

The Pygmy Skipper *Gegenes pumilio*: a new species to Bulgaria, and a confirmation of its occurrence in the eastern Balkan Peninsula (Lepidoptera: HesperIIDae)

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Summary. This paper details the first definitive record of the subtropical, circum-Mediterranean skipper *Gegenes pumilio* (Hoffmannsegg, 1804) from Bulgaria. The find is significant not only on a national scale, but primarily because it is the first certain proof of the occurrence of *G. pumilio* in the central-eastern parts of the Balkan Peninsula. The characters distinguishing this species from its close congener *G. nostradamus* (Fabricius, 1793) are reviewed and the differences in the male genitalia are clarified. Circumstances related to the ecology and conservation status of the species are also discussed.

Samenvatting. De eerste zekere waarneming in Bulgarije van de subtropische, circummediterrane soort *Gegenes pumilio* (Hoffmannsegg, 1804) wordt besproken. Deze vondst is niet alleen belangrijk op nationale schaal, maar vooral omdat ze het eerste bewijs is van het voorkomen van deze soort in de centraal-oostelijke delen van het Balkan schiereiland. De kenmerken die deze soort van de nauw verwante *G. nostradamus* (Fabricius, 1793) onderscheiden worden herbekeken en verschillen in de mannelijke genitalia worden uitgelegd. Onderwerpen i.v.m. de ecologie en de bescherming van deze soort worden ook besproken.

Résumé. On rapporte la première observation définitive en Bulgarie de l'espèce subtropicale, circumméditerranéenne *Gegenes pumilio* (Hoffmannsegg, 1804). Cette observation est importante pas seulement à l'échelle nationale, mais aussi parce que c'est la première preuve définitive de l'occurrence de cette espèce dans la partie centre-est de la péninsule des Balkans. Les caractères distinctifs de cette espèce par rapport à son proche congénère *G. nostradamus* (Fabricius, 1793) sont discutés et les différences dans l'appareil génital des mâles sont clarifiées. Des circonstances reliées à l'écologie et le statut de conservation de cette espèce sont discutés.

Keywords: Pygmy Skipper – *Gegenes pumilio* – *Gegenes nostradamus* – male genitalia – Bulgaria.

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Introduction

Distribution. The Pygmy Skipper *Gegenes pumilio* (Hoffmannsegg, 1804) is a highly xerothermophilous skipper species, which in Europe is distributed almost exclusively in coastal areas of the Mediterranean (Tolman 1997, Settele *et al.* 2008). In the Balkan Peninsula, *G. pumilio* is narrowly confined to the coastal areas of the Adriatic and Aegean seas in Croatia, Bosnia-Herzegovina, Montenegro and Albania (Jakšić 1988, Lelo 2008, Lorković 1971, Misja 2005), but is more widespread in Greece (Pamperis 2009) which is the centre of distribution of this species in the mainland Balkan Peninsula. Thus, in the second edition of his treatise on the butterflies of Greece, Pamperis (2009) provides the overwhelming part of data points for the distribution of *G. pumilio* in the Balkan Peninsula. Most of the records of *G. pumilio* are from southern, western and central Greece; by contrast, records are markedly scarcer in northern Greece. Only four published records from northern Greece exist: lake Kerkini, Mikroklioura and lake Vistonida in Greece's Macedonia province, and Megalo Rema in Thrace province (Pamperis, pers. comm. to Z. Kolev, 23.08.2013; the localities are shown in Fig. 1). Unfortunately none of these records is corroborated by visual or any other information apart from locality data, thus leaving the possibility for misidentification with its very similar congener *Gegenes nostradamus* (Fabricius, 1793), which is more widespread in northern Greece and European Turkey (Pamperis 2009, Hesselbarth *et al.* 1995).

The lack of published data to definitively prove the species identity of any of these records is regrettable, because 'common knowledge' perpetuated by all popular butterfly guides published so far is that *G. pumilio* does not occur in the central-eastern parts of the Balkan Peninsula (e.g. Chinery 1989, Tolman 1997, Tolman 2001, Lafranchis 2004, Haahtela *et al.* 2011). Seemingly agreeing with the latter viewpoint is the lack of records of *G. pumilio* not only from European Turkey but also from the whole Aegean coast of Turkey north of Izmir (Hesselbarth *et al.* 1995, Baytaş 2007).

