www.biodicon.com Biological Diversity and Conservation

ISSN 1308-8084 Online ISSN 1308-5301 Print

Research article
DOI: 10.46309/biodicon.2025.1411901
18/1 (2025) 53-57

Second record of *Panorpa tatvana ressli* Willmann, 1975 (Mecoptera: Panorpidae) in Bolu province, West Black Sea Region, Türkiye

Fatma Nur ELMA [*1], İnci ŞAHİN NEGİŞ [1]
ORCID: 0000-0003-0985-0338**;** 0000-0002-4481-2807

[1] Selcuk University, Faculty of Agriculture, Department of Plant Protection,42130 Konya, Türkiye

Abstract

This study documents the second occurrence of *Panorpa tatvana ressli* Willmann, 1975, a subspecies in the Panorpidae family, in Bolu province within the West Black Sea Region of Türkiye. Nearly five decades after its initial sighting, this reaffirms the enduring presence of *Panorpa tatvana ressli* in the area. This information provides a valuable contribution to the knowledge of the Mecoptera fauna of Turkey, and it also highlights the importance of continuous monitoring for understanding species continuity and ecosystem changes.

Keywords: Mecoptera, *Panorpa tatvana ressli,* Panorpidae, Scorpionfly, Türkiye

---------- * ----------

Panorpa tatvana reslii' nin Bolu'daki (Türkiye) ikinci kaydı

Özet

Bu çalışma, Türkiye'nin Batı Karadeniz Bölgesi'nde yer alan Bolu'da, Panorpidae familyasından bir alttür olan *Panorpa tatvana ressli* Willmann, 1975'nin varlığını ikinci kez ortaya koymaktadır. İlk kaydından neredeyse elli yıl sonra *Panorpa tatvana ressli*'nin bölgede kalıcı varlığı yeniden teyit edilmiştir. Çalışma, Türkiye'nin Mecoptera faunası bilgisine değerli bir katkı sağlamakta ve aynı zamanda tür devamlılığının ve ekosistem değişikliklerinin anlaşılmasında sürekli izlemenin önemini vurgulamaktadır.

Anahtar kelimeler: Mecoptera, *Panorpa tatvana ressli,* Panorpidae, Akrep sineği, Türkiye

1. Introduction

Mecoptera stands out among other insect orders due to the presence of a rostrum housing mouthparts at its apex, accompanied by fore- and hind wings characterized by comparable size and venation. The family Panorpidae holds the distinction of being the most extensive within Mecoptera, encompassing 500 species distributed among one extinct and eight extant genera. Its primary habitat is predominantly in the Northern Hemisphere [1]. Only 13 Panorpa species have been identified in Türkiye [2], yet recent studies from neighboring regions e.g., in the Caucasus [3], in the Balkans [4] highlight the dynamic nature of Panorpidae distributions and the need for ongoing targeted surveys. Wilmann reported *Panorpa tatvana ressli* for the first time in 1975, especially in Abant (Bolu). The same author reported the distribution areas of this subspecies as Kızılcahamam (Ankara), Bolkar Mountains (Çamlıyayla, Mersin), Ilgaz Mountains (Kastamonu), Bozdağlar (Izmir, along Manisa) [5].

Panorpa species prefer cool higher elevations where morning mist moistens the vegetation [6]. Adults of Panorpidae species exhibit a diverse feeding behavior consuming a range of substrates such as decaying animal and plant matter, as well as deceased insects; certain species among them are phytophagous [7]. However, some researchers have reported that Panorpidae species also feed on flowering plants [7-10].

* *Corresponding author*: Tel.: +905424816155; Fax.: +903322410108; E-mail: fdundar@selcuk.edu.tr
 Received: 30.12.2023; Published: 15.04.2025 BioDiCon. 1136-301223

Research on the family Panorpidae in Türkiye is scarce, likely due to two factors: Their lack of economic importance as pests or beneficial organisms to date, and insufficient reference materials for species identification, have contributed to this research gap. Analyzing habitat distribution by examining the relationship between habitat variables and the distribution and habitat preferences of animal species is critical for understanding their ecological roles. Information on the presence, abundance, distribution, and feeding status of animals within an area can be inferred from the condition and quality of the habitat. Through habitat status, anticipated positive or negative changes in a species or population, as well as the consequent impact on the habitat itself, can be assessed, enabling timely intervention if necessary [11].

