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Research Article

Additions to the Knowledge of the Flat Wasps Fauna of Türkiye (Hymenoptera, Bethylidae)

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ABSTRACT

To detect the natural enemies of *Scolytus rugulosus* (Muller, 1818) (Coleoptera: Curculionidae: Scolytinae), which is harmful to cherry trees, parasitoid wasp specimens were collected during field studies in the Kemalpaşa district of Izmir, Türkiye, between 1993 and 1995. This study evaluated 89 bethylid specimens collected in field studies. The wasps were collected by beating branches of cherry trees and reared on *S. rugulosus* larvae. All collected specimens were identified, and as a result, two previously unreported Bethylidae species, *Bethylus mandibularis* (Kieffer, 1904) and *Goniozus claripennis* (Förster, 1851) (Hymenoptera: Bethylidae), were recorded from Türkiye. The newly recorded species are briefly described and illustrated. Additional records are provided for *Cephalonomia hypobori* Kieffer, 1919, already reported from Türkiye. The number of species now known from the country has increased from 14 to 16, belonging to 14 genera and four subfamilies.

1. Introduction

The family Bethylidae (flat wasps) is a moderately large group of about 3000 known species [1, 2]. Members of this family are recognized mainly as gregarious ectoparasitoids developing on larvae of Coleoptera and Lepidoptera. Some members of the family Bethylidae are of interest as potential biological pest control agents [3].

Published records of Bethylidae from Türkiye are relatively scarce and only limited faunistic studies have been conducted on this group of insects by local and foreign researchers in this country [4–12]. Most recently, *Cephalonomia hypobori* Kieffer, 1919 was reported for the first time from Türkiye by Tezcan et al. [2]. The updated list of species of the flat wasp fauna, which reaches 14 species, was also presented in that study.

This study aims to identify the Bethylidae species collected during the research to determine the natural enemies of *Scolytus rugulosus* in the sweet cherry orchards of Izmir (Kemalpaşa district). As a result, two additional species, *Bethylus mandibularis* (Kieffer, 1904) and *Goniozus claripennis* (Foerster, 1851), were reported for the first time from Türkiye. The newly recorded species are briefly described and illustrated. In addition, new data about the previously known *Cephalonomia hypobori* was also shared.

2. Materials and Methods

The material was obtained from sweet cherry orchards in İzmir (Kemalpaşa), Western Türkiye, by beating and rearing in 1992-1995. Branches of trees infested by *S. rugulosus* were cut off, the tips were painted with paraffin wax to reduce drying, and the parasitoids were reared in cages

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under lab conditions. At the same time, they were also reared under natural conditions in cages on the branches of the trees [13–15]. The material was preserved and stored in the Entomology Research Laboratory, Department of Biology, Tokat Gaziosmanpaşa University (Tokat, Turkey). While the second author carried out field studies and specimen collection, species identifications were made by the other two authors. The photographs of the specimens were taken using a Leica M205C stereomicroscope controlled by the Leica Application Suite 3 software.

3. Results

Bethylus mandibularis (Kieffer, 1904), *Goniozus claripennis* (Förster, 1851), and *Cephalonomia hypobori* Kieffer, 1919 were identified in this study, and the first two species were new records for the Turkish Bethylidae fauna. All newly recorded species belonged to the subfamily Bethylinae.

Subfamily Bethylinae

Genus *Bethylus* Latreille, 1802

Bethylus mandibularis (Kieffer, 1904) (Figures 1a-e)

Material examined (1 ♀): İzmir (Kemalpaşa), Central province, 02.VII.1995, beating from branches of *Prunus avium*, 1 ♀, leg. S. Tezcan, det. İ. Can and J. de Rond, 2024.

Global distribution: Iran, Italy, Spain, Scotland (doubtful record) [6, 16, 17].

Remarks: This species is reported from Türkiye for the first time in this article.

Brief description: Female. Body length 3.6 mm (Fig. 1a). Body mostly black, metasoma reddish brown. Antenna yellow to brown (Fig. 1c). Legs castaneous, tarsi reddish. Forewing hyaline tinged with yellow (Fig. 1e); veins and pterostigma castaneous. Head coriaceous with sparse punctures (Fig. 1d). The dorsal part of pronotal area and mesoscutum coriaceous with shallow punctures (Fig. 1b). Metapostnotal disc rugulose, median ridge elevated and shiny; lateral marginal carina incomplete, absent near transverse anterior carina of metapectal-propodeal disc. Metasomal terga shiny with shallow tiny punctures.

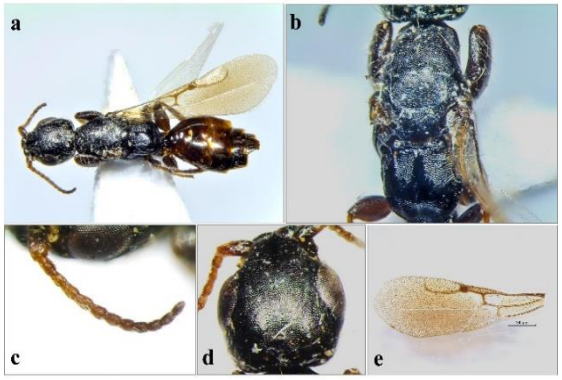

Figure 1. *Bethylus mandibularis* ♀; a) lateral habitus; b) mesosoma, dorsal view; c) antenna; d) head, dorsal view; e) forewing.

