratus* (Dalman, 1823): (Olm 1999)
- Aphelopus camus* Richards, 1939: (Olm 1999)
- Aphelopus melaleucus* (Dalman, 1818): (Olm 1999)
- Aphelopus querceus* Olmi, 1984: (Olm & Xu 2015)
- Aphelopus serratus* Richards, 1939: (Olm & Xu 2015)

Anteoninae

- Anteon ephippiger* (Dalman, 1818): (Olm 1999)
- Anteon fulviventre* (Haliday, 1828): (Olm & Xu 2015)
- Anteon gaullei* Kieffer 1905: (Olm & Xu 2015)
- Anteon jurineanum* Latreille, 1809: (Olm 1999)
- Anteon pubicorne* (Dalman, 1818): (Olm 1999)

- Anteon reticulatum* Kieffer, 1905: (Olm & Xu 2015)
- Anteon scapulare* (Haliday, 1837): (Olm & Xu 2015)
- Anteon tripartitum* Kieffer, 1905: (Olm & Xu 2015)
- Anteon tschirnhausi* Olmi 2011: (Olm 2011)
- Deinodryinus biroi* (Olm, 1984): (Burn 2011)
- Lonchodryinus ruficornis* (Dalman, 1818): (Olm 1999)

Dryininae

- Dryinus sanderi* Olmi, 1984: (Olm 1984)
- Dryinus tarraconensis* Marshall, 1868: (Olm 1999)

Gonatopodinae

- Echthrodelfax italicus* Olmi, 1984: **first record**
- Gonatopus baeticus* (Ceballos, 1927): (Olm & Xu 2015)
- Gonatopus bicolor* (Haliday, 1828): **first record**
- Gonatopus clavipes* (Thunberg, 1827): (Olm 1999)
- Gonatopus formicarius* Ljungh, 1810: (Olm & Xu 2015)
- Gonatopus horoathi* Kieffer, 1906: (Olm & Xu 2015)
- Gonatopus lunatus* Klug, 1810: (Olm 1999)
- Gonatopus lycius* Olmi, 1991: **first record**
- Gonatopus nearcticus* (Fenton, 1927): **first record**
- Gonatopus pedestris* (Dalman, 1818): **first record**
- Gonatopus pulicarius* Klug 1810: (Olm 1999)
- Gonatopus solidus* (Haupt, 1938): **first record**
- Gonatopus spectrum* (Snellen van Vollenhoven, 1874): (Olm 1999)
- Neodryinus typhlocybae* (Ashmead, 1893): **first record**

During the study of the Auchenorrhyncha fauna in Bulgaria specimens parasitized by larvae of the hymenopterous family Dryinidae as well as adult parasitoids were specifically targeted by collecting in the field. The new data significantly increase the number of Dryinidae species known from Bulgaria. Ten regions from different geographical areas of the country with diverse habitats and altitudes (0-1794 m) were visited.

As a result of the survey a total of 24 adult dryinid specimens were either directly collected by sweeping or rearing in the laboratory. The small number of specimens is due to relative rarity of the group.

Despite the small number of sampled specimens, the species richness was high: 15 species of six genera and three subfamilies were found. Most species belong to the subfamily Gonatopodinae (12 in total); ten of them are members of *Gonatopus*, one species of *Echthrodelfax* and one of *Neodryinus*; two species of Anteoninae (*Anteon* and *Deinodryinus*) and one of Dryininae (*Dryinus*). This composition is expected given that worldwide more than half of the described Dryinidae species are from the three genera, namely: *Anteon*, *Dryinus* and *Gonatopus* (Tribull 2015).

Of the 15 species determined, seven are new for the Bulgarian fauna: *Echthrodelfax italicus* Olmi, 1984, *Gonatopus bicolor* (Haliday, 1828), *G. lycius* Olmi, 1989, *G. nearcticus* (Fenton, 1927), *G. pedestris* Dalman, 1818, *G. solidus* (Haupt, 1938) and *Neodryinus typhlocybae* (Ashmead, 1893). Thus, the total number of known species for the country increases to 32. Nevertheless, our current knowledge of the Dryinidae in Bulgaria still remains sketchy and it is anticipated that further Bulgarian dryinids await discovery.

The results from the sampling localities in the survey show that Dryinids are not restricted to specific habitats and that they can be found in different sites from sea level to high mountains (e.g. Kom peak in Stara Planina mountain,

1794m). The species recorded from Bulgaria are widely distributed mainly in Europe or the Palaearctic, except for *Anteon tschirnhausi* which is recorded only from Bulgaria (Olmi 2011). An interesting finding is *Gonatopus lycius*, found previously only in Turkey and Italy.

It is known that most species of Dryinids are not species-specific in relation to the host. Some attack various host species of a single genus, other members of different families or rarely of two infraorders (Guglielmino & Olmi 1997, Guglielmino et al. 2013). Females can use the hosts both for oviposition and feeding. For example, a female of *Gonatopus flavifemur* Esaki & Hashimoto, 1932 attacked 466 different fulgoromorphs during 19 days for feeding or for oviposition (Tribull 2015).

In the current study, six species of Auchenorrhyncha were collected as hosts of six species of Dryinidae, all of them found during fieldwork and thereafter reared under laboratory conditions for the emergence of adult parasitoids. A new relationship was found between *Bubastia josifovi* and *Dryinus sanderi*. The latter species is known as parasitoid of Issidae only (Guglielmino et al. 2013). The relationship between *Javesella dubia* (Kirschbaum, 1868) (Delphacidae) and *Gonatopus bicolor* was previously recorded only from Italy, the relationship between *Balclutha punctata* (Fabricius, 1775) (Cicadellidae) and *G. horvathi* only from France. Regarding the genus *Psammodictyon* (Cicadellidae), several species are known as hosts of *Gonatopus formicarius* and those relationships are recorded from different Palaearctic regions.

The short-term study on Dryinidae as parasitoids and predators of Auchenorrhyncha in Bulgaria indicates the need for further research on species composition and host range. The knowledge of the relationships between the two groups of insects is important for the potential application of dryinids as agents of biological control of various auchenorrhynchous agricultural pests. The North American species *Neodryinus typhlocybae* was introduced in Europe (Italy) in 1994 and has been successfully used for the control of *Metcalfa pruinosa* (Guglielmino et al. 2013). The rapid dispersal of *M. pruinosa* and the extensive damage that it has caused to the vegetation in city parks in Bulgaria, particularly in the city of Varna, highlights the importance of monitoring both host and parasitoid populations.

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