New studies on rarely recorded species like *P. tatvana ressli* are essential to update regional biodiversity knowledge and renew scientific interest in this overlooked taxon. This study presents the second documented occurrence of Panorpa tatvana ressli in the Western Black Sea region. This finding not only verifies the presence of the subspecies in the specified geographical area but also attests to the establishment of a native population within the region. The identification of an indigenous population of P. tatvana ressli in the Western Black Sea region contributes significantly to our understanding of the subspecies' distribution and ecological dynamics in this particular geographical context.

2. Material and Methods

Panorpa tatvana ressli was collected Bolu, Western Black Sea, Türkiye. The samples were collected with the help of a sweep netting from the slopes of the mountain, which are rich in trees and shrubs (1005 m, N 40°41.27', E 31°40.24'). The collection of samples took place between July and October, with field visits conducted every 15 days. In the sampled area, coniferous trees such as pine and fir dominate the higher elevations, while deciduous species like oak, beech, and hornbeam are prevalent at mid and lower altitudes. Dense shrubs, herbaceous plants, and ferns populate the forest understory, providing habitat for various small animals and insects. The confirmation of identification was undertaken by Rainer WILLMANN (Germany) through a detailed examination of the male genitalia, with a specific focus on relevant paramers.

3. Results

Scorpionflies, or as they are often referred to, Mecoptera, make up an order that currently has a very low number of species and individuals. Their small numbers and rather secretive lifestyles where the reasons why very little research had been conducted on this group for a long time. Scorpionflies were first mentioned by Aristotle, but it was only in the 17th century that they began to be studied and described. However, all these descriptions were fragmented and unsystematic. In 1921, the first monograph on this group was published by Esben-Petersen [12]. The species of the family Panorpidae in Europe and America belong to the same genus and do not exhibit particularly sharp species differences, suggesting that they settled in relatively recent geological times. The taxonomy of modern representatives of this order is primarily based on morphological differences between the abdomens of males and females. Wing characteristics serve only as auxiliary traits [13].

The second record of *Panorpa tatvana ressli*, which was described a new subspecies for science by Rainer WILLMANN in 1975, and photographs of the subspecies are given below.

***Panorpa tatvana ressli* Willmann, 1975**

Diagnosis: The Panorpidae (Insecta: Mecoptera) showcases members with an orthognathous head, featuring uniform antennae and three ocelli on its frontal region along with compound eyes, contributes to the distinctive appearance of *Panorpa* species (Figure 1, 2, 5). The elongated facial structure, a result of modified 'beak' shaped jaws formed by the clypeus and labrum, is a notable characteristic. In males, the terminalia exhibit remarkable development, adopting a spherical morphology akin to the post-abdominal segment of scorpions. This unique feature, defining the order as 'scorpion flies,' encompasses gonopods and a distinct copulatory organ, typically characterized by two cerci in the tenth row (Figure 3). The copulatory organ's hypovalves, crucial in species determination, facilitate the mating structure's grip during copulation, ensuring contact with the spermatheca duct. Females, on the other hand, possess an ovipositor terminating in two cerci (Figure 4) [7, 10, 14-17].

Material examined: Türkiye, Bolu, 1005 m, N 40°41.27', E 31°40.24', 1 ♀, 1 ♂, 26.VII.2023 (leg. F. N. Elma).

