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Rare and endemic harvestmen (Opiliones, Arachnida) species from the Balkan Peninsula. II. Three species new for the Bulgarian fauna with zoogeographical notes

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A b s t r a c t : With the present paper the harvestmen-species *Platybessobius singularis* ROEWER 1940, *Graecophalangium atticum* ROEWER 1923, and *Rafalskia cretica* (ROEWER 1923) are added to the list of Bulgarian Opiliones. For the first time detailed drawings of the copulatory organs of the mentioned species are provided, the origin of these taxa is examined in relation to their phenological characteristics, and a zoogeographical classification is proposed. Besides, new chorological data about the opilionid species *Trogulus graecus* DAHL 1903, *Zachaeus crista* (BRULLÉ 1832), *Opilio saxatilis* C.L. KOCH 1839, and *Egaenus convexus* (C.L. KOCH 1835) in Bulgaria are presented.

K e y w o r d s : harvestmen, Opiliones, *Platybessobius singularis*, *Graecophalangium atticum*, *Rafalskia cretica*, genital morphology, chorology, zoogeographical notes, Bulgaria.

Introduction

So far, the Bulgarian Opiliones are represented by 51 species included in 29 genera and 6 families (Sironidae SIMON 1879 (5 spp.), Phalangodidae SIMON 1879 (2 spp.), Nemastomatidae SIMON 1879 (12 spp.), Dicranolasmatidae SIMON 1879 (3 spp.), Trogulidae SUNDEVALL 1833 (3 spp.), and Phalangiidae SIMON 1879 (26 spp.)) (STAREGA 1976, JUBERTHIE 1991, BERON & MITOV 1996, MITOV 1994, 1995, 1997, 2001, 2002).

While Bulgarian materials of Opiliones were examined, three further, previously not recorded, species were found among them – i. e. *Platybessobius singularis* ROEWER 1940 (Trogulidae), *Graecophalangium atticum* ROEWER 1923, and *Rafalskia cretica* (ROEWER 1923) (Phalangiidae). The first two species pertain to genera hitherto unknown from the territory of Bulgaria.

Material and methods

The present study bases on materials collected by Bulgarian zoologists during the period 1912-2002 from various localities in Central, Southern, and Southwestern Bulgaria. The majority of these materials were collected by hand and the rest by pitfall-traps. Presently,

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they are deposited in the private collection of the author (MCS). The taxon hitherto referred to as "*Zacheus*" is spelled as "*Zachaeus*" (see CRAWFORD 1992). For every species, summary data about the length of the specimens examined, the presence of parasites, and the presence of eggs in the egg reservoir (uterus internus) are provided.

For comparative purposes served 3♂♂ and 3♀♀ *Rafalskia cretica* from the arachnological collection of NHMV (labeled *Metaplatybunus rhodiensis* ROEWER 1924) [Greece: Rhodos: Monolithos, "16. Weg zum Strand", 11.IV.1959, Paget & Kritscher leg., J. Gruber det., (Inv. № 11696). – 1♂ (L: 5.6 mm), 1♀ (L: 8.0 mm); Island Rhodos: Profitis Ilias, 650 m, (36° 16'/27° 56'), 07.V.1975, leg. H. Malicky, det. J. Gruber (1976.II.), (Inv. № 5365). – 2♂♂ (L: 5.0-5.95 mm), 2♀♀ (L: 7.95-8.35 mm)]. The receptaculum seminis were compared with: 1♀ (L: 5.0 mm) (with eggs) *Platybessobius caucasicus* ŠILHAVÝ 1966 [Russia: Krasnodar Province, Lazarevskoye Distr., 200 m, 06.VII.-12.VIII.1984, pit trap, leg. A. G. Koval, det. J. C. Cokendolpher, (MCS)] and 1♀ (L: 8.35 mm) *Rafalskia cretica* (NHMV: Inv. № 5365).

The ovipositors were clarified by potassium hydroxide – those of *Platybessobius singularis* and *Platybessobius caucasicus* in 12% KOH for 48 hours, and those of *Graecophalangium atticum* and *Rafalskia cretica* in 20% KOH for 72 hours.

Additionally, some information about species occurring together with the three treated in detail is provided as well:

Trogulus graecus DAHL 1903: Distr. Petrich: locality Rupite, west slope of Maluk Kozhuh hill, 100-150 m, [UTM-FL 88], PTF, 20.IV.-18.V.1996, leg. B. Georgiev. – 1♂ (L: 11.0 mm).

Zachaeus crista (BRULLÉ 1832): Distr. Petrich: locality Rupite [UTM-FL 88]: 27.V.1991, leg. S. Beshkov. – 1♀ (without eggs) (vermined with Gregarinia), 1 juv.; 12.VI.1991, leg. S. Beshkov. – 2♂♂ (L: 8.2 mm); 10.IV.1993, leg. B. Petrov. – 1♀ (L: 7.0 mm); loc. Rupite, west slope of Maluk Kozhuh hill, 100-150 m, [UTM-FL 88], PTF, 20.IV.-18.V.1996, leg. B. Georgiev. – 6 juv. (L: 3.7-6.5 mm); Maluk Kozhuh hill, 100-281 m, [UTM-FL 88], 28.IV.2000, leg. P. Mitov. – 4 juv. (L: 4.1-6.0 mm); Eastern Rhodopi Mts.: Distr. Kurdzhali: in the vicinity of Studen Kladenets Village, 300 m, [UTM-LG 80], 25.IV.1990, leg. N. Kodzhabashev. – 39 juv. (L: 2.8-5.6 mm); District Krumovgrad, between Beli Dol and Boturche [UTM-MF 18], in *Quercus*-forest, under stones, 15.IV.1998, leg. B. Petrov & B. Burov. – 3 juv. (L: 2.0-2.3 mm).

Opilio saxatilis C.L. KOCH 1839: Distr. Petrich: loc. Rupite, west slope of Maluk Kozhuh hill, 100-150 m, [UTM-FL 88], PTF, 20.IV.-18.V.1996, leg. B. Georgiev. – 2 juv. (L: 1.7-2.5 mm); loc. Rupite, 100 m, [UTM-FL 88], under stones, 28.IV.2000, leg. P. Mitov. – 1 juv. (L: 1.7 mm); Eastern Rhodopi Mts.: Distr. Kurdzhali: Studen Kladenets Village, [UTM-LG 80]: under stones, 24.XII.1989, leg. S. Beshkov. – 1♂ (L: 2.5 mm); 29.IX.-03.X.1990, leg. S. Beshkov. – 1♂ (L: 3.5 mm).

