PERIODICUM BIOLOGORUM
VOL. 124, No 3–4, 147–154, 2022
DOI: 10.18054/pb.v124i3-4.23250

UDC 57:61
CODEN PDBIAD
ISSN 0031-5362

Short Communication

Distribution and biology of two Balkan scorpionflies, *Panorpa rufostigma* and *P. lacedaemonia* (Mecoptera: Panorpidae)

LIBOR DVOŘÁK[1]*
DUŠAN DEVETAK[2]

[1] Mariánské Lázně, Czechia

[2] Department of Biology, Faculty of Natural Sciences and Mathematics, University of Maribor, Maribor, Slovenia

***Correspondence**
Libor Dvořák
E-mail address: lib.dvorak@seznam.cz

Key words: panorpids; Balkan Peninsula; Albania; mapping; ecology

Abstract

Background and purpose: *Two scorpionflies,* Panorpa rufostigma *Westwood, 1841 and* P. lacedaemonia *Lauterbach, 1972, are poorly known and understudied from faunistic and ecological aspects. A review of published and new records of two species in the Balkan Peninsula and Crete is presented.*

Material and methods: *The scorpionflies were caught by various entomologists using a sweeping net, preserved in ethanol, and sent to the article authors.*

Results: *Altogether five unpublished records of* P. rufostigma *and 19 unpublished records of* P. lacedaemonia *are presented. The paper summarizes the data on the identification, phenology, altitude preferences and habitats of both species. Three collecting places of* P. lacedaemonia *in south Albania are the first records in the country. Color images detailing some morphological characters of* P. lacedaemonia *are presented for the first time.*

Conclusions: *Both species have a wider geographical distribution than previously known. The species* P. rufostigma *is a summer/autumn species preferring shrubby or semi-open stands, often of dry character. The species* P. lacedaemonia *occurs the whole year with two distributional peaks between and prefers forest or bushy stands, often by water.*

Received September 14, 2022
Revised November 30, 2022
Accepted December 13, 2022

INTRODUCTION

The fauna of Panorpidae (scorpionflies) of the Balkan Peninsula is the richest in Europe and includes 13 species or 82% of the European scorpionflies sensu Willmann *(1)*. Six of them have so far been found exclusively on the Balkan Peninsula, namely: *Aulops plitvicensis* (Lauterbach, 1972), *Panorpa clavigera* Klapálek, 1902, *P. pieperi* Willmann, 1975, *P. rufostigma* Westwood, 1841, *P. schweigeri* Willmann, 1975, and *P. thrakica* Willmann, 1976. Although several papers on scorpionflies from this area have been published recently *(2,3,4,5,6,7,8)*, knowledge of the distribution of most of them is still unsatisfactory.

This study aims to present the current state of knowledge of two scorpionflies in the Balkan peninsula. A wealth of new data has accumulated on distribution, phenology and ecology of *P. rufostigma* and *P. lacedaemonia* in the last few years. The first species discussed in this paper, *P. rufostigma* is recognizable by its unmistakable red pterostigma in both forewings and hindwings and its male genitalia *(7)*.

In contrast to most European panorpids with blackish or dark occiput, that part of the head of *P. lacedaemonia* is orange. As there is less published data about the latter species *(9,10,11,12)*, we present some new findings in this paper.

The aims of this study are: 1) to present color images of some taxonomic characters of *P. rufostigma* and *P. lacedaemonia*, 2) to represent new faunistic data and map the known localities of both species, and 3) to summarize the data on the ecology and phenology of the two scorpionfly species.

MATERIAL AND METHODS

If not stated otherwise, the material was identified by L. Dvořák and it is deposited in his private collection.

We used the following internet links to create maps: https://www.freeworldmaps.net/europe/balkan-peninsula/ and https://d-maps.com/carte.php?num_car=241564&lang=en.

Photos were taken with a stereoscopic zoom microscope Nikon SMZ 800 with a mounted digital camera Nikon DS-Fi2 and processed with NIS-Elements D 4.20 software. Digital images captured at different focal planes were assembled using the application Helicon Focus 4.62 Lite.

RESULTS AND DISCUSSION

Panorpa rufostigma Westwood, 1841

This scorpionfly can be distinguished from all other European species by the red pterostigma in both forewings and hindwings (Figure 1).