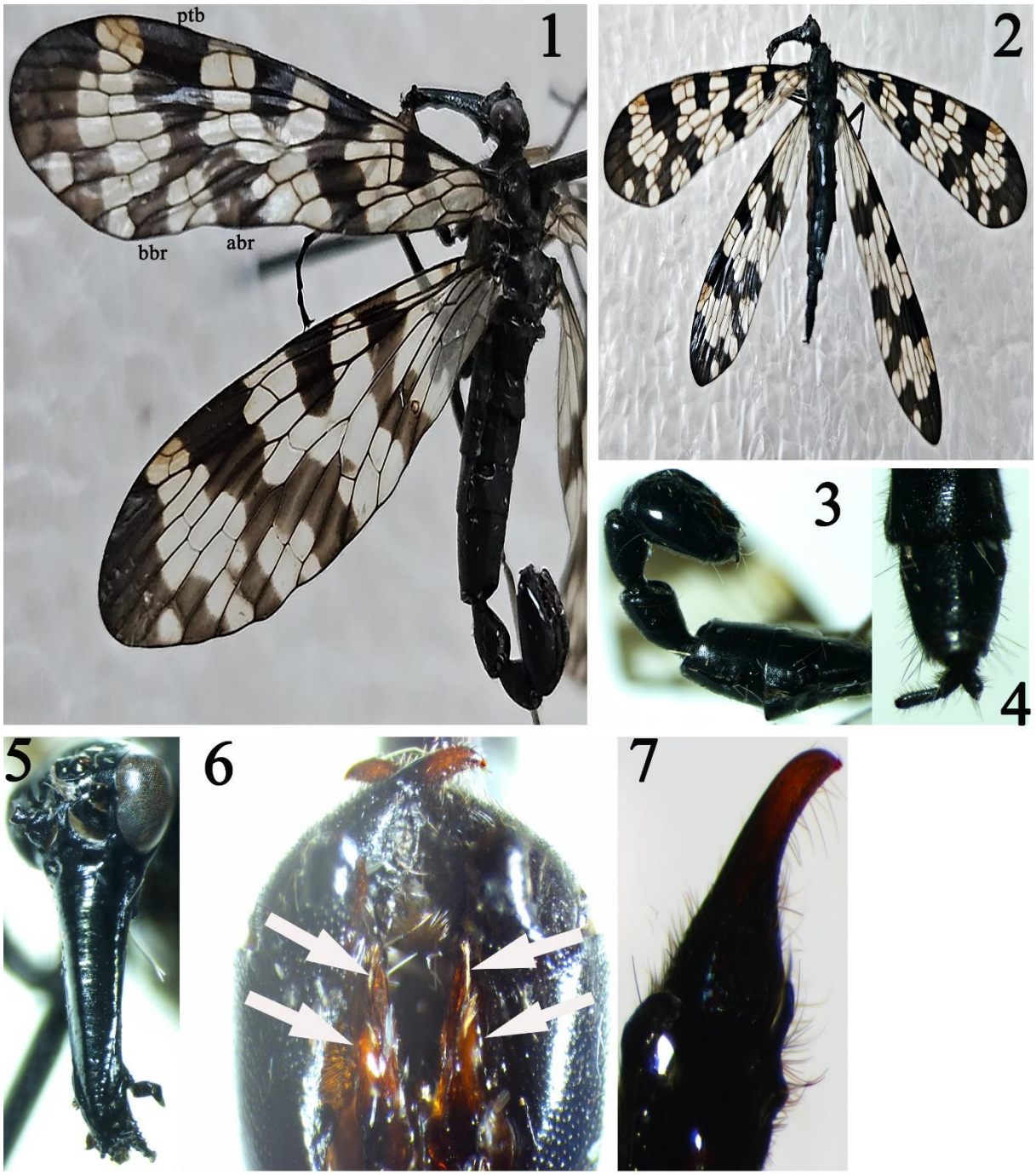

Figure 1–7. *Panorpa tatvana ressli* Willmann. (1) male left wings in dorsal view (ptb: pterostigma band, abr: apical branch, bbr: basal branch); (2) female habitus in dorsal view; (3) male terminal abdomen V–IX in lateral view; (4) female abdominal segments IX–XI in ventral view and cercus; (5) male head in frontal view; (6) male genital bulb in ventral view, white arrows indicated hypovalve; (7) male gonostylus in ventral view.