Egaenus convexus (C.L. KOCH 1835): Eastern Rhodopi Mts.: District Krumovgrad, between Beli Dol and Boturche [UTM-MF 18], in *Quercus*-forest, under stones, 15.IV.1998, leg. B. Petrov & B. Burov – 2 juv. (L: 8.0 mm).

The plant-community classification is after BONDEV (1991).

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Abbreviations used in the text

Inv. № ..... museum inventory number
juv. ..... juveniles
L ..... body length
l ..... lenght of the eggs
MCS ..... in Mitov Collection, Sofia
MNHS ..... National Museum of Natural History, Sofia
MNHV ..... Museum of Natural History, Vienna
$t_{\bar{x}\,(\mathrm{month})}$ ..... mean air-temperature for the corresponding month
$t_{\bar{x}\,(\mathrm{year})}$ ..... mean annual air-temperature

Results and Discussion

Trogulidae SUNDEVALL 1833

Platybessobius singularis ROEWER 1940

Material examined: Eastern Rhodopi Mts.: District Krumovgrad: Madzharovo [UTM-MG 00], 180 m, Vegetation: xerothermal grass communities; mixed forests of cerris oak (*Quercus cerris* L.), *Q. frainetto* TEN. and Mediterranean elements, stone quarry near Arda river, *Quercus* leaf litter and under bark, 19.VI.2002, leg. B. Petrov. – 1♂ (L: 3.9 mm); between Beli Dol and Boturche [UTM-MF 18], Vegetation: Mixed *Quercus virgiliana* (TEN.) TEN., *Q. frainetto* TEN., *Q. pubescens* WILLD. and *Carpinus orientalis* MILL. forests with Mediterranean elements, partly of secondary, under stones in *Quercus*-forest, 15.IV.1998, leg. B. Petrov & B. Burov. – 1♀ (L: 4.25 mm) (without eggs).

Distribution: Greece: Kallidea N Esimi, Zante Island, Corfu Island, Crete Island (ROEWER 1940, 1950, MARTENS 1966, GRUBER 1969), Turkey: Anatolia (GRUBER 1969)[1].

Genital morphology: Here, for the first time a drawing of the receptaculum seminis in this species is presented (Fig. 2 a). They consist of two almost equal ampulae (length: 24-27 μm, width: 16-19 μm), contrary to these in *Platybessobius caucasicus* ŠILHAVÝ 1966, which have the one ampulla wide and the other slim (see Fig. 2 b, c). In *Platybessobius caucasicus* (Fig. 2 b) the bigger ampulla is nearly 76 μm long and 32 μm wide, and the dimensions of the shorter and slimmer one – respectively 64 μm and 14.4 μm.

Note: The original drawing of ŠILHAVÝ (1966, p. 152, fig. 13 – *Platybessobius caucasicus* (Paratypus)) is also included for comparative purposes, but here it is in its correct orientation (not turned upside-down) (see Fig. 2 c). It must be noted that when examined with a light-microscope these structures are placed above each other (also see ŠILHAVÝ (1966, fig. 11)).

Co-occurring species: The following thermophilous opilionid species: *Zachaeus crista* 3 juv. (L: 2.0-2.3 mm), and *Egaenus convexus* 2 juv. (L: 8.0 mm). The present locality is new for them.

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[1] GRUBER (1969) states that "Nach Revisionsergebnissen von ŠILHAVÝ gehören alle anatolischen *Platybessobius* zu *P. caucasicus* ŠILHAVÝ 1966.".

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Phalangiidae SIMON 1879

***Graecophalangium atticum* ROEWER 1923**

Material examined: SW Bulgaria: Upper Strouma Valley: Konyavska Mt., [UTM-FM 59], Vegetation: Mixed Mizian beech (*Fagus sylvatica* L. ssp. *moesiaca* (K. MALY) HYELMQ.) and ordinary hornbeam (*Carpinus betulus* L.) forests; carstic terrain, meadow E of peak Viden, 1450 m, VIII.1997, FPT, leg. T. Minkova. – 3♂♂ (L: 4.6-5.2 mm); Middle Strouma Valley: District Sandanski, next to Mikrevo [UTM-FM 81], Vegetation: Querceta pubescentis and Virgilian oak (Querceta virgilianae) forests with Mediterranean elements, 05.IV.2002, under stones, leg. S. Lazarov. – 1♀ (L: 5.5 mm)(without eggs); in the range of Petrich: locality Rupite, 100-150 m, [UTM-FL 88], Vegetation: Shrubs with prevalence of Christ's thorn (Paliureta spina-christi) mixed with jasmine (*Jasminum fruticans* L.), combined with xerothermal grass communities replacing mostly xerothermal forest communities of *Quercus pubescens* WILLD. and Virgilian oak (*Q. virgiliana* (TEN.) TEN.), and rarely replacing cerris oak (*Q. cerris* L.), or other forests: Maluk Kozhuh hill, 150 m, under stones, 10.IV.1993, leg. B. Petrov. – 1♂ (L: 5.7 mm), 1♀ (L: 6.5 mm)(with eggs), 1♀ (subadultus) (L: 7.2 mm); Maluk Kozhuh hill–"Toumbata", 100-150 m, under stones, 10-12.IV.1996, leg. A. Antov. – 1♂ (L: 6.0 mm), 1♀ (L: 8.0 mm) (with many eggs (l=0.64 mm)) (vermined with Gregarinia); Demyanitsa station–Maluk Kozhuh hill, 100-150 m, on the ground, 07.III.1998, leg. A. Antov. – 1♂ (L: 4.5 mm), 1♀ (L: 6.4 mm) (without eggs); Maluk Kozhuh hill, near Levounovo [UTM-FL 99], on wall, 14.III.1999, leg. S. Beshkov. – 2 juv. (L: 3.95-5.2 mm); Slavyanka Mt. [UTM-GL 29]: "post № 1" (? = locality above Paril), 1200 m, 07.VI.1936, leg. P. Drenski (MNHS). – 1♀ (L: 6.4 mm) (with eggs); S Bulgaria: Western Rhodopi Mts.: Peshtera, Bratsigovo [UTM-KG 85], 420-450 m, Vegetation: Mixed Mizian beech (*Fagus sylvatica* L. ssp. *moesiaca* (K. MALY) HYELMQ.) and ordinary hornbeam (*Carpinus betulus* L.) forests; mixed balkanic durmast (*Quercus dalechampii* TEN.) and aquatic hornbeam (*Ostrya carpinifolia* SCOP.) forests), 21.IV.1968, leg. H. Delchev. – 1♀ (L: 7.2 mm) (with eggs).

