



New Data for the Zygaenidae (Lepidoptera) from the Sakar Mountain, Bulgaria

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Abstract: Although the Sakar Mountain in Bulgaria is very rich in terms of biodiversity, there are no published data on the fauna of the family Zygaenidae in this area. The aim of the present study is to enhance the knowledge about the species diversity of Zygaenidae in the Sakar Mt. and to provide information about rare species of conservation concern. Nine localities were studied during two field trips in 2019. Altogether 13 species were found, the most interesting of which were *Rhagades amasina* as a new species for Bulgaria and *Theresimima ampellophaga*, *Zygaena diaphana* and *Z. laeta*, which are known to be relatively rare in the south-eastern Bulgaria, north-eastern Greece (Greek Thrace) and Turkish Thrace.

Key words: faunistics, *Rhagades amasina*, Procridae, Zygaenidae, south-eastern Bulgaria

Introduction

Although Bulgaria is a well-explored country in terms of the fauna of the family Zygaenidae in comparison with other countries on the Balkan Peninsula (NAHIRNIĆ 2018), there is no study dedicated to this lepidopteran family for a certain area, i.e. Sakar Mountain. This mountain is very rich in biodiversity and it is of high nature conservation importance; however, there are no published data on the Zygaenidae from this area. The purpose of our study was to establish the species diversity and occurrence of Zygaenidae in the Sakar Mt.

Sakar is a low mountain in SE Bulgaria with the highest summit Vishegrad (856 m a. s. l.). The surface of the mountain is approximately 167,101 ha (ABADJIEV & BESHKOV 2007). The Sakar Mt. is directly connected with the Turkish Thracian Valley and exposed to various climatic influences. The mountain is situated near the Bulgarian boundary

with Turkey. Its landscape is dominated by round hills and open valleys of rivers (e.g. Maritsa and Tundzha) and their tributaries. The lower parts are occupied by agricultural lands and forests of *Quercus pubescens* Wild and *Q. virgiliana* (Ten.) Ten., interspersed with xerothermic grass communities dominated by *Dichanthium ischaemum* (L.) Roberty, *Poa bulbosa* L., *Chrysopogon gryllus* (L.) Trin. and, more rarely, by mesoxerothermic vegetation. The bush communities consist of *Paliurus spina-christi* Mill., mixed with *Jasminum fruticans* L. The ridge and the slopes above 500 m a. s. l. are covered by mixed oak forests. The populated areas are surrounded by vineyards and tobacco fields.

The Sakar Mt. is a Prime Butterfly Area (ABADJIEV & BESHKOV 2007). The largest part of the mountain is a part of Natura 2000 sites BG0000212 “Sakar” from 92/43 EEC Habitat Directive and “Sakar” BG0002021 from 79/409 EEC Bird Directive.

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A small part of the Sakar Mt., including the Matochina area is a part of another Natura 2000 site: BG0000217 “Zhdreloto na reka Tundzha”.

Materials and Methods

We (AN and SB) made two short trips at the beginning of May and at the beginning of June, 2019 to the Sakar Mt. with the intention to find *Theresimima ampellophaga* (Bayle-Barelle, 1808), *Rhagades amasina* (Herrich-Schäffer, 1851), *Adscita obscura* (Zeller, 1847), *Zygaena laeta* (Hübner, 1790) and *Z. diaphana* Staudinger, 1887. During these field trips, we visited nine selected localities. The following sampling methods were used to verify the presence of Zygaenidae species in the study area: (1) direct visual observation, (2) collecting of specimens with an entomological net or by hand, (3) beating the bushes, (4) using pheromone traps and (5) attachment of a pheromone lure to the hat of the researcher when walking during the day in the habitat (see TARMANN et al. 2019).

All specimens were collected by AN and SB, with the exception of *Jordanita budensis* (Speyer & Speyer, 1858), which was collected by Albena Lapeva-Gjonova and Ilia Gjonov.

The studied localities were as follows:

1. Dripchevo Village W, 41°58'48"N, 26°12'23"E, 445 m a. s. l.
2. Dripchevo Village E, 41°58'36"N, 26°14'57"E, 514 m a. s. l.
3. Vicinity of Mustrak Village, 41°51'19"N, 26°17'49"E, 270 m a. s. l.
4. Below Dervishka Mogila summit, at the turn to Dervishka Mogila Village, 41°53'55"N, 26°20'02"E, 430 m a. s. l.
5. Shtit Village, W, 41°49'36"N, 26°20'51"E, 268 m a. s. l.
6. Vicinity of Mihalich Village, 41°51'06"N, 26°25'49"E, 348 m a. s. l.
7. Vicinity of Mihalich Village, turn to the village near the main road, 41°50'48"N, 26°26'16"E, 300 m a. s. l.
8. Matochina Village, 41°51'11"N, 26°32'56"E, 160 m a. s. l.
9. Matochina Village, 41°50'56"N, 26°32'52"E, 203 m a. s. l.