Published data: *Panorpa rufostigma* was described by Westwood *(13)* from Albania without exact locality. The second record was published by Esben-Petersen *(14)* from Attiki, Greece (again without exact locality). Bartoš *(15)* reported the occurrence from Borshi, Albania and Lauterbach *(9)* from the Pindos Mountain Range, near village Pyli (probably Nomos Trikalon), Greece. Two years later, Willmann *(10)* added two records from Korfu and three

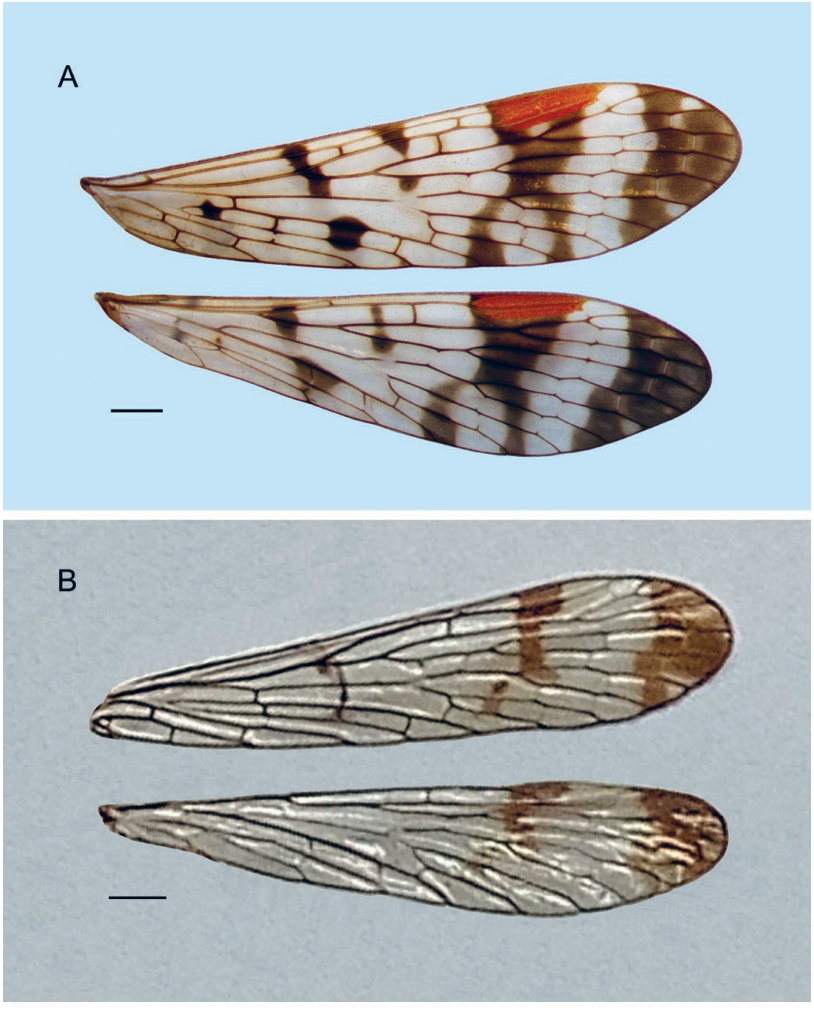

Figure 1. *Wings of two scorpionfly species: A – Right wings of Panorpa rufostigma; B – Right wings of P. lacedaemonia. Scale bar: 1 mm.*