Distribution: Until now, *G. atticum* was known from Northern Greece, Macedonia, Saloniki, Chalkidike Peninsula and Attika (ROEWER 1923, 1956, MARTENS 1966). The herewith newly established locality on Konyavska Mt. is the northernmost in the species areal.

Genital morphology: Bearing in mind the variability of one of the important taxonomical characters, i. e. the number of cheliceral apophyses, and also the high similarity of coloration and armament of the body and appendages within the members of this genus, according to MARTENS (1966) the best species-separation character in this genus remains the structure of penis. In spite of this fact, in the literature a description of copulatory organs in *G. atticum* is completely missing. Therefore here I am providing such data based on Bulgarian populations of the species because I believe that this is essential for the understanding of the taxon mentioned.

The penis (Fig. 3) is yellow-brown, only the middle 2/4 of the truncus is black-brownish. The length of penis varies between 3.25 and 3.42 mm (Mean=3.33 mm, n=6). Glans penis in one of the specimens (L: 3.37 mm) is 0.39 mm long (Fig. 3 c).

The ovipositor (in 2♀♀, loc. Rupite) consists of 40-48 segments (including the segments of the furca). Receptaculum seminis is shown on Figure 4. They are situated in the region between the 4th and 7th segment of the ovipositor (the numbering includes the segments of the furca), and include a long and a short ampulla. The short one doesn't bear a process as in *G. cretaeum* MARTENS (1966, p. 353, f. 14); the ampullae are wrinkled (in females from Slavyanka Mt. and Western Rhodopi Mts. this is not the case). The length of the long ampullae varies between 176 and 260 μm (medially 20-28 μm

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wide), whereas the short ones are 60 μm long (distally 19.1-20.7 μm wide).

Variability: The body-length in males varies between 4.5 and 6.0 mm (Mean=5.16 mm, n=6), between 5.5 and 8.0 mm in females (Mean=6.67 mm, n=6).

It is noteworthy that the individuals (3♂♂) of *Graecophalangium atticum* from Konyavska Mt. are much more darker (with yellowish-brown body and appendages) compared to the males from the more southern localities (Mikrevo and loc. Rupite), which are yellowish-white to yellowish-gray in color. This stronger pigmentation is most probably connected to the fact that the mentioned mountainous population inhabits meadows in the intermediately high mountain zone (~1400 m) more northwards than the others and this peculiarity may help these animals to accumulate more effectively heat, or to protect themselves from the relatively more intensive UV-radiation at higher altitudes (for further examples see ZLOTIN 1975).

In one of the specimens from Konyavska Mt. the chelicerae bear only two (instead of three apophyses, see ROEWER 1923, p. 756, fig. 932), and the remaining two specimens bear only one. Such examples for variation of the number of apophyses in this species report also MARTENS (1966).

A significant amount of variation is observed also in the diameter of the middle part of truncus penis, as well as in the width and length of the extended basal part of the truncus. Variations are also observed in the curvature shape (with or without emargination) of the dorsal margin of the truncus base.

In the female from Western Rhodopi Mts. (Bratsigovo) the ovipositor consists of 37 segments (incl. the furca-segments). Receptaculum seminis – in the region between the 4th and 7th segment of the ovipositor (the numbering includes the segments of the furca); the length of long ampullae varies between 208 and 260 μm (their medial width is 15.95 μm), and the short ones are 47.9 and 57.4 μm long (distally 12.7-14.4 μm wide); the ampullae may be not wrinkled.

Co-occurring species: In the range of Rupite together with *Graecophalangium atticum* may be found the relatively thermophilous species: *Trogulus graecus* DAHL 1903 (1♂, L: 11.0 mm), *Opilio saxatilis* C.L. KOCH 1839 (3 juv., L: 1.7-2.5 mm), and *Zachaeus crista* (BRULLÉ 1832) (2♂♂, L: 8.2 mm; 2♀♀, L: 7.0 mm; 11 juv., L: 3.7-6.5 mm). For the first and latter species the present locality is new for Bulgaria. It is interesting that at this locality active females (L: 7.0 mm) of *Z. crista* are encoutered by the end of the first decade of April – a fact indicating the presence of favourable climatic conditions.

Rafalskia cretica (ROEWER 1923)

Material examined: Central Bulgaria: Upper Thracian Lowland: Stara Zagora [UTM-LH 80], 25.V.1912, leg. P. Drenski (MNHS). – 1♀ (L: 5.8 mm) (without eggs); South Bulgaria: Eastern Rhodopi Mts., in the range of Studen Kladenets reservoir [UTM-LG 80], Vegetation: Balkan durmast (Querceta dalechampii) forests, forests and shrubs of Oriental hornbeam (Carpineta orientalis) with Mediterranean elements: in the vicinity of Studen Kladenets Village and Arda river, [UTM-LG 80], 300 m, near a brook, 22.III.1990, leg. N. Kodzhabashev. – 1♂ (L: 7.0 mm); in the range of Kroyatsi hut, [UTM-LG 81], 300 m, between stones, 24.III.1990, leg. N. Kodzhabashev. – 1♀ (L: 6.5 mm) (without eggs).

Distribution: Greece: Lesbos Island, Chios Island, Ikaria Island, Leros Island, Kalymnos Island, Kos Island, Rhodes Island, Karpathos Island, Crete Island; Turkey:

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West and Southwest Anatolia (ROEWER 1924, 1956, CAPORIACCO 1948, MARTENS 1965, 1966, GRUBER 1966, 1978, STAREGA 1981).

N o t e : STAREGA (1981) synonymizes *Metaplatybunus rhodiensis* ROEWER 1924 with *Metaplatybunus creticus* ROEWER 1923 and transfers the latter into genus *Rafalskia* STAREGA 1963.

According to GRUBER (1978), the determined by CAPORIACCO (1925) material as "*Dasylobus laevigatus*" from Kalymnos Island and Leros Island, probably belongs to *Metaplatybunus rhodiensis*.