Published Bulgarian 'record'. *G. pumilio* has not been explicitly and reliably recorded from Bulgaria. There is, however, a single reference connecting *G. pumilio* to the country: a map depicting the European distribution of *G. pumilio*, where a single dot is plotted within the state borders of Bulgaria, but without any further information (Kudrna 2002, Settele *et al.* 2008, Kudrna *et al.* 2011, Gesellschaft für Schmetterlingsschutz 2015). In our opinion, this 'record' is erroneously plotted, a misdetermination, or both. Our argumentation is as follows:

– Suitable conditions for the Mediterranean species of the genus *Gegenes* do not occur anywhere in the grid cell in question. Part of that area is occupied by high mountains (Rila, 2925 m), while the rest of the grid cell covers part of the upper Struma valley. The latter area is under only limited Mediterranean influence, and its climatic conditions cannot sustain any of the xerothermophilous butterfly species occurring in the

extreme southernmost part of Struma valley, such as *Gegenes nostradamus*, *Erynnis marloyi* (Boisduval, [1834]), *Gonepteryx farinosa* (Zeller, 1847), *Anthocharis gruneri* (Herrich-Schäffer, [1851]), *Lycaena ottomana* (Lefebvre, [1830]), *Freyeria trochylus* (Freyer, [1845]), *Tarucus balkanicus* (Freyer, [1844]), *Pseudochazara anthelea amalthea* (Frivaldszky, 1845), *Hipparchia fatua* Freyer, [1844], or *H. senthes* (Fruhstorfer, 1908). The southern Struma valley is in the grid cell to the south of the plotted dot of *G. pumilio*. This discrepancy indicates that this "record" may be erroneously plotted, most likely due to the flaws inherent in Kudrna's proprietary Reference Locality System (RLS) used for the project Mapping European Butterflies (MEB). These methodological flaws, which can lead to extreme cases of erroneous plotting of actual records, have been discussed in detail by Kolev (2003) and Fiedler (2011).

– It is notable that none of the published records of *G. nostradamus* from SW Bulgaria (Gogov 1963, Lehmann 1990, Ganey 1983, Ganey 1984, Abadjiev 2001) has been plotted on Kudrna's map for *G. nostradamus* in the first edition of the Atlas (Kudrna 2002). This indicates the possibility that the initial record for *G. pumilio* in the MEB database has resulted from misdetermination and misinterpretation of a published record for *G. nostradamus*.

– Moreover, a competent reporter must have been aware of the significance of such a record as the species has not been previously reported for the country (Abadjiev 2001). Nevertheless, no further data have been published and the material on which the record was based remains unknown. In the absence of these data, it is clear that this record cannot be considered seriously.



Fig. 1. Known localities of *Gegenes pumilio* in the eastern Balkan Peninsula.

1: new record, Chuchuligovo village,
2: lake Kerkini,
3: Mikroklisoura,
4: lake Vistonida,
5: Megalo Rema (2–5: Pamperis, pers. comm. to Z. Kolev). Hatched area around record 1: potential range in Bulgaria. See text for details.

First record of *Gegenes pumilio* from Bulgaria

Material. 1♂, SW Bulgaria, lower Struma valley, Chuchuligovo village, 41°24'28"N, 23°21'51"E, ca. 100 m a.s.l., 02.08.2013, leg. et coll. Z. Kolev (location shown in Fig. 1; specimen pictured in Figs. 2a and 2b, genitalia in Fig. 3). The habitat is a dry sandy and gravelly riverbed with sparse ruderal vegetation dominated by *Marrubium peregrinum*, *Verbascum* sp., etc. (Fig. 2e).

Other noteworthy butterfly species recorded at this locality by the authors during a total of 13 visits between 19.08.2012–01.09.2012, 06.04.2013–02.08.2013 07.05.2014–11.11.2014, and 20.09.2015 include: *Gegenes nostradamus*, *Carcharodus orientalis*, *C. lavatherae*, *Pyrgus cinarae*, *Zerynthia cerisy*, *Tarucus balkanicus*, *Kretania sephirus*, *Hyponophele lupina*, *Hipparchia senthes*, *H. fatua*, *Limenitis reducta*, etc. This is also the only confirmed locality of *Freyeria trochylus* in Bulgaria (Wetton 2012, Ignatov et al. 2013), although it is noteworthy that, thus far, we have failed to find the species there again, despite intensive search for it.