4. Conclusions and discussion

The second detection of *Panorpa tatvana ressli* Willmann, 1975 Mecoptera: Panorpidae) in the Western Black Sea Region (Bolu) not only contributes significantly to the in-depth understanding of the region's biodiversity and ecosystems but also introduces a novel perspective on the distribution of this species in Türkiye. Despite its inclusion within the *Panorpa aspoecki* species group, comprising seven known species and ten subspecies, including *P. tatvana tatvana* Willmann, 1974 found in the European part of Türkiye [18], the lack of specific identification keys poses challenges for future research. These keys, essential for distinguishing between closely related species, necessitate referencing Willmann's earlier works for accurate classification. However, future research efforts should aim to establish updated and comprehensive identification tools, focusing on both morphological traits and molecular markers to aid species delimitation.

Despite relying on the shape of the sub genital plate (sclerite 9) as a determining factor for *Panorpa* species, variations exist among European species and most Anatolian members of the *aspoecki* group. While some display a caudal recess in their sub genital plate, this feature remains species-specific, absent in others or showing weaker indentations, serving as individual distinctions. The distinct characteristics of the *aspoecki* group include a completely black body coloration, well-defined wing color patterns, and distinct male genitalia [19]. Given the current reliance on morphological features, exploring molecular phylogenetics offers promising avenues for future studies. By utilizing techniques such as mitochondrial DNA sequencing (e.g., mtCOI gene), researchers could unravel the evolutionary relationships between *Panorpa tatvana ressli* and other species within the *aspoecki* group, potentially revealing cryptic diversity or more precise species boundaries. Molecular studies could also provide insights into the species' biogeographical history and dispersal patterns across Anatolia and neighboring regions.

The differentiation and identification of the species primarily rely on their terminal morphological characteristics, particularly the localized shapes of the hypovalves (Figure 6). The entire body and wing markings display a black to black-brown hue. Notably extensive, the wing marks consist of a basal band that doesn't extend to the wing's rear edge. The apical branch (abr) is linked to the basal branch (bbr) of the pterostigma band (ptb). The male genitalia exhibit a broadly oval shape. The hypovalvae barely reach the midpoint of the gonopods, excluding their terminal scales. Adjacent to the terminal scales, each hypovalvae showcases a distinct, narrow longitudinal groove, continuing caudally beyond their base. The basal segment of the ventral parameres is broad and shield-shaped, with a slender gonostylus (Figure 7).

As of current records, *P. tatvana ressli* remains reported solely from its type locality in Türkiye, , specifically Bolu, Abant lake [19]. This paper presents the second documented instance of this subspecies in Türkiye. This information makes a significant contribution to Turkey's Mecoptera fauna and provides information on the continued continuity of the species.

In conclusion, the detection of *P. tatvana ressli* in Bolu significantly enhances our knowledge of the species' distribution and underscores the importance of continued research in the region. Future studies focusing on molecular phylogenetics, ecological interactions, and broader biogeographical comparisons will not only clarify the species' place within the *aspoecki* group but also contribute to a more profound understanding of Mecoptera diversity in Türkiye and beyond.

Acknowledgement

The authors extend their sincere gratitude to Prof. Dr. Rainer WILLMANN from the Georg-August-Universität Göttingen (Germany) for his invaluable support and guidance throughout this research endeavor.

References

[1] Wang, J. S. & Hua, B. Z. (2021). Morphological phylogeny of Panorpidae (Mecoptera: Panorpoidea). *Systematic Entomology*, 46(3), 526-557. https://doi:10.1111/syen.12474.

[2] Tezcan, S. (2020). Analysis of the insect fauna of Turkey and suggestions for future studies. *Munis Entomology & Zoology*, 15(2), 690-710.

[3] Dvořák, L. & Devetak, D. (2022). Distribution and biology of two Balkan scorpionflies, *Panorpa rufostigma* and *Panorpa rufa* (Mecoptera, Panorpidae), with a description of their ecological traits. *Zootaxa*, 5071(3), 408-422. https://doi.org/10.11646/zootaxa.5071.3.5.