The following lures were used during the study: the synthetic sex pheromone of *Th. ampellophaga* (2R)-butyl (7Z)-tetradecenoate (SUBCHEV et al. 1998), the synthetic sex pheromone component of *Illiberis rotundata* Jordan, 1907 (2R)-butyl (7Z)-dodecenoate (R12) and its opposite enantiomer (2S)-butyl (7Z)-dodecenoate (S12)

(SUBCHEV et al. 2009), alone or the mixture of R12 and S12 in a ratio of 1:1. For preparation of lures, 100 µg of the compounds were applied as hexane (Sigma-Aldrich, purity ≥ 99.0%) solutions onto grey rubber cap (0.7 cm diameter) dispensers. We used Delta traps of a transparent PVC foil, previously used for trapping several zygaenid species (SUBCHEV et al. 2010). Sticky layers covered by non-drying Tanglefoot insect glue were placed at the bottom of the traps to keep the attracted moths. Baited traps were set only for faunistic purposes. One trap with the synthetic sex pheromone of *Th. ampellophaga* was set in an abandoned vineyard near the Mustrak Village on 03.v.2019. This trap was inspected for captured male moths on 10.vi.2019. One trap with R12 and another with R12+S12 mixture were set at locality 4 on 03.v.2019 and inspected on 10.vi.2019.

Determination was based on habitus with the exception of *Adscita statices* (Linnaeus, 1758), *A. manni* (Lederer, 1853), *Jordanita budensis*, *Zygaena diaphana* and *Z. purpuralis* (Brünnich, 1763), which were determined based on genitalia following the standard genitalia dissection protocol of ROBINSON (1976).

Results

In this study, the following species were recorded. All catches refer to adults unless stated otherwise.

PROCRIDINAE

Theresimima ampellophaga (Bayle-Barelle, 1808): locality 3 – 03.v.-10.vi.2019

Rhagades amasina (Herrich-Schäffer, 1851): locality 8 – 10.vi.2019

Adscita statices drenowskii (Alberti, 1939): locality 2 – 04.v.2019

A. manni (Lederer, 1853): locality 4 - 03.v.-10.vi.2019 (7 males in the trap with R12+S12)

Jordanita budensis (Speyer & Speyer, 1858): locality 7 – 03.v.2019

J. graeca (Jordan, 1907): locality 9 - 10.vi.2019

ZYGAENINAE

Zygaena diaphana Staudinger, 1887: locality 5 – 09.vi.2019; locality 6 – 09.vi.2019

Z. purpuralis (Brünnich, 1763): locality 6 – 09.vi.2019

Z. laeta (Hübner, 1790): locality 6 – 02.v.2019, one penultimate larva on *Eryngium campestre* L.

Z. punctum Ochsenheimer, 1808: locality 1 – 03.v.2019, one half-grown larva, locality 2 – 04.v.2019, over 20 from half to full-grown larvae, locality 4 – 10.vi.2019; locality 5 – 09.vi.2019; locality 6 – 02.v.2019, several half to full-grown larvae, local-

ity 8 – 10.vi.2019; locality 9 – 02.v.2019, one penultimate larva. All larvae were found on *E. campestre*.

Z. carniolica (Scopoli, 1763): locality 4 – 10.vi.2019; locality 5 – 09.vi.2019; locality 6 – 09.vi.2019; locality 8 – 10.vi.2019

Z. loti ([Denis & Schiffermüller], 1775): locality 4 – 10.vi.2019; locality 5 – 09.vi.2019; locality 6 – 09.vi.2019; locality 8 – 10.vi.2019

Z. filipendulae (Linnaeus, 1758): locality 4 – 10.vi.2019; locality 5 – 09.vi.2019, locality 6 – 09.vi.2019; locality 8 – 10.vi.2019.