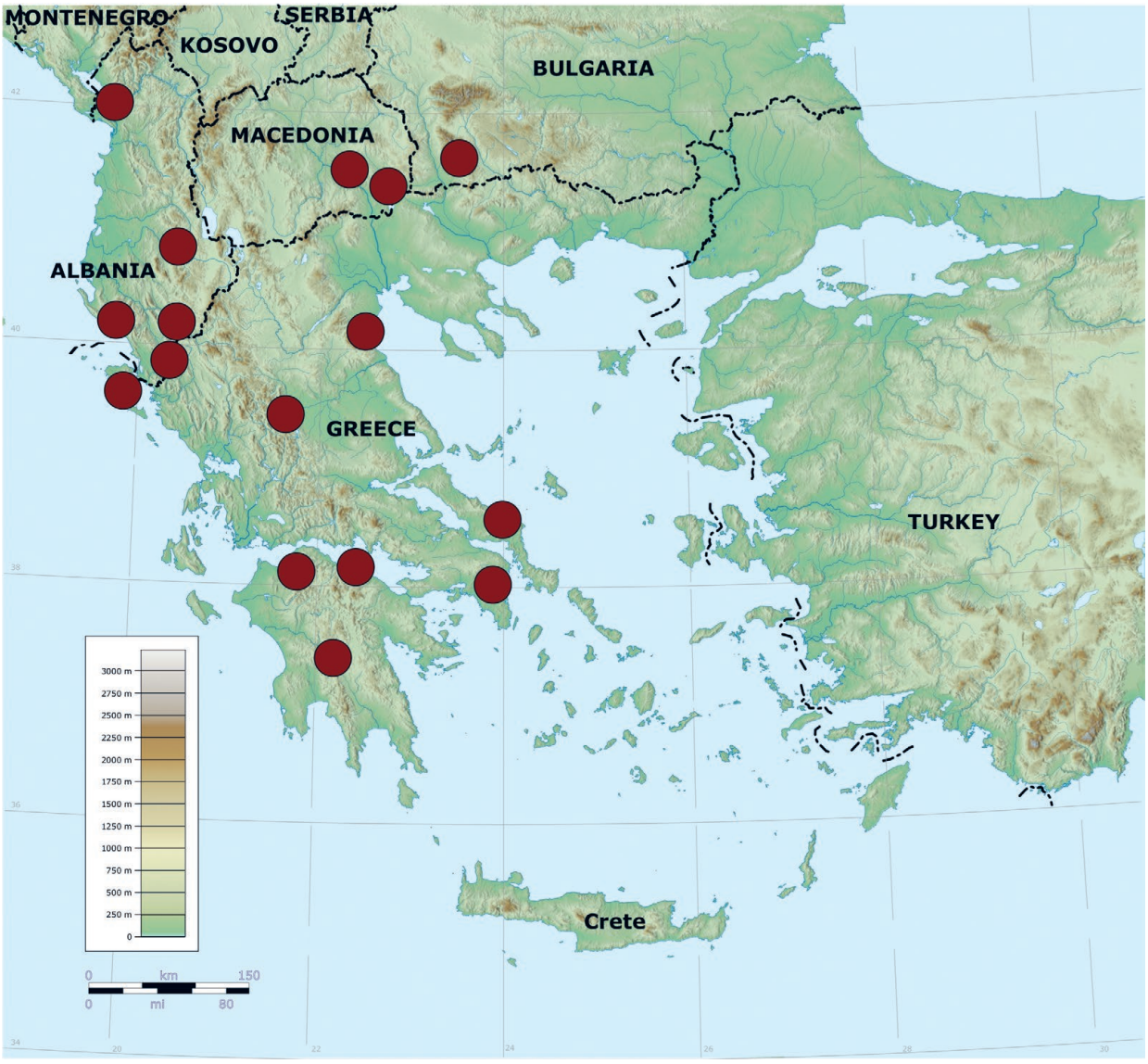

Figure 2. *The present known distribution of Panorpa rufostigma. Orig. M. Boukal.*

from mainland Greece. The last paper published information about this species in the 20th century is that of Willmann *(11)*, who only cited *P. rufostigma* from the Greek mainland, Kerkira (Korfu) island, and Albania. Recently, Pollmann et al. *(16)* published the species from Nomos Achaias, Alepochorion (first report from Peloponnese); Dvořák *(4)* from Manikiatis (first report from Euboa island), Likoporia and Lake Doxa; Dvořák et al. *(7)* from Besvica near Demir Kapija (first report from North Macedonia); and Dvořák *(5)* from Kovachevo (first report from Bulgaria).

New material: Albania: Gjirokastër district, Tsamantas Mts, Sotirë, dry karst forest S (above) of the village, 525 m, N39.8147333°, E20.3622167°, 13.X.2013, 1 ♂, 1 ♀, leg. P. Juhász, T. Kovács, D. Murányi & G. Puskás. – Përmet district, Petran, the river Vjosë and limestone rocks by the village, 260 m, N40.2079333°, E20.4150167°, 13.X.2013, 1 ♀, leg. P. Juhász, T. Kovács, D. Murányi & G. Puskás. – Shkodër district, Vau i Dejës, macchia along the road to Koman, 115 m, N42.0171833°, E19.66145°, 10.X.2012, 1 ♂, leg. P. Juhász, T. Kovács, D. Murányi & G. Puskás. – Korçë district, Opari area, Moglicë, torrent in bushy flysh vegetation E of the village, 500 m, N40.7064500°, E20.4177833°, 500 m, 16.X.2013, 1 ♀, leg. P. Juhász, T. Kovács, D. Murányi & G. Puskás. – **North Macedonia:** Southeastern region, Dorjansko Basin, Nikolich, macchia brook W of the village, 215 m, N41.2591000°, E22.7339500°, 4.X.2013, 1 ♀, leg. Kovács, D. Murányi.