G e n i t a l m o r p h o l o g y : In comparison to the individuals of the Greek population (MARTENS 1965: figs. 21-23) the penis of the Bulgarian specimen is slightly different: the shape of glans penis (weaker developed ventral curvature at its base – see the arrow in Fig. 5) and of the broadened basal part of truncus penis as shown on Fig. 5. These differences very possibly lie within the intrapopulation variability. The penis is 7.5 mm long; glans penis (0.39 mm) is yellow-brown, the stylus is dark brown. The truncus penis is yellow-brown; its strongly widened basal part is reddish-brown. The basal width of truncus penis is 0.84 mm, whereas in the Greek populations it is 0.56-0.69 mm (Mean=0.63 mm, n=3♂♂, NHMV: Inv. №№ 11696, 5365).

The ovipositor has 33 segments (incl. these of the furca). Receptaculum seminis (of three ovipositors), presented on Fig. 6, are situated in the region 5th-9th segments (incl. furca). The ampullae on one and the same ovipositor are not of equal length (0.31÷0.35 mm) (Fig. 6a) and the difference in length is sometimes significant (0.42 mm÷0.294 mm) (Fig. 6b).

C o - o c c u r r i n g s p e c i e s : In the area of the East-Rhodopean locality of *Rafalskia cretica* along with it, some other thermophilous harvestmen-species occur: *Zachaeus crista* (20 juv., L: 2.8-4.3 mm), and *Opilio saxatilis* (2♂♂, L: 2.5-3.5 mm). This locality is new for these two species within Bulgaria.

The occurrence of sexually mature individuals of *Opilio saxatilis* in the end of December may be explained by the favorable temperature-regime in this region, that permit a more extended activity period of these animals, as well as with the phenological peculiarities of this species – in this case it could be possible that overwintering adults from the new (second) generation were observed. This consideration is not conflicting with the assumptions of ŠILHAVÝ (1965) and STAREGA (1976) about the possibility of developing more than one generation of *Opilio saxatilis* per year.

Phenology and origin

JOSIFOV (1987, 1991) based on his studies on Heteroptera suggested that the phenology of a particular species contains information about the historical conditions under which this species has evolved and this information may be useful in the process of zoogeographical characterization of the species. According to these ideas, species originated and evolved under the conditions of the Mediterranean climate (moist and mild winter, warm and not very dry spring, and hot and dry summer) should occur (in Bulgaria too) only during the spring (V-VI), sometimes for only a short time-period, when the most-favorable for its development conditions occur.

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Applying these considerations to the Opiliones, and judging from the phenological data contained in the literature (GRUBER 1963, 1966, MARTENS 1965, present study), most probably all the three species covered by the present study (i. e. *Platybessobius singularis, Graecophalangium atticum, Rafalskia cretica*) may be considered as having their origins in areas with Mediterranean climate. Despite that these species have expanded their ranges northwards (into the territory of Bulgaria) into areas with transitional Mediterranean and Continental climate (where $t_{\bar{x}\ (January)} > 0°$ C (after GULUBOV et al. 1956)), the above mentioned species have retained the predicted phenology-type – until now adults of all these species were found only during the period March-May (in the lowlands) and June (in the mountains). It seems that the copulation and the egg-laying occurs right then, when the environmental conditions, being very similar to those in the Mediterraneum, are most favorable; later the adults go extinct and the overwintering stages are most probably the subadults and young adults from the new generation.

Chorological and zoogeographical notes

Graecophalangium atticum most probably has invaded deeply northwards the territory of Bulgaria through the valley of Strouma river (Fig. 1, A_1). This is highly possible, due to the orographic (low altitudes) and climatic conditions (transitional-Mediterranean climate: mild winter – $t_{\bar{x}\ (January)} = 2°$ C; $t_{\bar{x}\ (April)} = 13.5\text{-}14°$ C; $t_{\bar{x}\ (year)} = 14°$ C) in this region (GEORGIEV 1991, STANEV et al. 1991, DILOV 1998). It is known (KITANOV 1983, GRUEV & KUZMANOV 1994), that the Mediterranean climatic influence reaches deeply into the Strouma Valley and this geographic structure was found to be the main migration pathway through which many Mediterranean, sub-Mediterranean and other thermophilous species have penetrated northwards into the territory of Bulgaria (KITANOV 1983, GRUEV & KUZMANOV 1994).

The occurrence of *Graecophalangium atticum* at a relatively high altitude (1450 m) in Konyavska Mt. may be explained with the characteristic peculiarities of this mountain, termed by KITANOV (1983) "Mediterranean oasis"[2]. This mountain has calcareous terrains, permitting heat accumulation and contrary to the situated more northwards mountains of the Kraishte region, the mountains climate is characterized with a warmer and more dry spring and a generally higher mean annual temperature. Additionally, the mountain is opened towards the Strouma Valley and this is considered as a reason for the clear Mediterranean climatic influences (NIKOLOV & YORDANOVA 1997).

Very interesting is the finding of *Graecophalangium atticum* on the hilly and foothill landscapes next to the northern slopes of Western Rhodopi Mts. (Bratsigovo), situated just above the Thracian Lowland. The specimens from these localities are similar to these from Slavyanka Mt. and it may be suggested that the penetration of this species northwards occurred also along the valley of Mesta river (Fig. 1, A_2), as it is also well known that Mediterranean climatic influence reaches Central Bulgaria along this river-valley too (KITANOV 1983, GRUEV & KUZMANOV 1994). It seems very probable, that the embryonic and juvenile phases of this species are frigostable and this has permitted the localization of this species also in the low-mountain regions, which are considered as

[2] Under the term "Mediterranean oasis" KITANOV (1983) describes "the isolated communities of southern plants on calcareous terrains, surrounded by central-European vegetation".

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parts of the transitional-continental climatic sub-region, but with a relatively mild winter $t_{\bar{x}\ (January)}$ = 0 to -2.5° C (STANEV et al. 1991). The occurrence of *Graecophalangium atticum* at this locality, makes its finding in the region of the Thracian Lowland also highly possible.