Genus *Goniozus* Förster, 1856

Goniozus claripennis (Förster, 1851) (Figures 2a-d)

Material examined (1 ♀): İzmir (Kemalpaşa), Central province, 23.VIII.1993, beating from branches of *Prunus avium*, 1 ♀, leg. S. Tezcan, det. İ. Can and J. de Rond, 2024.

Global distribution: Belgium, Czech Republic, Germany, France, Hungary, Iran, Italy, Norway, Russia, Slovakia, United Kingdom [18].
Remark: The species is reported from Türkiye for the first time in this article.

Brief description: Female. Body length: 3.9 mm (Fig. 2a). Body black; legs with coxa and femur testaceous, other segments yellow; antenna uniformly yellow except for the brownish scape; mandible brownish yellow, basal, dorsal, and ventral margins brownish; wings hyaline, pterostigma and prostigma testaceous, costa and subcosta light brown, other veins unpigmented. Basal part of metasoma testaceous. Head longer than wide; frons and vertex coriaceous with scattered shallow punctures (Fig. 2b). Clypeal carina strong and arcuate in profile. The dorsal part of the pronotum coriaceous with scattered shallow punctures, as in the head. Mesoscutum and scutellum shiny with sparse punctures. The median basal triangle of the metapectal propodeal disc smooth and polished, extended to the centre of the disc, connected to the posterior

transverse carina by a longitudinal carina; other parts of the disc and posterior declivity microreticulate (Fig. 2c). Forewing without areolet; Rs+M slightly curved at the apex (Fig. 2d).

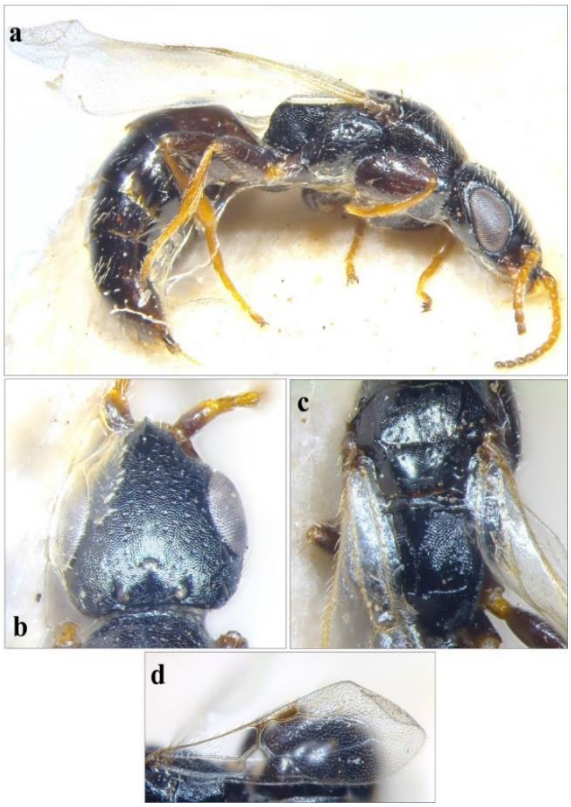

Figure 2. *Goniozus claripennis* ♀; a) lateral habitus; b) head, dorsal view; c) mesosoma, dorsal view; d) forewing.