Notes on distribution and ecology: *Panorpa rufostigma* is known in almost the whole mainland Greece, southernmost parts of Bulgaria, North Macedonia and from various parts of Albania (Figure 2). The northernmost Albanian record suggests the possibility of the spe-

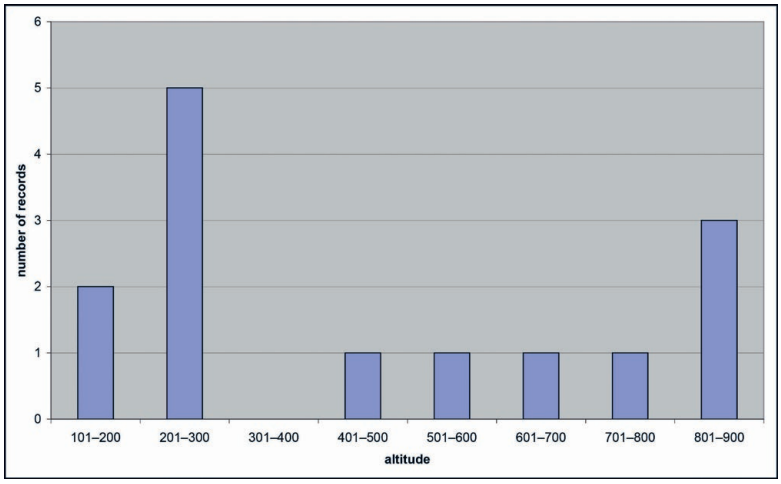

Figure 3. *The altitudinal preferences of Panorpa rufostigma.*

cies' occurrence in southern Montenegro along the Skadar Lake.

There are only several known published and unpublished records and not in all cases the altitude is known. Based on these 14 data, the occurrence of *P. rufostigma* is concentrated mainly into the lowlands up to 300 m a. s. l. (50% of all records) but can be found up to 900 m (Figure 3). From this point of view, the investigation in southern parts of Kosovo could be interesting as the migration from Albania along the river Drin is possible.

Little is known about the biotope preferences of *P. rufostigma*. Bartoš *(15)* published it from a littoral terrace with *Olea* and *Ficus*, Dvořák *(4)* from an open shrubland with some *Pinus halepensis* and a coniferous forest meadow, Dvořák et al. *(7)* from a pseudomaquis and Dvořák *(5)* from a degraded grassland and *Rubus* shrubland. All published and here presented data indicate the preference for shrubby or semi-open stands, often of dry character.

In 18 cases, the full date of occurrence is known (Figure 4). Except the record of Bartoš *(15)* from the 2nd half of May, the other records were conducted in September and October. Among west Palaearctic species, similar occurrence in autumn and partly late summer is known in Caucasian *Panorpa arcuata* (Navás, 1912) *(17,18,19)*.

Panorpa lacedaemonia Lauterbach, 1972

Color photographs of this scorpionfly are presented for the first time. While the part of the head between the compound eyes of most European panorpids is blackish or brown, in *P. lacedaemonia* is orange with a dark spot around the ocelli (Figure 5). This unique feature was published by Ward *(12)* already. Dorsal view of *P. lacedaemonia* and its male genitalia are shown in Figures 6-7.

Published data: This species was described by Lauterbach *(9)* from two localities in Peloponnese (Greece). Willmann *(10)* added four new records from Pelopon-

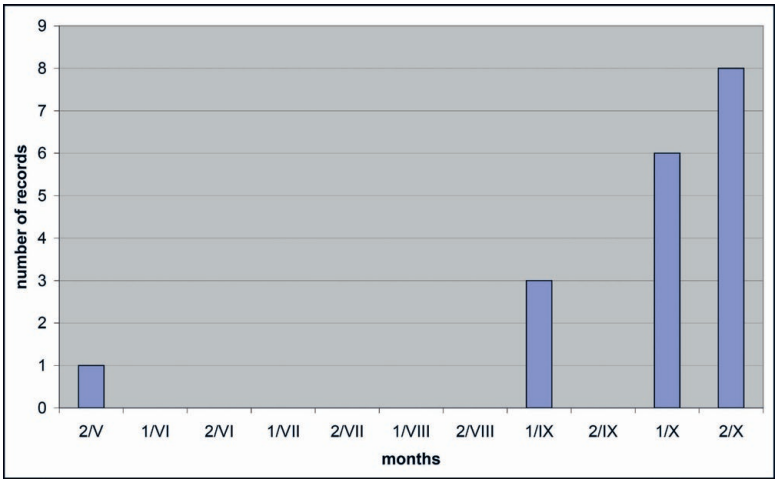

Figure 4. *The phenology of Panorpa rufostigma. The data were arranged in a half a month periods.*