The penetration of *Platybessobius singularis* and *Rafalskia cretica* into the territory of Bulgaria has occurred most probably along the valley of Maritsa river (respectively along its right feeders – the rivers Byala reka and Arda) (from Turkey and/or continental Greece) (Fig. 1 b), along which many Mediterranean, sub-Mediterranean and other thermophilous plant and animal species penetrate into the territory of Bulgaria (KITANOV 1983, GRUEV & KUZMANOV 1994). Factors, that favour such a role of the Maritsa Valley are again the orographic characteristics of the Eastern Rhodopi Mts. (hilly lay, low mean altitude of 330 m) and transitional-Mediterranean climate (mild winter: $t_{\bar{x}\ (January)}$ = 1 to -1.5° C; $t_{\bar{x}\ (April)}$ = 12° C (in the lower altitudes); $t_{\bar{x}\ (Year)}$ = 13.5° C), as well as the Mediterranean climatic influence along the Maritsa river valley (GEORGIEV 1991, STANEV et al. 1991). Compared to the other two new to the Bulgarian fauna species, *Rafalskia cretica* reaches most deeply northwards [Bulgaria: Upper Thracian Lowland: Stara Zagora $t_{\bar{x}\ (Year)}$ = 12.9° C, after VELEV 1990)]. It may be suggested that this is a result of a relatively higher ecological tolerance of this species, as already mentioned by MARTENS (1966) (sub *Metaplatybunus rhodiensis*), and which is characteristic for the evolutionary younger species (see JOSIFOV 1987). The new localities of *Rafalskia cretica* are interesting also from a chorological perspective – until now there are no records of this species from continental Greece (see MARTENS 1965), and it is highly possible that its occurrence in Bulgaria is in closely related to its hypothetical presence right there.

Only two are the known species of genus *Platybessobius* ROEWER 1940 – *P. singularis* (Balkan Peninsula and (?) Asia Minor (ROEWER 1940, 1950, MARTENS 1966, GRUBER 1969)), and *P. caucasicus* (Asia Minor and Caucasus (GRUBER 1969, STAREGA 1978)). From genus *Graecophalangium* ROEWER 1923 until now 5 species have been described; these occur on the Balkan Peninsula, Asia Minor, and in the Middle East (ROEWER 1923, MARTENS 1966, STAREGA 1973, MITOV 1995). And finally, from genus *Rafalskia* STAREGA 1963 altogether three species from the Balkan Peninsula and Asia Minor are hitherto known (see STAREGA 1981).

Bearing in mind the above, as well as the data about the total distribution ranges, and the phenological data available for *Platybessobius singularis*, *Graecophalangium atticum*, and *Rafalskia cretica*, it may be suggested that these species have spread postglacially from the great Mediterranean refuge, and also show various degree of expansiveness and may be characterized as Ponto-Mediterranean faunistic elements (sensu DE LATTIN 1949, 1967).

Conservation status

Graecophalangium atticum is a Balkan endemic, *Platybessobius singularis* may be considered an Balkan endemic too, if we assume that it is not present in Anatolia (see GRUBER 1969), and *Rafalskia cretica*, known also from Asia Minor, is a Balkan subendemic species. All these species are so far found in only low numbers in a limited number of localities which mark the northern range of their areals. This makes both the conservation of these species, as well as of the habitats they live in, necessary.

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Zusammenfassung

In der vorliegenden Arbeit werden die Weberknechtarten *Platybessobius singularis* ROEWER 1940, *Graecophalangium atticum* ROEWER 1923 und *Rafalskia cretica* (ROEWER 1923) zur Liste der Bulgarischen Opiliones hinzugefügt. Zum ersten Mal werden ausführliche Zeichnungen der Kopulationsorgane der erwähnten Arten präsentiert, es wird der Ursprung dieser Taxa in Zusammenhang mit ihren phänologischen Besonderheiten untersucht und eine zoogeographische Klassifizierung wird vorgeschlagen. Außerdem werden neue chorologische Daten über die begleitenden Arten *Trogulus graecus* DAHL 1903, *Zachaeus crista* (BRULLÉ 1832), *Opilio saxatilis* C. L. KOCH 1839 und *Egaenus convexus* (C.L. KOCH 1835) dargestellt.

References

BERON P. & P. MITOV (1996): Cave Opilionida in Bulgaria. — Hist. nat. bulg. **6**: 17-23.

BONDEV I. (1991): The vegetation of Bulgaria. Map 1: 600 000 with explanatory text. — "St. Kl. Ochridski", University Press, Sofia, 184 pp. (in Bulgarian, with English summary).

CAPORIACCO L. Di (1925): Una racolta di Aracnidi del Dodecanneso. — Boll. Soc. entomol. ital. Genoa **57**: 107-112.

CAPORIACCO L. Di (1948): L'Arachnofauna di Rodi. — Redia **33**: 27-75.

CRAWFORD R.L. (1992): Catalogue of the genera and type species of the harvestman superfamily Phalangioidea (Arachnida). — Burke Mus. Contrib. Anthropol. Natur. Hist., **8**: 1-60.

DE LATTIN G. (1949): Beiträge zur Zoogeographie des Mittelmeergebietes. — Verh. Dtsch. Zool. Ges., Kiel (1948), Leipzig, Supl. **13**: 143-151.

DE LATTIN G. (1967). Grundriß der Zoogeographie. — Jena. 602 pp.

DILOV Ch. (1998). The micro algae – my destiny. — Holistic center "Anhira", Sofia, 112 pp. (in Bulgarian).

GEORGIEV M. (1991): Physical geography of Bulgaria. "St. Kl. Ochridski", University Press, Sofia, 406 pp. (in Bulgarian).

GRUBER J. (1963): Ergebnisse der von Dr. O. Paget und Dr. E. Kritscher auf Rhodos durchgeführten zoologischen Exkursionen. VII. Scorpiones und Opiliones (1 Teil). — Ann. Naturhistor. Mus. Wien **66**: 307-316.

GRUBER J. (1966): Ergebnisse der von Dr. O. Paget und Dr. E. Kritscher auf Rhodos durchgeführten zoologischen Exkursionen. XV. Scorpiones und Opiliones (2 Teil). — Ann. Naturhistor. Mus. Wien **69**: 423-426.

GRUBER J. (1969): Ergebnisse der österreichisch-türkischen Anatolien Expeditionen 9. – Weberknechte der Familien Sironidae und Trogulidae aus der Türkei (Opiliones, Arachnida). — Rev. Fac. Sci. Univ. Istanbul **B 34(1/2)**: 75-88.

