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A Remarkable Record of Little-Known Parasitoid Wasp *Helorus striolatus* (Hymenoptera: Heloridae) from Türkiye with A Global Checklist of the this Family

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Abstract

The Heloridae (Hymenoptera: Proctorupoidea) is a family of parasitoid wasps composed of a single genus, *Helorus* with eighteen extant species. For Türkiye, only two species have been reported: *Helorus anomalipes* (from Ankara, Central Anatolia) and *H. striolatus* (from Bingöl, Eastern Anatolia). In this study, a new distribution record is given for *H. striolatus* from Kocaeli province (Marmara region), which is the second record of this relatively little-known species in this country. In addition, an updated checklist of the family Heloridae is presented.

Keywords: Hymenoptera, heloridae, parasitoid, *Helorus striolatus*, second record, Türkiye

1. INTRODUCTION

The Heloridae Foerster, 1856 is a small family belonging to superfamily Proctotrupoidea of order Hymenoptera. Members of this family are solitary endoparasites of green lacewings larvae (Neuroptera: Chrysopidae). Their larvae feed on the nutrition contents of the host and emerge as adults from the cocoon [1].

This family contains only one genus: *Helorus* Latreille, 1802, and 18 valid species described nearly worldwide. So far, four species of the genus have been recorded in the western Palearctic and two of them are known from Türkiye: *H. anomalipes* (Panzer, 1798) and *H. striolatus* Cameron, 1906. These species were recorded from the country based on only one specimen of each species collected in 1977 and 1985 [2, 3]. As in

the rest of the world, information about this group is also very rare in Türkiye. On the other hand, the species list of Heloridae has been given in a few articles [2-4], so the updated data of the family in the world have not been compiled.

In this study, it was aimed to provide the second record of *H. striolatus* from Türkiye over 35 years. In addition, data on the distribution and biology of all species of the family are provided.

2. MATERIALS AND METHODS

The adult wasp specimen was collected using an insect net in the Kocaeli province of Türkiye. Identification and nomenclature of *Helorus striolatus*, follows van Achterberg [3], and Izadizadeh et al. [4]. The collected material is deposited in the Entomological Research Laboratory, in

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Gaziosmanpaşa University, Tokat, Türkiye. Based on the literature review, the species list and information about Heloridae are given in Table 1. The photographs of the specimen were taken using a Leica M205C stereomicroscope controlled by the Leica Application Suite 3 software.

3. RESULTS

Order: Hymenoptera

Superfamily: Proctotrupeoidea

Family: Heloridae Förster, 1856

Genus: *Helorus* Latreille, 1802

Members of the Heloridae have a general morphology, with the robust, usually black body (6-8 mm); long, sickle-shaped, and crossing over scissor-like mandibles; long and narrow labrum; ring-like article between pedicel and first flagellomere; pectinated tarsal claws; distinctly elongated first metasomal segment; fore wing with five closed cells; metasomal terga 2-4 fused into syntergite [1].

***Helorus anomalipes* (Panzer, 1798)**

Global distribution: Austria, Belgium, Bulgaria, Canada, China, England, Estonia, France, Germany, Hungary, Ireland, Korea, Lebanon, Mongolia, Netherlands, Spain, Sweden, Türkiye, United States of America (Figure 1a).

The previous record in Türkiye: Ankara (no specific locality) [2] (Figure 1b).

***Helorus striolatus* Cameron, 1906** (Figure 2)

Global Distribution: Austria, Bulgaria, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Poland, Russia (south), Spain, Sweden, Switzerland, Türkiye, Ukraine (Figure 1a).

The previous record in Türkiye (Figure 1b): Bingöl, 15 km S Genç, 1400 m, 13.viii.1985 [3].

Material examined: Kocaeli, Gölcük, İhsaniye, 40°41'00" N; 29°48'56" E, 111 m, 06.vi.2019, ♀.