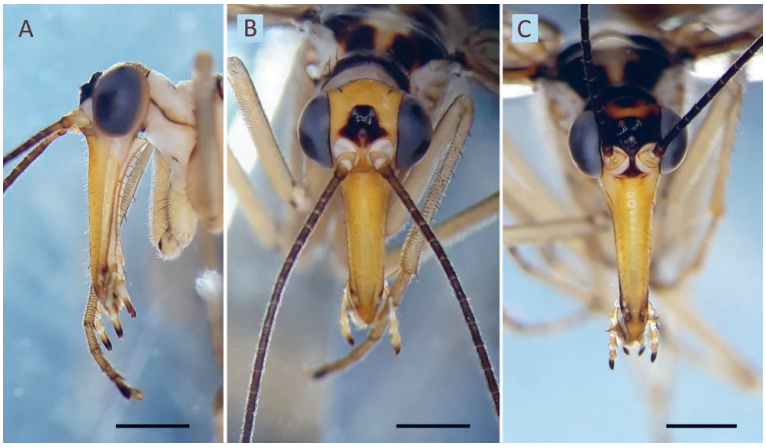

Figure 5. *Heads of two scorpionfly species: P. lacedaemonia (Albania, Mesopotam): A – lateral, B – frontal; C – P. germanica (Albania, Hotolisht): frontal. Scale bar: 1 mm.*

Figure 6. *P. lacedaemonia: body coloration, dorsal view. Scale bar: 1 mm.*

nese, two from central Greece and 12 from Crete. Later, Willmann *(11)* reported additional localities from north and central Greece, Peloponnese and Crete. Ward *(12)* published several localities from mainland Greece, Lefkada, and Korfu and also synonymized *P. germanica corcyraea* Lauterbach, 1972 with *P. lacedaemonia*.

New material: Albania: Tepelenë district, Tepelenë, Uji i Ftohtë, karst springs and forest, 165 m, N40.2501833°, E20.0591333°, 13.X.2012, 1 ♂, leg. P. Juhász, T. Kovács, D. Murányi, G. Puskás. – Delvinë, Gjerë Mts, Bistricë, forest karst spring E of the village, 105 m, N39.9187500°, E20.1466500°, 13.X.2013, 1 ♂, leg. P. Juhász, T. Kovács, D. Murányi & G. Puskás. – Vlorë County, Mesopotam, riparian vegetation along the river Bistrica, 28 m, N39.905°, E20.0858333°; 30.VI.2014; 1 ♂, leg., det. et coll. D. Devetak. – **Greece, mainland:** Olympia, the river Kladeos, N37.6327778°, E21.6247222°, 4.IV.2014, 2 ♂, 1 ♀, J. Pražák. – Epirus, Preveza peripheral unit, Mitikas, bush and rocky seashore of the Ionian Sea at the village, 0 m, N39.0017667°, E20.7014°, 5.V.2011, 3 ♂♂, 3 ♀♀, leg. J. Kontschán, D. Murányi, T. Szederjesi, Zs. Ujvári. – Arcadia county, Tetrazi Mts, Ag. Theodora, stream and karst spring, 490 m, N37.3544833°, E21.9797°, 5.IV.2009, 1 ♂, 1 ♀, leg. J. Dányi, J. Kontschán & D. Murányi. – Mes-

Figure 7. *Male genitalia of P. lacedaemonia; the genital bulb is photographed turned slightly to the right. Scale bar: 1 mm.*