Circumstances. The herewith reported specimen of *G. pumilio* was found at ca. 9 a.m. on a hot day, with ambient temperature approaching 30°C by that time of the morning, in the course of a search for *G. nostradamus* in the locality discovered for the latter species by the senior author in 2012. The *G. pumilio* male appeared suddenly, attracted to the sweaty boots of the senior author, and then proceeded to perch on dry pebbles which it probed with its extremely long proboscis for mineral salts. Finally, after a brief disappearance in the extremely fast flight typical of *Gegenes*, the specimen returned to feed on flowers.

Already during the first minute of photographing the specimen with wings closed on a pebble (Fig. 2b), the senior author noted the spotted hindwing underside and voiced a suggestion that this specimen might actually be *G. pumilio*. A careful comparison of photos of the specimen in question (Figs. 2a and 2b) and of *G. nostradamus* from this and another nearby locality (Figs. 2c and 2d), as well as a comparison of the captured specimen with a male and a female of *G. nostradamus* from Bulgaria (General Todorov village, V. Gashtarov leg., in coll. Z. Kolev) confirms that the former indeed belongs

to *G. pumilio*. This is confirmed by a dissection and study of the male genitalia carried out by the senior author. The external and genital morphological differences

between *G. pumilio* and *G. nostradamus* will be dealt with below.



Fig. 2: a) *Gegenes pumilio*: male, SW Bulgaria, lower Struma valley, Chuchuligovo village, 100 m, 2.08.2013;
b) same data as (a);
c) *G. nostradamus*: male, 1.09.2012, same data as (a);
d) *G. nostradamus*: SW Bulgaria, lower Struma valley, Melnishka reka near Novo Konomladi village, 7.08.2007;
e) habitat of *G. pumilio* and *G. nostradamus*, same data as (a).
Photos: Z. Kolev.

Differentiating characters between *Gegenes pumilio* and *G. nostradamus*

The only other species similar to *G. pumilio*, both morphologically and ecologically, is its congener, the Mediterranean Skipper *Gegenes nostradamus* (Fabricius, 1793). In terms of ecology, the two have similar, predominantly coastal-Mediterranean distributions in Europe, with *G. nostradamus* typically reaching further inland from the coast. However, where comparable data are available, contrary to expectations it is actually *G. pumilio* that reaches higher up in mountains: up to 1800 m a.s.l. in Greece, whereas *G. nostradamus* is said not to exceed 1200 m there (Pamperis 2009). Despite the

ecological similarities, few cases are known of the two species occurring together (Larson 1982, Coutsis & Olivier 1993, Hesselbarth *et al.* 1995).

The two *Gegenes* species differ constantly in both external and genital morphology (Coutsis & Olivier 1993). The external characters are as follows:

1. Size: *G. pumilio* is markedly smaller than *G. nostradamus*. The forewing length of the Bulgarian *G. pumilio* male is 15.9 mm, while that of the available male *nostradamus* in coll. Kolev is 16.8 mm.
2. Upperside colour: dark blackish brown in *G. pumilio*, lighter cinnamon brown in *G. nostradamus*.

3. Markings on hindwing underside: distinct pale postdiscal spots are always present in *G. pumilio*, and absent (hindwing unmarked) in male *G. nostradamus*.

4. Hair tuft at hindwing base: Along the costal edge of the hindwing, *G. pumilio* carries short, fine and sparse hair-like scales which are typically visible only upon close inspection, otherwise giving the impression of a smooth costal edge. By contrast, in *G. nostradamus*, these scales are long, coarse and numerous, and form a tuft which can be clearly seen even at a distance, sometimes protruding well beyond the costal edge of the forewing (Figs. 2c and 2d).

We note that special care must be exercised with identifying photographs based on these characters, since their visibility depends strongly on lighting, condition of the specimen, and angle of viewing. The fourth character in particular, although often cited in butterfly guides (Tolman 1997, Haahtela *et al.* 2011), can be very misleading. For example, the senior author has a series of photos of the same *G. nostradamus* specimen, taken only seconds apart from slightly varying angles due to the specimen moving around on the inflorescence. The tuft of scales is conspicuous in some photos (Fig. 2d), but entirely undetectable in others. Therefore, while its presence is proof of *G. nostradamus*, its absence in and of itself may not be sufficient for determination.