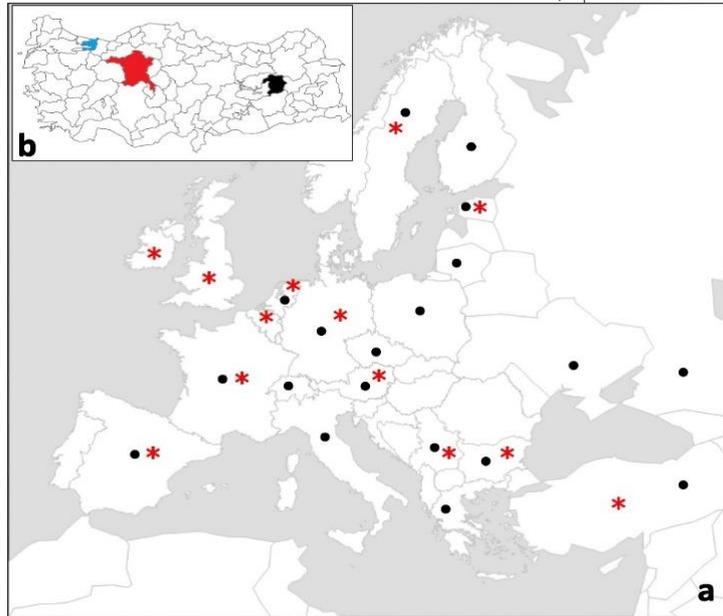


Figure 1 Distribution maps of Heloridae species found in Türkiye; a) Western Palearctic distribution of *Helorus anomalipes* (stars) and *Helorus striolatus* (circles); b) previous locality record of *H. anomalipes* (red) and *H. striolatus* (black), and new locality record of *H. striolatus* (blue) in Türkiye

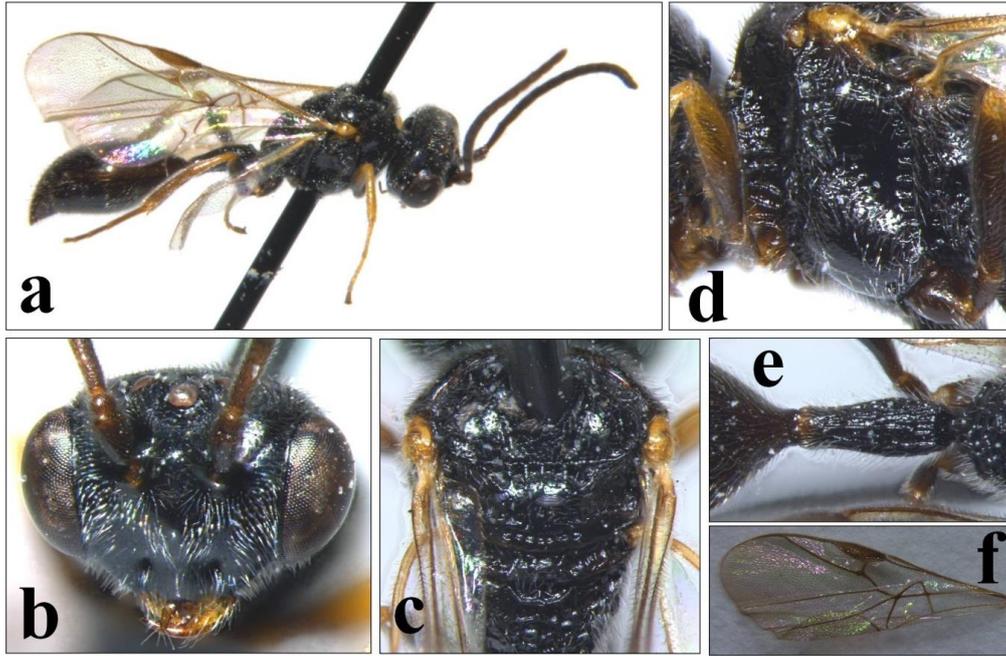


Figure 2 Some taxonomic characters of *Helorus striolatus* Cameron, 1906, ♀; a) general habitus; b) frontal view of the head; c) dorsal view of mesosoma; d) mesopleuron; e) dorsal view of first metasomal tergite; f) forewing

4. DISCUSSION

The first specimen of *H. striolatus* was collected from the Bingöl province in the eastern Anatolian region of Türkiye in 1985 by R. Hensen and deposited in the National Museum of Natural History, Leiden, Netherlands. Then this specimen was identified and recorded for the first time from Türkiye by van Achterbeg [3]. Almost thirty-five years after the first detection date, this species was recorded for the second time from the Marmara region of Türkiye, and its presence in the country was verified by this study (Figure 1b). While the individual belonging to this species had been caught almost in the middle of August in the Eastern Anatolia region in the previous study, it was caught in the Marmara region at the beginning of June in this study. The material in this study based on a randomly collected specimen during field studies. Thus, more rigorous work is necessary for revealing Heloridae taxa currently found in Türkiye.

If the habitats of their prey, Chrysopidae (Neuroptera), are followed in subsequent studies, more specimens will be able to be caught with Malaise traps.

The updated checklist of family Heloridae

Townes [2] carried out the most important research on the first revision of Heloridae and gave detailed information about all species. Subsequently, van Achterberg [3] provided the relevant details on European species of genus *Helorus* as well as describing additional new species based on Sulawesi specimens.