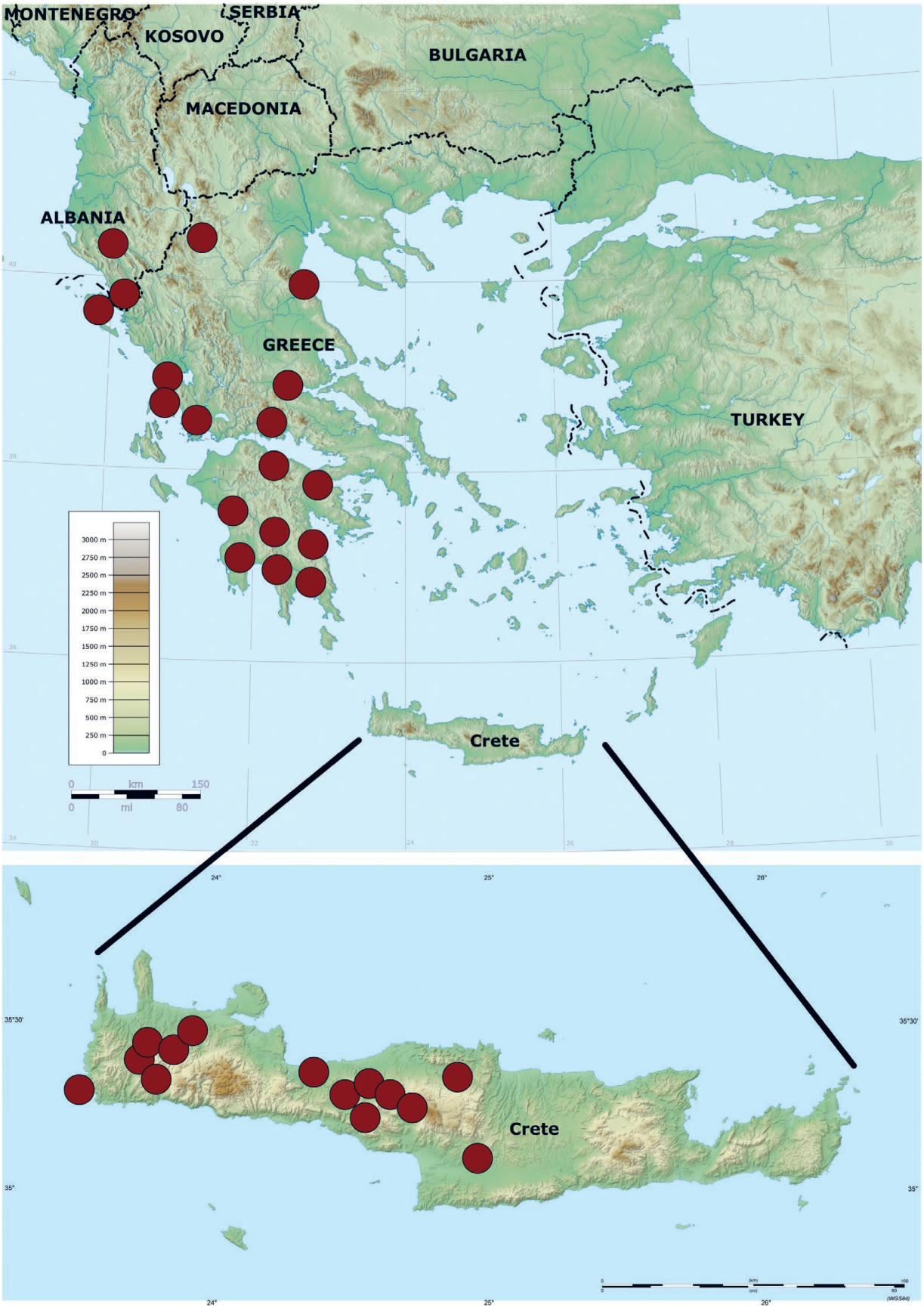

Figure 8. *The present known distribution of Panorpa lacedaemonia. Orig. M. Boukal.*

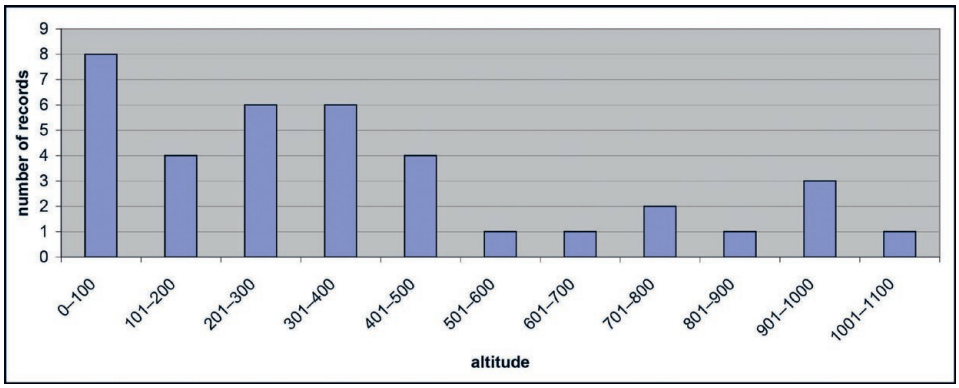

Figure 9. *The altitudinal preferences of Panorpa lacedaemonia.*

sinia county, Kalamata, side-channel of the river Pamisos, W of the city, 5 m, N37.0258°, E22.0177667°, 4.IV.2009, 1 ♀, leg. J. Dányi, J. Kontschán & D. Murányi. – West Greece, Aetolia-Acarnania peripheral unit, Agios Nikolaos, tall macchia and roadside vegetation N of the village, 80 m, N38.8929833°, E20.8030500°, 5.V.2011, 1 ♀, J. Kontschán, D. Murányi, T. Szederjesi, Zs. Ujvári. – **Greece, Korfu:** Spartilas, 17.VI.2012, 1 ♂, leg. O. Kouklík. – Greece, Korfu, Moraitika, path in olive park, N39.4872222°, E19.9208333°, 28.IV.2014, 1 ♀, leg. J. Pražák. – **Greece, Ionian islands:** Lefkada peripheral unit, plane tree gallery and bush W of the village, 50 m, N38.7227167°, E20.6900667°, 6.V.2011, 1 ♂, leg. J. Kontschán, D. Murányi, T. Szederjesi & Zs. Ujvári. – **Greece, Crete:** Rethymno regional unit, Mirthios, D. Dason Rethymnis, spring E of the village, 155 m, N35.29365°, E24.556°, 1.IV.2013, 1 ♂, 1 ♀, leg. J. Kontschán, D. Murányi & T. Szederjesi. – Rethymno regional unit, Gouleditiana, olive grove with oak stands at the village, 440 m, N35.2867667°, E24.49915°, 1.IV.2013, 2 ♂♂, 1 ♀, leg. J. Kontschán, D. Murányi & T. Szederjesi. – Rethymno regional unit, Apostoli, stream and its plane tree gallery, N of the village, 320 m, N35.2701833°, E24.6136833°, 1.IV.2013, 1 ♀, leg. J. Kontschán, D. Murányi & T. Szederjesi. – Chania regional unit, Skafi, stream and its plane tree gallery, S of the village, 370 m, N35.3134333°, E23.7935333°, 31.III.2013, 2 ♂♂, 2 ♀♀, leg. J. Kontschán, D. Murányi & T. Szederjesi. – Chania regional unit, Kakopetros, stream and its plane tree gallery near the village, 430 m, N35.4133833°, E23.7565167°, 31.III.2013, 1 ♂, leg. J. Kontschán, D. Murányi & T. Szederjesi. – SE Spili, 29.IV.2014, 1 ♀, leg. Z. Lucbauer. – Elafonisi, Inachori, 24.IV.2014, 1 ♀, leg. Z. Lucbauer. – W Kavalios, Kouris Lake, 29.IV.2014, 1 ♀, leg. Z. Lucbauer.