[4] Dvořák, L., Ruchin, A. B., Aleksanov, V. V., Egorov, L. V., Esin, M. N., Lukiyanov, S. V., Lobachev, E. A., & Fayzulin, A. I. (2024). Ecology of some *Panorpa* (Mecoptera, Panorpidae) species from several regions of Russia. *Forests*, 15(9), 1608. https://doi.org/10.3390/f15091608.

[5] Willmann, R. (1977). Bemerkungen zu anatolischen Mecopteren. *Annalen des Naturhistorischen Museums in Wien*, 517-523.

[6] Bicha, W., Schiff, N., Lancaster, A., Suttiprapan, P., Dokjan, T. & Scheffler, B. (2022). A Key to Species of the Scorpionflies of Thailand with the Description of New Species of *Panorpa* and *Neopanorpa* (Mecoptera: Panorpidae) Based on Morphology and DNA Barcodes. *Transactions of the American Entomological Society*, 148(2), 201-228. https://doi:10.3157/061.148.0202.

[7] Byers, G. W. & Thornhill, R. (1983). Biology of the Mecoptera. *Annual review of entomology*, 28(1), 203-228.

[8] Jacquemart, A.-L., Gillet, C. & Cawoy, V. (2007). Floral visitors and the importance of honeybee on buckwheat (*Fagopyrum esculentum* Moench) in central Belgium. *Journal of Horticultural Science and Biotechnology*, 82(1), 104-108. https://doi:10.1080/14620316.2007.11512205.

[9] Libor, D. & Yu, Z. E. (2023). Distribution of species from the genus *Panorpa* (Mecoptera, Panorpidae) in European Russia except the Caucasus. *Nature Conservation Research*. Заповедная наука, 8(1), 24-33. https://doi:10.24189/ncr.2023.001.

[10] Palmer, C. (2010). Diversity of feeding strategies in adult Mecoptera. *Terrestrial Arthropod Reviews*, 3(2), 111-128. https://doi:10.1163/187498310x519716.

[11] Aksan, Ş., Özdemir, İ. & Oğurlu, İ. (2014). Modeling the distributions of some wild mammalian species in Gölcük Natural Park/Turkey. *Biological Diversity and Conservation*, 7 (1): 1-15.

[12] Esben-Petersen, P. (1921). Mecoptera. Monographic revision. Collections zoologiques du baron Edm. de Selys Longchamps: catalogue systématique et descriptif, 5, 1–172.

[13] Penny, N. D. (1975). Evolution of the Order Mecoptera. *Annual Review of Entomology*, 20, 117-136. https://doi.org/10.1146/annurev.en.20.010175.001001.

[14] Thornhill, R. & Sauer, K. P. (1991). The notal organ of the scorpionfly (*Panorpa vulgaris*): an adaptation to coerce mating duration. *Behavioral Ecology*, 2(2), 156-164. https://doi:10.1093/beheco/2.2.156.

[15] Zhong, W. & Hua, B. (2013). Mating behaviour and copulatory mechanism in the scorpionfly *Neopanorpa longiprocessa* (Mecoptera: Panorpidae). *PLoS One*, 8(9), e74781. https://doi: 10.1371/journal.pone.0074781.

[16] Zhong, W., Ding, G & Hua, B. (2015). The role of male's anal horns in copulation of a scorpionfly. *Journal of Zoology*, 295(3), 170-177. https://doi:10.1111/jzo.12194.

[17] Engels, S. & Sauer, K. P. (2006). Love for sale and its fitness benefits: nuptial gifts in the scorpionfly *Panorpa vulgaris* represent paternal investment. *Behaviour*, 143(7), 825-837. https://doi:10.1163/156853906778017962.

[18] Willmann, R. (1976). Eine neue europaische *Panorpa* (Mecoptera, Panorpidae). *Entomologische Zeitschrift*, (86), 60-64.

[19] Willmann, R. (1975). Die Gattung *Panorpa* (Insecta, Mecoptera) in der Türkei. *Annalen des Naturhistorischen Museums in Wien*, 543-564.