For the purposes of this report, the senior author examined published illustrations of the male genitalia of *G. pumilio* (Coutsis & Olivier 1993, Jakšić 1998) and *G. nostradamus* (Coutsis & Olivier 1993, Jakšić 1998, Zahm 2012). It was found that, in view of the characters observed in the genitalia of the Bulgarian material (Fig. 3) these limited sources apparently do not represent the full scale of character variation in either species. For a more comprehensive assessment, unpublished genitalia drawings of both species were kindly provided by J. G.

Coutsis to the senior author. Based on all available data (in total 14 specimens of *G. pumilio* and 13 specimens of *G. nostradamus*), it was concluded that the two species indeed differ constantly and markedly by certain characters in the valva, as follows:

1. Apical process (cucullus) of the valva. In view of the examined samples, and even by comparison with the illustrations provided therein, the description of this character in Coutsis & Olivier (1993) is incomplete and partly inaccurate. In fact, it appears that the descriptions for the two species have been swapped. The actual difference is as follows: in *G. pumilio*, the dentition of the cucullus is most sclerotized at the distal end, and consists of more irregularly sized teeth which generally decrease in size and degree of sclerotization toward the base of the valva. By contrast, in *G. nostradamus*, the cucullus bears a roughly crescent-shaped crown of teeth, with the two endpoints being the most heavily sclerotized and most prominent. Besides, as noted by Coutsis & Olivier (1993), the cucullus in *G. pumilio* on average does not project as far beyond the tip of the valva as it does in *G. nostradamus*.

2. The ventral (lower, in lateral view) edge of the valva: in *G. pumilio*, on average more strongly curved inward (concave) between the basal and middle thirds of its length. This character is here reported for the first time.

Further differences in other parts of the male genitalia besides the valva, e.g. in the shape and size of the cornuti of the penis, and the relative lengths of the saccus, uncus and tegumen, were also stated by Coutsis & Olivier (1993). The female genitalia of the two species, which likewise bear clear differentiating characters (Coutsis 2012), shall not be discussed here due to the lack of material of both species.

Gegenes nostradamus



Gegenes pumilio

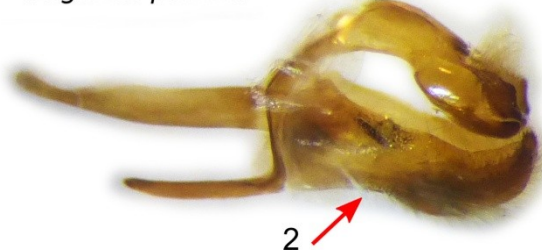


Fig. 3. Male genitalia of *Gegenes pumilio* and *G. nostradamus*, lateral view. 1. Shape and dentition of the cucullus. 2. Ventral edge of the valva. The characters are described in detail in the text (© Z. Kolev).

Discussion

The present report provides the first definitive proof of the occurrence of *G. pumilio* in Bulgaria and in the wider region of this part of the Balkan Peninsula. With this record, the skippers of Bulgaria reach a total of 28 confirmed species, and the total of confirmed butterfly and skipper species in the country reaches ca. 217. This discovery has been entirely unexpected, in view of the

fact that Bulgaria lacks a true Mediterranean zone (Kolev 2013) and the ambiguity of the few published records from north-east Greece (see above). Moreover, it must be pointed out that the presently reported record is in fact the northernmost record from this part of the Peninsula. This discovery lets us speculate that, in a similar manner, other butterfly species occurring in the Mediterranean zone of northern Greece might also be found in Bulgaria in the future, e.g. *Papilio alexanor*

Esper, [1799], *Archon apollinus* (Herbst, 1798), *Pyronia cecilia* (Vallantin, 1894), *Proterebia afra* (Fabricius, 1787), *Charaxes jasius* (Linnaeus, 1767), etc. The recent confirmation for Bulgaria of two other such species, viz. *Freyeria trochylus* (Ignatov *et al.* 2013) and *Cacyreus marshalli* (Butler, 1898) (Z. Kolev, pers. observ. in Melnik, 2013; Langourov & Simov 2014), also supports such expectations.

Yet more significant from a zoogeographical point of view is the fact that the present report confirms beyond doubt the occurrence of this Mediterranean species in the central-eastern part of the Balkan Peninsula. This suggests that *G. pumilio* is very likely to occur also in European Turkey, and perhaps also in the ex-Yugoslav Republic of Macedonia (F.Y.R.O.M.).