GRUBER J. (1978): Weberknechte (Opiliones, Arach.) von Inseln der Ägäis. — Ann. Naturhistor. Mus. Wien **81**: 567-573.

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GRUEV B. & B. KUZMANOV (1994): General Biogeography. — "St. Kl. Ochridski", University Press, Sofia, 498 pp. (in Bulgarian).

GULUBOV ZH., IVANOV IL., PENCHEV P., MISHEV K. & V. NEDELCHEVA (1956): Physical Geography of Bulgaria. — Narodna Prosveta, Sofia, 346 pp. (in Bulgarian).

JOSIFOV M. (1987): Phenology and zoogeography with Insects. — In: Modern achievements of the Bulgarian Zoology. Sofia, BAN: 17-20 (in Bulgarian).

JOSIFOV M. (1991): Steht die Phänologie der Miridenarten (Heteroptera) in gewissem Zusammenhang mit ihren zoogeographischen Charakteristiken? — Proceedings of the 4th ECE/XIII. SIEEC, Gödöllö 1991, pp. 634-636.

JUBERTHIE C. (1991): Sur *Trenteeva paradoxa*, Opilion troglobie et les Opilions Cyphophthalmes de Bulgarie. — Mém. Biospéol. **18**: 263-267.

KITANOV B. (1983): The penetration pathways of Mediterranean plants into Bulgaria. — Geography **5**: 1-4 (in Bulgarian).

MARTENS J. (1965): Über südägäische Weberknechte der Inseln Karpathos, Rhodos und Kos. — Senck. biol. **46**: 61-79.

MARTENS J. (1966): Zoologische Aufsammlungen auf Kreta. III. Opiliones. — Ann. Naturhistor. Mus., Wien **69**: 347-362.

MITOV P. (1994): *Siro beschkovi*, spec. nov. aus Bulgarien (Arachnida, Opiliones, Cyphophthalmi). — Spixiana **17(3)**: 275-282.

MITOV P. (1995): New faunistic and chorological data about Opiliones (Arachnida) from Bulgaria. — Ann. Univ. Sofia, Livre 1, Zoologie **86/87(1)**: 63-65.

MITOV P. (1997): Ein neuer *Nelima* Roewer aus Bulgarien (Arachnida, Opiliones, Phalangiidae). — Spixiana **20(2)**: 97-105.

MITOV P. (2001): Harvestmen (Opiliones, Arachnida) of Kresna Gorge (SW Bulgaria). — In BERON P. (ed.), Biodiversity of Kresna Gorge (SW Bulgaria): pp. 75-83 (in Bulgarian, with English Summary).

MITOV P. (2002): Rare and endemic harvestmen (Opiliones, Arachnida) species from the Balkan Peninsula. I. On *Mediostoma stussineri* (SIMON 1885) (Nemastomatidae) – a new species and genus for the Bulgarian fauna. — Linzer biol. Beitr. **34(2)**: 1639-1648.

NIKOLOV V. & M. YORDANOVA (1997): The mountains of Bulgaria. — "Prof. Marin Drinov", Sofia, 219 pp. (in Bulgarian).

ROEWER C.-FR. (1924): Opilioniden von der Insel Rhodos, Italien und Sardinien, sowie der Cyrenaica. — Boll. Mus. Zool. Anat. Univ. Torino, n. S. **39(19)**: 1-7.

ROEWER C.-FR. (1940): Neue Assamiidae und Trogulidae. Weitere Weberknechte X. — Veröff. Kolon. Übersee-Mus. Bremen **3(1)**: 1-31.

ROEWER C.-FR. (1950): Über Ischyropsalididae und Trogulidae. Weitere Weberknechte XV. — Senckenbergiana **31(1/2)**: 11-56.

ROEWER C.-FR. (1956): Über Phalangiinae (Phalangiidae, Opiliones Palpatores). (Weitere Weberknechte XIX). — Senck. biol., Frankfurt a. M. **37(3/4)**: 247-318, tt. 36-43.

ROEWER C.-FR. (1923): Die Weberknechte der Erde. Systematische Bearbeitung der bisher bekannten Opiliones. — Jena, 1116 pp.

ŠILHAVÝ V. (1965): Die Weberknechte der Unterordnung Eupnoi aus Bulgarien; zugleich eine Revision europäischer Gattungen der Unterfamilien Oligolophinae und Phalangiinae (Arachnoidea, Opilionidea). Ergebnisse der zoologischen Expedition der Tschechoslowakischen Akademie der Wissenschaften nach Bulgarien im Jahre 1957 (Teil V.). — Acta entom. bohemosl. **62**: 369-406.

ŠILHAVÝ V. (1966): Neue Troguliden aus dem Kuban-Gebiet und dem Kaukasus (Arach., Opiliones). — Senck. biol., Frankfurt a. M. **47(2)**: 151-154.

STANEV SV., KYUCHUKOVA M. & ST. LINGOVA (1991): The climate of Bulgaria. BAN, Sofia, 499 pp. (in Bulgarian, with English summary).

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STAREGA W. (1973): Beitrag zur Kenntnis der Weberknechte (Opiliones) des Nahen Ostens. — Ann. Zool., Warszawa **30(6)**, 129-153.

STAREGA W. (1976): Die Weberknechte (Opiliones, excl. Sironidae) Bulgariens. — Ann. Zool. Warszawa **33(18)**: 287-433.

STAREGA W. (1978): Katalog der Weberknechte (Opiliones) der Sowjet-Union. — Fragm. faun. Warszawa **23(10)**: 197-241.

STAREGA W. (1981): Über *Platybunus strigosus* (L. KOCH, 1867), nebst Bemerkungen über andere Arten der Platybuninae (Opiliones: Phalangiidae). — B. Acad. Pol. Sci.-Biolog. **28(8-9)** (1980): 521-525.

VELEV S. (1990): The climate of Bulgaria. — Narodna Prosveta, Sofia, 179 pp. (in Bulgarian).

ZLOTIN R.I. (1975): Life in the high Mountains (Studies on the organization of the high-mountain ecosystems of Tyan-Shan). — Mysl, Moscow, 236 pp. (in Russian).