Table 1 Information about species of Heloridae family in the world

Number	Name of Species	Synonym	Described sexes	Host	Recorded Country	References
1	<i>Helorus alborzicus</i> Izadizadeh, van Achterberg and Talebi, 2015	<i>H. xinjiangensis</i> He and Xu, 2015	♀, ♂	Unknown specific host	Iran	[4, 5]
2	<i>Helorus anomalipes</i> (Panzer, 1798)	<i>Sphex anomalipes</i> Panzer, 1798 <i>Helorus ater</i> Latreille, 1802 <i>Copelus paradoxus</i> Provancher, 1881	♀, ♂	<i>Chrysopa majuscula</i> <i>Dichochrysa prasina</i> <i>Chrysoperla carnea</i> <i>Chrysopa rufilabris</i> ?	Austria, Belgium, Bulgaria, Canada, China, England, Estonia, France, Germany, Hungary, Ireland, Korea, Lebanon, Mongolia, Netherlands, Spain, Sweden, Türkiye, USA	[3, 4, 6]
3	<i>Helorus antefurcalis</i> He and Xu, 2015	–	♀, ♂	Unknown specific host	China	[4]
4	<i>Helorus australiensis</i> New, 1975	–	♀, ♂	<i>Chrysopa ramburi</i> <i>Chrysopa near</i> <i>Chrysopa near dispar</i> <i>Chrysopa near signata</i>	Australia	[2]
5	<i>Helorus brethesi</i> Ogloblin, 1928	–	♀, ♂	Unknown specific host	Argentina, Brazil, Colombia, Costa Rica, Mexico, Panama	[7]
6	<i>Helorus caii</i> He and Xu, 2015	–	♂	Unknown specific host	China	[4]
7	<i>Helorus celebensis</i> van Achterberg, 2006	–	♀, ♂	Unknown specific host	Indonesia	[3]
8	<i>Helorus chinensis</i> He, 1992	–	♀, ♂	<i>Chrysopa septempunctata</i>	China	[8, 9]
9	<i>Helorus elgoni</i> Risbec, 1950	–	♀, ♂	<i>Chrysoperla spp</i>	Kenya	[2]
10	<i>Helorus heilongjiangensis</i> He & Xu, 2015	–	♀	Unknown specific host	China	[9]
11	<i>Helorus jilinensis</i> He and Xu, 2015	–	♀	Unknown specific host	China	[9]
12	<i>Helorus nigripes</i> Foerster, 1856	<i>H. rugosus</i> Thomson, 1858	♀, ♂	<i>Chrysopa nigricostata</i> <i>Chrysopa septempunctata</i> <i>Chrysopa spp.</i>	Austria, Belgium, Bulgaria, Czechia, Denmark, England, Estonia, France, Germany, Hungary, Moldova, Netherlands, Sweden, Switzerland, Ukraine	[2, 3, 6, 10]

Table 1 Information about species of Heloridae family in the world (continue)

Number	Name of Species	Synonym	Described sexes	Host	Recorded Country	References
13	<i>Helorus niuginiae</i> Naumann, 1983	–	♂	Unknown specific host	New Guinea	[11]
14	<i>Helorus reni</i> He and Xu, 2015	–	♂	Unknown specific host	China	[9]
15	<i>Helorus ruficornis</i> Foerster, 1956	<i>H. coruscus</i> Haliday, 1857 <i>H. flavipes</i> Kieffer, 1907	♀, ♂	<i>Chrysopa prasina</i> <i>Chrysopa ventralis</i> <i>Chrysopa shansiensis</i> <i>Dichochrysa ventralis</i> <i>Pseudomallada prasinus</i>	Andorra, Austria, Bulgaria, Burundi, Czechia, England, Estonia, Finland, France, French Polynesia (Tahiti), Germany, Hawaiian Islands, Italy, Japan, Kenya, Korea, Nepal, Pakistan, Saouth Africa, Spain, Sweden, Switzerland, U. S. A	[2-4, 6, 9, 12-14]
16	<i>Helorus striolatus</i> Cameron, 1906	<i>H. meridionalis</i> Pschorn-Walcher, 1955	♀, ♂	<i>Chrysopa flavifrons</i> <i>Chrysopa septempunctata</i>	Austria, Bulgaria, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Poland, Russia (south), Spain, Sweden, Switzerland, Türkiye, Ukraine	[2, 3, 6]
17	<i>Helorus suwai</i> Kusigemati, 1987	–	♀	Unknown specific host	Japan	[15]
18	<i>Helorus yezoensis</i> Kusigemati, 1987	–	♂	Unknown specific host	Japan	[15]

More information on Heloridae was provided by Izadizadeh [5] that a new species was described from Iran and new species records were given in that study. Zhang et al. [4], with the studies carried out on the Chinese fauna, created the identification key for all species except the Australian region and described unknown female of *Helorus caii*. In the same study, they reported that the *Helorus xinjiangensis* He and Xu, 2015 is a junior synonym of *H. alborzicus* Izadizadeh, van Achterberg and Talebi, 2015. In this study, some important data belonging to the family so far have been compiled and brought together in Table 1

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