Discussion

Totally, 13 zygaenid species were collected. Some species are rare in Bulgaria and are discussed below, while others are common in the country. The highest number of species was collected using the entomological net. Since the collecting efforts and the number of examined localities varied for each method, the effectiveness of different methods could not be directly compared. However, their combination provides valuable information about species diversity of the family Zygaenidae at the Sakar Mt. Together with the newly recorded *Rh. amasina*, the total number of the Zygaenidae species in Bulgaria is 29. Further studies on the Sakar Mt. should target on the biology of *Rh. amasina*, the subspecific determination of *Z. diaphana* and the discovery of *A. obscura*. Moreover, since our target species occur in xerothermic habitats, mesophytic habitats have not been inspected. Visiting of higher areas, such as around Dervishka Mogila summit (690 m) and the more forested areas, would probably result in the discovery of other mesophilous and xero-mesophilous species, such as *Rhagades pruni* ([Denis & Schiffermüller], 1775), *J. notata* (Zeller, 1847), *J. globulariae* (Hübner, 1790), *J. subsolana* (Staudinger, 1862), *Z. viciae* ([Denis & Schiffermüller], 1775), *Z. osterodensis* Reiss, 1921, *Z. ephialtes* (Linnaeus, 1767), *Z. angelicae* Ochsenheimer, 1808 and *Z. lonicerae* (Scheven, 1777).

We provide comments on several species:

Theresimima ampellophaga: Two fresh males of *Th. ampellophaga* were found in a trap at locality 3. In the SSW of the village, there are ca. 320 acres of vineyards with different types of management. TOSHOVA et al. (2017) presented a distribution map of *Th. ampellophaga* in Bulgaria, where there were no records of that species in the Sakar Mt. and in the wider area around the mountain. In Bulgaria, this species is relatively widely distributed in the vineyard regions and it is considered as a pest of *Vitis vinifera* L. (HARIZANOV et al. 2006, TOSHOVA et al. 2017).

Rhagades amasina: Two species of *Rhagades* were expected to be found in the Sakar Mt.: *Rh. pruni* and *Rh. amasina*. Suitable xero-thermophytic habitats with scattered bushes of their host-plants (*Crataegus* spp., *Rosa* spp., *Prunus* spp. *Pyrus* spp.) are widely distributed in the mountain. However, we did not observe any attraction of males of these species to the lures used by us in the studied localities. SUBCHEV et al. (2010) reported that R12 alone (Crimea) and in various ratios in mixtures with S12 including 1:1 ratio (Bulgaria, Crimea and Hungary) attracted males of *Rh. pruni*, while males of *Rh. amasina* were attracted to 2*S*-butyl-2-dodecenoate and 2-butyl-2-dodecenoate (CAN et al. 2019). The last lures were not tested during the current study.

One fresh male of *Rh. amasina* was found at 7:30 in the morning, resting in the grass near Matochina Village. The locality was inspected in detail, including beating the bushes, until noon and even R12 and R12+S12 attached to the researcher's hat were employed but no more specimens were found. The known distribution of this species includes Greece, Turkey, Syria, Lebanon and Israel. This is the first record of *Rh. amasina* in Bulgaria. It was located at 630 m from the Turkish border and 101 km from the nearest known locality of this species, Malkara-Kiremitlik, Turkey, reported by CAN CENGİZ et al. (2018). It is the northernmost locality of this species, 95 km north of the species current northernmost locality. Together with that of Gelibolu (GRAVES 1926), it is also the westernmost record. Since this is the only locality in Bulgaria and the edge of the species range, efforts are required to study this species in more detail and evaluate its conservation status.

As there are not many records of *Rh. amasina* published throughout its whole range (Fig. 1), two additional unpublished records are provided here: Turkey, Antalya 10 km WSW, bank of Karaman River, 300 m a. s. l., 10.v.1999, leg. Beshkov S. & Gelbrecht J., 1 male, collection Stoyan Beshkov in the National Museum of Natural History Sofia; Syria, Damaskus 25 km W, 08.vi.1961, leg. Kasy F. & Vartian E., 1 male, Natural History Museum Vienna.

Distribution map of *Rh. amasina* is presented on Fig. 1.

Zygaena diaphana: For a long time, the only published records of *Z. diaphana* remained that of NAUMANN et al. (1983) for Melnik, Kresna and Kresna Gorge. Then it was published as *Z. minus* ([Denis & Schiffermüller], 1775), however genitalia drawings given therein can be assigned to *Z. diaphana*, recently reinstated by NAHIRNIĆ (2019). The nearest record to the Sakar Mt. is that of CAN