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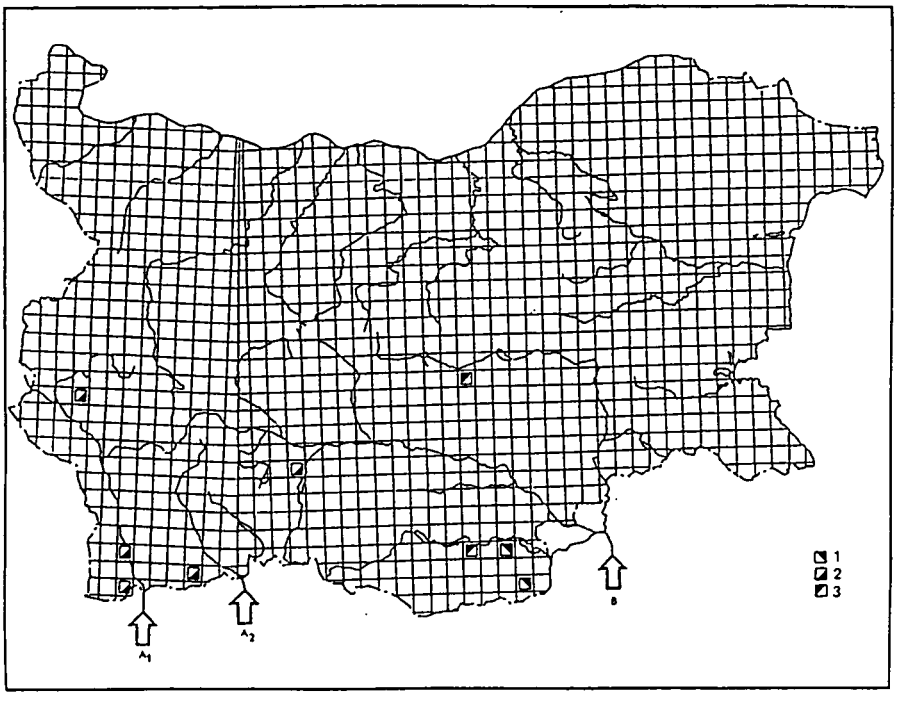

Fig. 1. Localities of the Opiliones new to the Bulgarian fauna (UTM-grid, 10 × 10 km square). **1** – *Platybessobius singularis* ROEWER 1940, **2** – *Graecophalangium atticum* ROEWER 1923, **3** – *Rafalskia cretica* (ROEWER 1923). Arrows mark the possible penetration pathways of these harvesmen species into the territory of Bulgaria: **A** – from Greece: along the valleys of Strouma river (A_1) and of Mesta river (A_2), **B** – from Greece and Turkey, along the valley of Maritza river.

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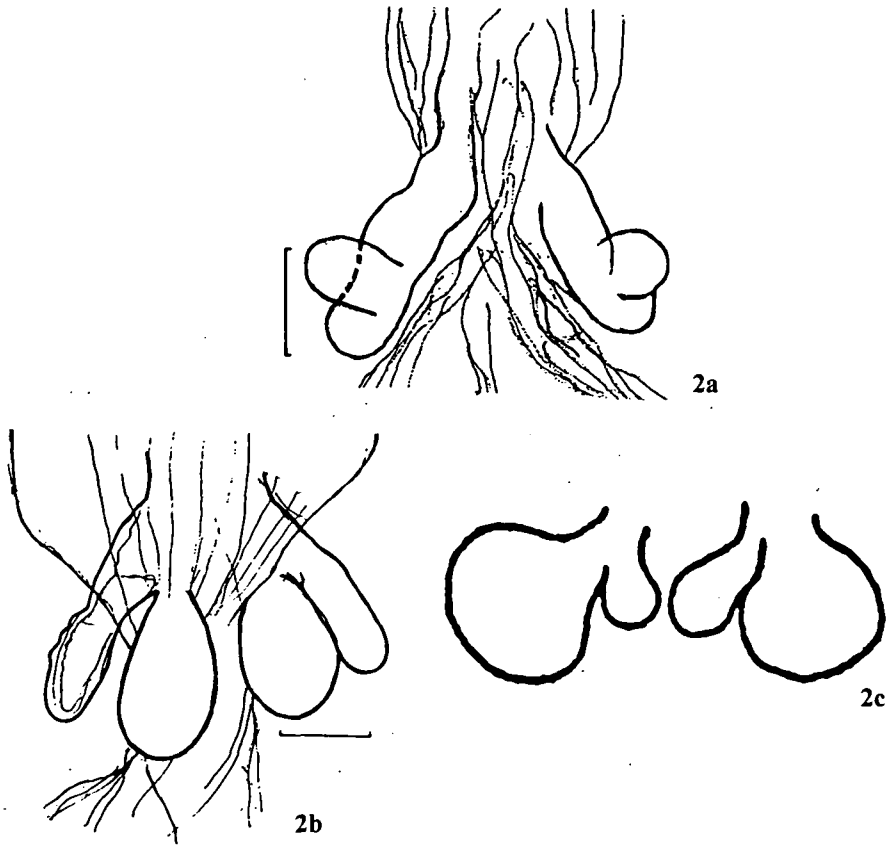

Fig. 2. Receptaculum seminis. – **a**: *Platybessobius singularis* ROEWER 1940, ♀, Bulgaria; – **b**: *Platybessobius caucasicus* ŠILHAVÝ 1966, ♀, Russia: Krasnodar Province; – **c**: *P. caucasicus* ŠILHAVÝ 1966, ♀ Paratypus, Caucasus (original figure after ŠILHAVÝ 1966). Scale lines: 30 μm.