The two *Gegenes* species tend to occur in the same habitats in East Africa, the Arabian Peninsula, Levant (Larson 1982) and on the island of Crete (Coutsis & Olivier 1993) but apparently not so in Anatolia (Hesselbarth *et al.* 1995), despite their similar overall ranges. It is therefore very intriguing, from an ecological perspective, that both *Gegenes* species occur in the herewith reported locality at Chuchuligovo. This raises interesting questions about the interaction and possible ecological differences between the two species that could be addressed by further research.

The Pygmy Skipper is listed as “Not threatened” in the European Red List of Butterflies (Van Swaay *et al.* 2010); however its conservation status varies widely in individual European countries. While in Greece the species is considered “not threatened” (Pamperis 2009), it has been evaluated as “Critically Endangered” in France where it has not been observed since 1997 (IUCN France *et al.* 2012). The decline is attributed to intensive urbanisation which has destroyed most of the species habitat along France's south-east Mediterranean coast. As discussed below, habitat destruction and degradation are likely the main threats to the Bulgarian population as well.

The range of the Pygmy Skipper in Bulgaria is most probably limited to the lowermost Struma valley; it seems highly unlikely that the species may occur anywhere else in the country. In our opinion, the region with suitable climatic conditions and habitats for this highly xerothermophilous species is the Kresna-Kulata section of the Struma valley, with limits to the west and east set respectively by the lowest foothills of Mt. Ograzhden and Mt. Pirin (see Fig. 1). The total area of the thus defined potential range (extent of occurrence) of *G. pumilio* in Bulgaria is less than 500 km². Furthermore, beside being very limited in absolute terms, this potential range of the species in Bulgaria is situated in a rather densely populated region with developed and locally intensifying human activities such as agriculture, road construction, and gravel extraction from riverbeds. Hence the actual area of occupancy must be much smaller – probably not more than 10% of the entire potential range.

This anthropogenic activity is exceedingly likely to be detrimental to *G. pumilio*. Especially worrying are the effects of the just completed construction of the Struma Highway, which has caused both a spike in gravel extraction from local rivers such as Struma and its tributary Melnishka reka, as well as the literal and dramatic annihilation of large sections of potential habitat, e.g. the south-facing hillsides north-west of Marino Pole village (Z. Kolev, pers. obs.). Activities such as these will very likely lead to the degradation and destruction of the habitats of *G. pumilio*, *G. nostrodamus*, and possibly other xerothermophilous species which within Bulgaria are restricted to this region. However, the adverse impact could be particularly strong especially on the Pygmy Skipper, which appears to have an especially narrow ecological tolerance (Hesselbarth *et al.* 1995). Moreover, in case of the presently reported record the species is already at the vulnerable northernmost extremity of its range, which makes it susceptible to greatly increased risk of stochastic extinction due to natural causes alone. It is to be noted that the existence so far of only a single Bulgarian record of *G. pumilio* indicates that this species is much rarer than *G. nostrodamus* in the country. This is especially true in light of the fact that the lower Struma valley is very well studied by national standards, since it has been a collecting hotspot for Bulgarian and foreign lepidopterists for over a century.

The above analysis indicates that *G. pumilio* satisfies IUCN criteria B1+2ab(iii) for Endangered regional Red List status in Bulgaria (IUCN 2012a). Since the Pygmy Skipper usually occurs in widely separated small colonies (Larsen 1982, Hesselbarth *et al.* 1995), the possibility that an endangered population may be rescued by cross-border migration does not seem significant and is unlikely to affect the extinction risk; hence no adjustment of the category is deemed necessary (IUCN 2012b). Considering the significant anthropogenic pressures on the distribution area of this species, *G. pumilio* should be considered a species of high conservation priority. We also recommend its inclusion into the Red Data Book of Bulgaria. Because of the very limited data on its actual distribution and population trends, urgent research must be undertaken in order to gather more information and to determine appropriate conservation measures. As our preliminary assessment of the extinction risk is based mainly on the availability of suitable habitats, additional data may result in raising the threat category to Critically Endangered.

Acknowledgements

We thank Mr Lazaros Pamperis for data on the distribution of *G. pumilio* in Greece and Mr John G. Coutsis for providing unpublished drawings of male genitalia of *G. nostrodamus* and *G. pumilio*. We are also grateful to Mr Paul Wetton for communicating the circumstances and locality of his discovery of *Freyeria trochylus* in Bulgaria prior to publication.

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