Notes on distribution and ecology: *Panorpa lacedaemonia* is known from many parts of mainland Greece (it has not been found in northeast), Korfu, Lefkada, and western Crete (Figure 8). Here are published first records from Albania.

37 records of *P. lacedaemonia* with altitudinal data are presented in this paper, most of them (28 records) are known from lower and medium altitudes, up to 500 m a. s. l. (Figure 9). This species is rarely found in higher altitudes, in one case above 1000 m. Almost a half of all records originates from the altitudes up to 300 m, which is similar as in *P. rufostigma*.

According to the list of here presented localities, *P. lacedaemonia* prefers forest or bushy stands, often by water, it means different preferences in opposite of *P. rufostigma*. Both species were published from Alepochorion from the same date by Willmann *(10)*, but without any notes about the species' biotope.

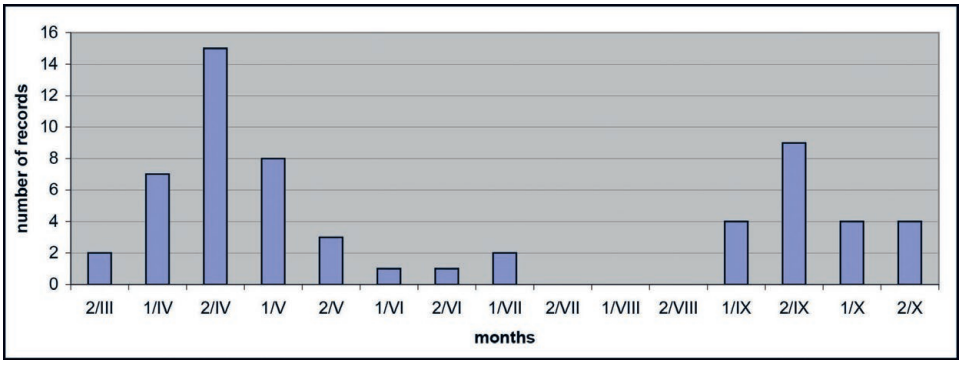

Figure 10. *The phenology of Panorpa lacedaemonia. The data were arranged in a half a month periods.*

In 60 cases, the full date of occurrence is known (Figure 10). Ward *(12)* stated: "Published records would seem to indicate two main broods in nature, on occurring between the beginning of April and early May and the other from mid September to late October." As Figure 10 shows, Ward's indication was totally supported after collecting much more recorded data.

CONCLUSIONS

Both species have a centre of distribution in mainland Greece. *P. rufostigma* is known also from southernmost parts of Bulgaria, North Macedonia, from various parts of Albania, and from Korfu and Euboa islands. *P. lacedaemonia* is known also from Korfu and Lefkada islands, and from western Crete. Here are published first records from Albania.

Almost half of records of both species are concentrated mainly into the lowlands up to 300 m a. s. l. but can be rarely found up to 900 m (*P. rufostigma*) or above 1000 m (*P. lacedaemonia*).

The available data indicate that *P. rufostigma* prefers shrubby or semi-open stands, often of dry character, whilst *P. lacedaemonia* prefers forest or bushy stands, often by water.

P. rufostigma is a summer/autumn species with occurrence in September and October; the only exception is one published record in May; *P. lacedaemonia* occurs the whole year with two distributional peaks between the beginning of April and early May and between mid-September and late October.