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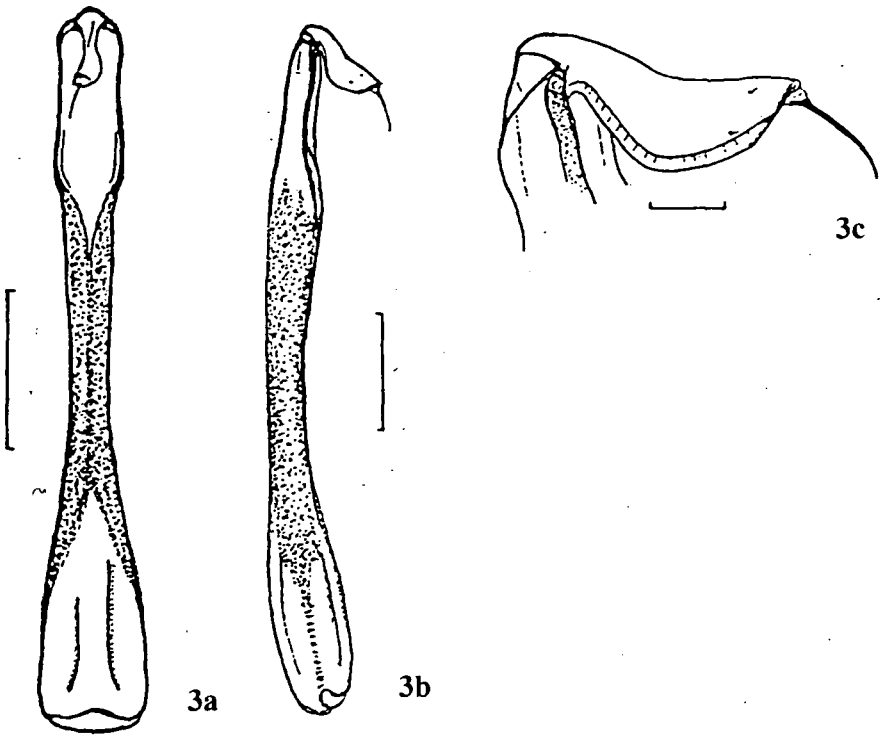

Fig. 3. *Graecophalangium atticum* ROEWER 1923 (1♂, Bulgaria: loc. Rupite). – **a**: corpus penis, dorsal. Scale line: 0.5 mm; – **b**: corpus penis, lateral. Scale line: 0.5 mm (punctured fields on corpus penis are black-brown colored); – **c**: glans penis, lateral. Scale line: 0.1 mm.

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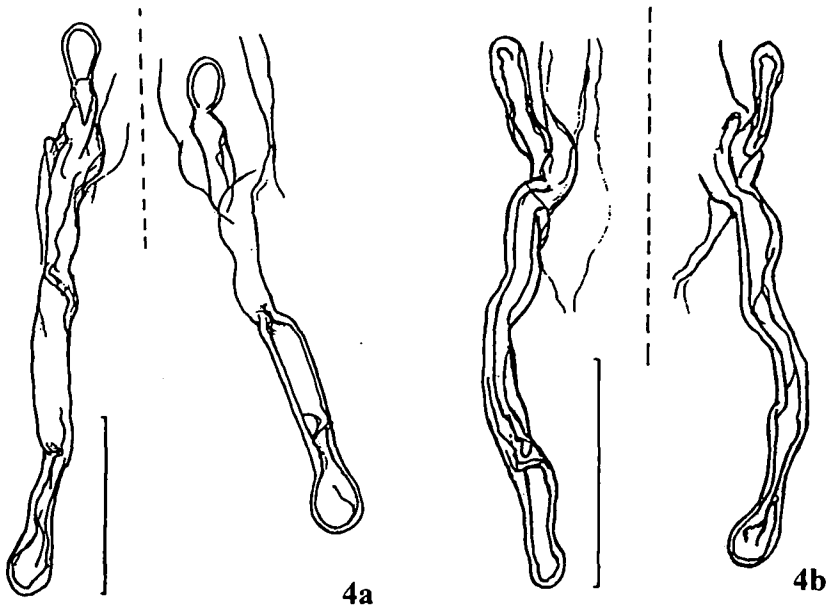

Fig. 4. *Graecophalangium atticum* ROEWER 1923. – **a**: receptaculum seminis (1 ♀, Bulgaria: loc. Rupite). – **b**: receptaculum seminis (1 ♀, Bulgaria: Mikrevo). Scale lines: 0.1 mm.

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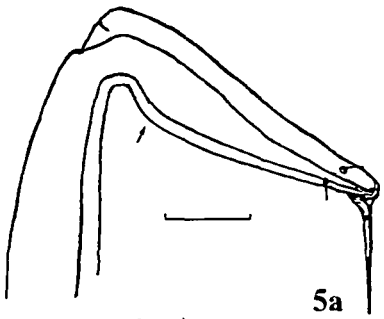


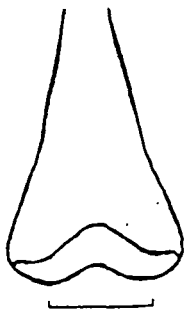
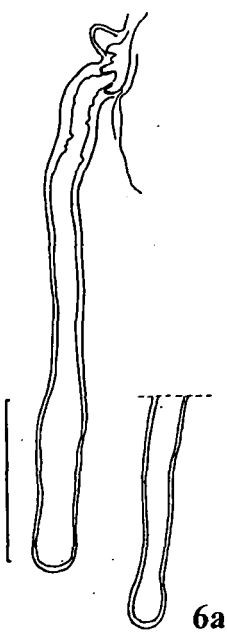
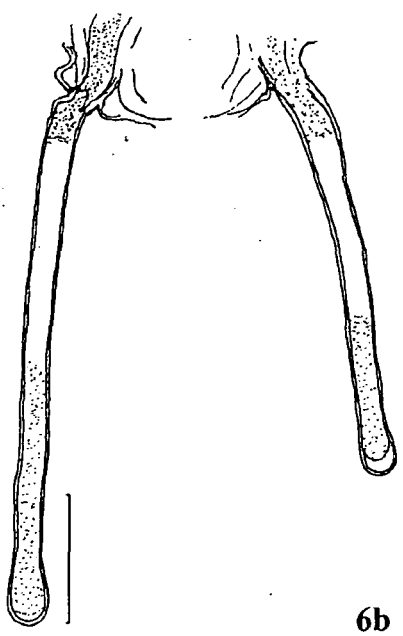


Fig. 5. *Rafalskia cretica* (ROEWER 1923) (1♂, Bulgaria: Eastern Rhodopi Mts.). – **a**: glans penis, lateral. Scale line: 0.1 mm (the arrow points the ventro-basal curvature of glans penis); – **b**: corpus penis, basal part, dorsal. Scale line: 0.5 mm.

Fig. 6. *Rafalskia cretica* (ROEWER 1923) – **a**: receptaculum seminis (1♀, Bulgaria: Eastern Rhodopi Mts.) (only the distal part of the other ampulla is shown). Scale lines: 0.1 mm; – **b**: receptaculum seminis (1♀ (L: 8.35 mm), Greece, NHMV: inv. № 5365).





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