Subfamily Scleroderminae

Genus *Cephalonomia* Westwood, 1833

***Cephalonomia hypobori* Kieffer, 1919 (Figures 3a-3b)**

Material examined (83 ♀♀, 4 ♂♂): İzmir (Kemalpaşa), Central province, October 1992 / November 1992 reared from larvae of *Scolytus rugulosus*, 22 ♀♀, 2 ♂♂; 18.01.1993, reared from larvae of *S. rugulosus*, 1 ♀; 21.01.1993, reared from larvae of *S. rugulosus* in branches of *Prunus avium*, 1 ♀; 03.06.1993, reared from larvae of *S. rugulosus* in branches of *P. avium*, 23 ♀♀; 08.06.1993, beating from branches of *P. avium*, infested with *S. rugulosus*, 2 ♀♀; 02.07.1995, beating from branches of *P. avium*,1 ♀; 27.07.1995, beating from branches of *P. avium*, 3 ♀♀, 3 ♂♂; **Ören**, 15.01.1993, reared from larvae of *S. rugulosus*, 1 ♀; 03.05.1993, beating from branches of *P. avium*, infested with *S. rugulosus*, 1 ♀; 28.05.1993, reared from larvae of *S. rugulosus*, 1 ♀; 08.11.1993, reared from larvae of *S. rugulosus*, 3 ♀♀; 02.09.1994, reared from larvae of *S. rugulosus*, 1 ♀; **Sütçüler**, 11.03.1993, reared from larvae of *S. rugulosus*, 2 ♀♀; 14.06.1993, beating, from branches of *P. avium*, infested with *S. rugulosus*, 1 ♀; 08.11.1993, reared from larvae of *S. rugulosus*, 1 ♀; **Kuyucak**, 06.05.1993, reared from larvae of *S. rugulosus* in cages on the branches of *P. avium* under natural conditions, 1 ♀; 13.05.1993, reared from larvae of *S. rugulosus*, 2 ♀♀; 17.05.1993, reared from larvae of *S. rugulosus* in branches of *P. avium*, 1 ♀; 14.06.1993, beating, from branches of *P. avium*, infested with *S. rugulosus*, 3 ♀♀; 08.11.1993, reared from larvae of *S. rugulosus* in branches of *P. avium*, 1 ♀; 25.07.1994, beating, from branches of *P. avium*, infested with *S. rugulosus*, 1 ♀; 21.10.1994, beating, from branches of *P. avium*, infested with *S. rugulosus*, 2 ♀♀; **Bağyurdu**, 22.01.1993, reared from larvae of *S. rugulosus*, 4 ♀♀; 23.01.1993, reared from larvae of *S. rugulosus* in branches of *P. avium*, 2 ♀♀; **Örnekköy**, 09.09.1994, beating, from branches of *P. avium*, infested with *S. rugulosus*, 1 ♀ leg. S. Tezcan, det. J. de Rond, 2024.

Global distribution: Czech Republic, France, Iran, Israel, Italy, Morocco, Tunisia, Türkiye [2, 18].

4. Discussion

In the study carried out to determine the parasitoids that are the natural enemies of *Scolytus rugulosus*, which damages the cherry orchards in Izmir, three species belonging to the Bethylidae family were identified: *Bethylus mandibularis*, *Cephalonomia hypobori* and *Goniozus claripennis*. *B. mandibularis* and *G. claripennis* are new records for the Turkish fauna.

It is known that species of *Bethylus* and *Goniozus* prefer various lepidopteran larvae as hosts [1]. Therefore, they are unrelated to *Scolytus rugulosus* and were caught incidentally in this study. These two species are probably parasitoids of the lepidopteran larvae found in the cherry orchards in Kemalpaşa. As a result of the studies

carried out in cherry orchards in Türkiye, it has been reported that there are 140 species /subspecies belonging to 21 families of Lepidoptera [19]. In previous studies conducted in cherry orchards in Manisa (Sultanyayla), a *Goniozus* species was reared from the larvae of *Archips rosana* (Linnaeus, 1758). However, the author was not able to identify it at the species level [f20].

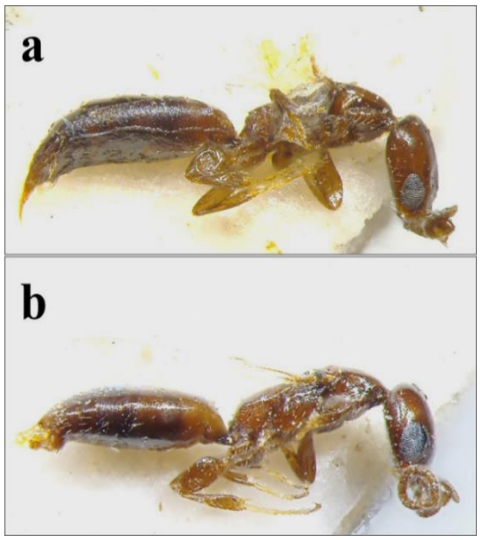

Figure 3. *Cephalonomia hypobori* a) female, lateral habitus; b) male, lateral habitus.

C. hypobori is a parasitoid of many larvae of Scolytinae species that manifest themselves as agricultural pests. The presence of this bethylid species in Türkiye has only recently been detected [2]. In this study, many specimens of this species were obtained by beating from branches and reared from larvae. Considering the large number of specimens of *C. hypobori*, it can be said that this species is a control agent that has significant potential to affect the population development of *S. rugulosus* in the study area. Nearly 30 years have passed since the field studies were carried out in this research. So, future studies should evaluate the extent to which this flat wasp is effective against *S. rugulosus* in the area.

Most Bethylidae species in Türkiye are often challenging to collect in the field because their habits are poorly known. It is evaluated that many potential discoveries regarding this poorly studied family can be made in Türkiye. In conclusion, we hope that future studies will provide more biological information, such as the species' host, distribution, and occurrence, and use it as a reference in understanding the habits of these species.

Article Information Form

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Authors' Contribution
The authors contributed equally to the study.

The Declaration of Conflict of Interest/ Common Interest
No conflict of interest or common interest has been declared by the authors.

The Declaration of Ethics Committee Approval
This study does not require ethics committee permission or any special permission.

The Declaration of Research and Publication Ethics
The authors of the paper declare that they comply with the scientific, ethical and quotation rules of SAUJS in all processes of the paper and that they do not make any falsification on the data collected. In addition, they declare that Sakarya University Journal of Science and its editorial board have no responsibility for any ethical violations that may be encountered, and that this study has not been evaluated in any academic publication environment other than Sakarya University Journal of Science.

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