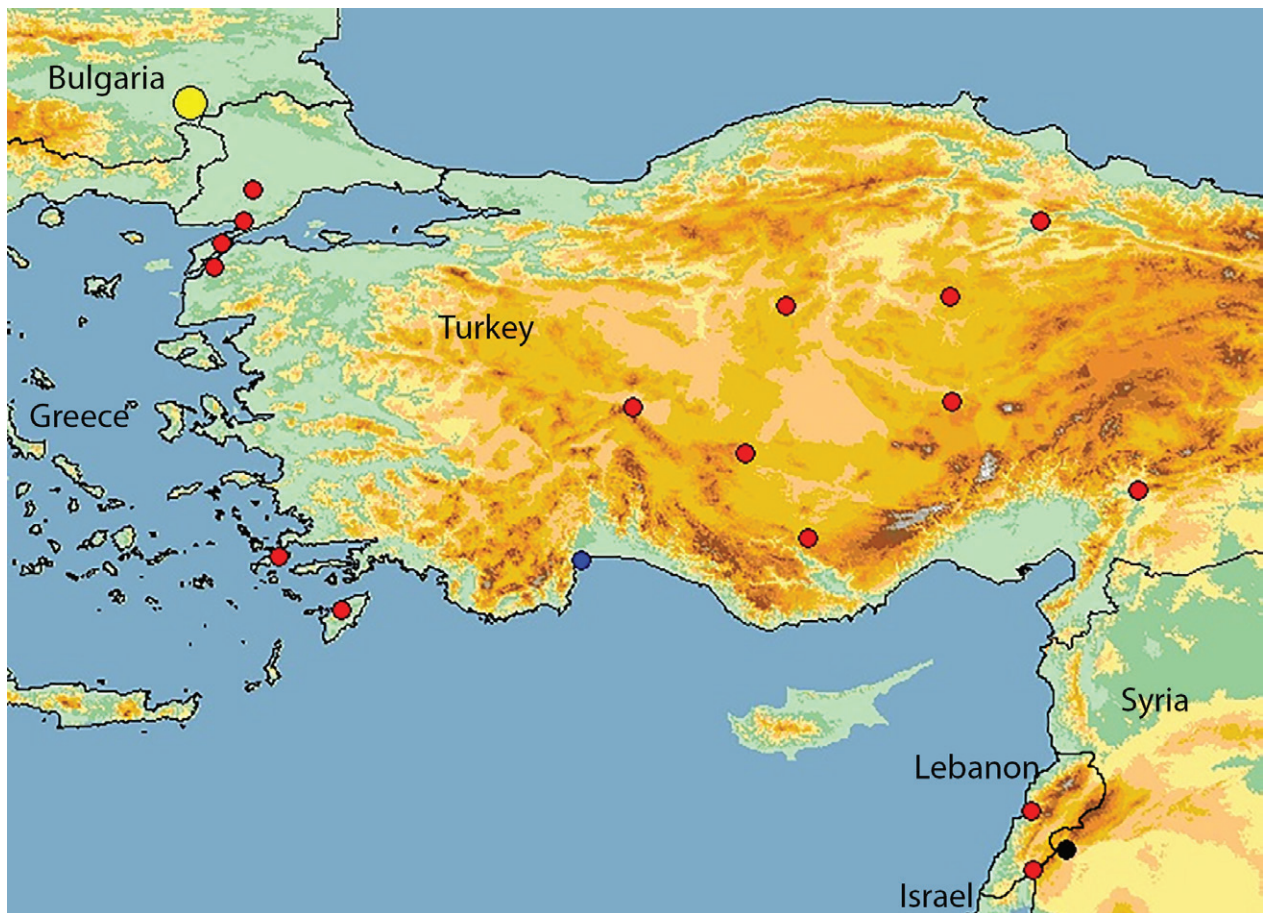


Fig. 1. Map of the distribution of *Rhagades amasina* (Herrich-Schäffer, 1851). Red dots – published records; yellow dot – new record at The Sakar Mt. (yellow dot covers approximately whole territory of The Sakar Mt.); blue dot – Antalya 10 km WSW, Karaman river bank; black dot – Syria, Damaskus 25 km W.

CENGİZ (2018) from Şarköy in Turkish Thrace, which is at 147 km from the localities in the Sakar Mt. The next nearest populations are in western Bulgaria (NAHIRNÍĆ, 2019). As the specimens from the Sakar Mt. are worn, it is not possible to discuss their subspecific status.

Zygaena laeta: This is a rare and local species in its whole range. The majority of literature records report single specimens or lack data on the number of observed specimens. According to the published records, this species has not been reported in Bulgaria since 1987 (LEHMAN 1990). We found a single larva, which was parasitised by hymenopterans. At the same habitat, many larvae of *Z. punctum*, also *Eryngium campestre*-feeders, were noticed. We visited this locality again on 9 June 2019, but no adults were found. On that day, we observed mostly worn specimens of *Z. purpuralis*, worn and fresh specimens of *Z. carniolica* and *Z. punctum*, which indicated that that period could be the very beginning of the flight season for *Z. laeta*. The ecology of this species is puzzling and deserves more attention.

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