Acknowledgement: *We are very grateful to Dávid Murányi (Eszterházy Károly Catholic University, Eger, Hungary), Zdeno Lucbauer (Malacky, Slovakia), Jan Pražák (Museum of Eastern Bohemia in Hradec Králové, Hradec Králové, Czechia), and Ondřej Kouklík (Faculty of Science, Charles University in Prague, Czechia) for donating the material, and to Milan Boukal (Pardubice, Czechia) for preparing the maps of the distribution. We are grateful two anonymous reviewers for their helpful comments.*

REFERENCES

1. WILLMANN R 2013 Fauna Europaea: Mecoptera. Fauna Europaea version 2.6.2. http://www.faunaeur.org (Accessed 15.5.2022)
2. DVOŘÁK L 2014 The first record of scorpion-fly Panorpa schweigeri Willmann, 1975 (Insecta, Mecoptera, Panorpidae) from Bulgaria. ZooNotes 51: 1–3.
3. DVOŘÁK L 2016 The second record of Panorpa thrakica Willmann, 1976 (Insecta, Mecoptera, Panorpidae). ZooNotes 88: 1–4.
4. DVOŘÁK L 2018 New records of the scorpion fly Panorpa rufostigma Westwood, 1846 (Mecoptera: Panorpidae) from Greece. Parnassiana Arch 6: 7–9.
5. DVOŘÁK L 2022 New records of scorpion-flies (Mecoptera: Panorpidae) from Bulgaria. ZooNotes 196: 1–4.
6. DVOŘÁK L, GEORGIEV D 2017 New and interesting records of scorpion flies of the genus Panorpa (Mecoptera: Panorpidae) from Bulgaria with a country checklist. Ecol Montenegr 15: 22–25. https://doi.org/10.37828/em.2017.15.4
7. DVOŘÁK L, NAHIRNIĆ A, DEVETAK D 2020 The first record of Panorpa rufostigma Westwood, 1846 from North Macedonia (Mecoptera: Panorpidae). Acta Entomol Slov 28(1): 59–64.
8. WILLMANN R, KULIJER D, DVOŘÁK L 2022 Panorpa clavigera Klapálek, 1902 - redescription and comparison with P. hybrida McLachlan, 1882 (Insecta: Mecoptera). Entomol Z 132 (1): 3–10.
9. LAUTERBACH K.-E 1972 Zur Kenntnis der Skorpionsfliegen des Balkans (Mecoptera, Panorpidae). Deut Entomol Z 19: 109–140. https://doi.org/10.1002/mmnd.4810190112
10. WILLMANN R 1974 Zur Kenntnis von Panorpa in Griechenland. Biol Gallo-Hellenica 5: 319–331.
11. WILLMANN R 1977 Die subspezifische Gliederung von Panorpa germanica L. auf dem Balkan (Mecoptera: Panorpidae). Entomol Scand 8: 13–28. https://doi.org/10.1163/187631277X00035
12. WARD PH 1978 The taxonomy and biology of Panorpa lacedaemonia Lauterbach (Mecoptera, Panorpidae). Entomol Gazette 29(1/2):79–98.
13. WESTWOOD JO 1841 Proceedings of the Learned Societies. Entomology Society. March 5th, 1841. A monograph of the genus Panorpa, together with descriptions of species of various allied genera. Ann Mag Nat Hist 8: 298–300.
14. ESBEN-PETERSEN P 1921 Mecoptera. Monographic revision. Collections Zoologiques du Baron Edm. de Selys Longchamps 5(2): 1–172.
15. BARTOŠ E 1965 Ergebnisse der Albanien-Expedition 1961 des Deutschen Entomologischen Institutes. 35. Beitrag. Mecoptera. Beitr Entomol 15: 661–664.
16. POLLMANN C, MISOF B, SAUER KP 2008 Molecular phylogeny of panorpodid scorpionflies: An enigmatic, species-poor family of Mecoptera (Insecta). Org Divers Evol 8(2): 77–83. https://doi.org/10.1016/j.ode.2006.12.001
17. DVOŘÁK L, JAPOSHVILI G 2018 The scorpionflies (Mecoptera) from Lagodekhi Reserve, with some distributional and seasonal activity data. Zootaxa 4407(1): 137–140. https://doi.org/10.11646/zootaxa.4407.1.11
18. MAKARKIN VN, SHCHUROV VI 2019 Neuropterida and Mecoptera from the North-Western Caucasus. Caucasian Entomol Bull 15(2): 299–316 https://doi.org/10.23885/181433262019152-299316
19. SHCHUROV VI, MAKARKIN VN 2017 New records of Neuropterida (Neuroptera: Raphidioptera) and scorpion-flies (Mecoptera) from the North-Western Caucasus. Caucasian Entomol Bull 13(1): 77–90. https://doi.org/10.23885/1814-3326-2017-13-1-77-90