

ARTÍCULO:

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Indice, resúmenes, abstracts

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#### Abstract

The opilionid fauna of Dobrudzha is not well studied, and Northern and Southern Dobrudzha have not been studied equally. For example, only 15 species have been reported from Northern Dobrudzha, while from Southern Dobrudzha they are three times less. As a result of this study and the summarized data from literature, 17 harvestmen species (about 28% of the Bulgarian harvestmen fauna) were found in the area of Southern Dobrudzha. Twelve of them (*Nemastoma bidentatum sparsum*, *Carinostoma elegans*, *Mitostoma gracile*, *Trogulus tricarinatus*, *T. closanicus*, *Dicranolasma giljarovi*, *Phalangium opilio*, *Zachaeus* cf. *anatolicus*, *Egaenus convexus*, *Lacinius horridus*, *Odiellus lendli*, *Astrobonus laevipes*) are new for the Southern Dobrudzha. From the territory of its adjacent regions 18 opilionid species were recorded, four of them (*Trogulus closanicus*, *Dicranolasma thracium*, *Rilaena buresi*, *Eudasylobus beschkovi*) being new to these regions. Notes on expected species, endemism and conservation status of the recorded harvestmen species are given. The similarity of the harvestmen faunas of Northern and Southern Dobrudzha, its adjacent regions, and the Sofia Kettle is illustrated by a dendrogram of faunistic data from the investigated regions.

**Key words:** Opiliones, harvestmen, new faunistic records, Bulgaria, Dobrudzha.

#### Opiliones (Arachnida) del sur de Dobrudzha (NE Bulgaria) y de sus áreas adyacentes

#### Resumen:

La fauna de opiliones de Dobrudzha está escasamente conocida. Lo mismo ocurre con las zonas septentrionales y meridionales adyacentes. Por ejemplo, solo 15 especies se han señalado del Norte de Dobrudzha, mientras que en el sur su conocimiento es mucho menor. Como resultado de este estudio, junto con los datos previos existentes en la literatura, se señalan 17 especies (cerca del 28% de la fauna de opiliones de Bulgaria) del área meridional de Dobrudzha. Doce de ellas representan nuevas citas para esta zona (*Nemastoma bidentatum sparsum*, *Carinostoma elegans*, *Mitostoma gracile*, *Trogulus tricarinatus*, *T. closanicus*, *Dicranolasma giljarovi*, *Phalangium opilio*, *Zachaeus* cf. *anatolicus*, *Egaenus convexus*, *Lacinius horridus*, *Odiellus lendli*, *Astrobonus laevipes*). De esta zona y de sus regiones adyacentes se han registrado 18 especies de opiliones, cuatro de ellas (*Trogulus closanicus*, *Dicranolasma thracium*, *Rilaena buresi*, *Eudasylobus beschkovi*) son nuevas citas para esta región. Se aportan datos sobre el número de especies esperadas, el número de endemismos y su estado de conservación. Mediante un dendrograma se ilustra la similitud faunística de Dobrudzha Septentrional y Meridional, así como de sus regiones adyacentes y de Sofia Kettle.

**Palabras clave:** Opiliones, nuevos datos faunísticos, Bulgaria, Dobrudzha.

## Introduction

Dobrudzha (Fig. 1) is situated in the northeast part of the Balkan Peninsula with an area of 23100 km<sup>2</sup>, and is divided between Romania and Bulgaria in Northern (Pontic) Dobrudzha (ND) and Southern (Danubian) Dobrudzha (SD) (of 7565 km<sup>2</sup>). Southern Dobrudzha is the Bulgarian “granary” and is one of the most anthropized regions in Bulgaria. Between 50 and 60 % of its area is under agriculture (Koprarev, 2002). Progressive xerophytisation of the plant cover under the influence of human activity (logging and grazing) has led to the compacting and erosion of soil and major changes in the local ecological conditions - first in the water regime, which led to the drying of the rivers and the appearance of dry valleys (Stoyanov et al., 1955, Angelova et al., 2002). As a result of the destruction of the native forests, the local mesophilic fauna is slowly being replaced by a xerophilic one (Drenski, 1952). These are the reasons for which Southern Dobrudzha, with its specific climate and plant communities, is of such interest to botanists and zoologists alike.

### REVIEW OF PREVIOUS INVESTIGATIONS

The opilionid fauna of Dobrudzha is not well studied and the two regions have not been studied equally. According to Roewer (1951), Avram & Dumitrescu (1969), Dumitrescu (1970, 1972) and Martens (1978) in Northern Dobrudzha there are 15 species of harvestmen [which is about 26 % of the species found in Romanian harvestmen fauna (Babalean, 2004, 2005)] (see Table I), while the literature data about the species of Southern Dobrudzha are few (Roewer, 1956, Starega, 1976, and Mitov, 1997, 1998), in which only five species are mentioned. During last years however, as a result of the more intensive study of the area of Southern Dobrudzha, new data and materials of Opiliones were gathered, which allows a new look on its harvestmen fauna.

### CHARACTERISTICS OF THE SOUTHERN DOBRUDZHA PHYSIOGRAPHY

Southern Dobrudzha extends from the Danube Delta in the north to the fault of the Moesian karstic platform, near the village Obrotchishte, in the South. It has borders with the Ludogorie (Mad Forests) region and the lower course of the Danube to the West; and with the Black Sea to the East (Fig. 1).

The limits of Southern Dobrudzha are taken from the landscape division of Batakliiev (Koprarev, 2002, p. 393, Fig. 7.1) and after Stoyanov (1940, p. 140, map) – the most western point along the Danube shore is Tzar Samuil Village; the southern limit along the Dobrudzha coast of Black Sea is the outfall of Batova River (Fig. 1).

In the physiocgeographic aspect Southern Dobrudzha is a vast serrated plateau, highest in the Southwestern part (350 m a. s. l.), lowest in the Eastern and Northeastern part, where at Durankulak and Shabla it reaches sea level (Angelova & Ivanova, 1997, Angelova et al., 2002). Here are mainly black soils, formed upon quaternary aeolian loess formations situated on top of

Lower Cretaceous and Sarmatian limestone (Koinov, 1955, Koprarev, 2002).

### CLIMATE

Characteristic for this region is the transitional moderate-continental to continental-mediterranean climate (Angelova & Ivanova, 1997, Koprarev, 2002), which is relatively milder compared to that of the grasslands in Southeastern Europe, because of the soothing (even if weak) influence of the Black Sea – the annual temperature amplitude is about 22° C and the winter is milder. The winds are predominantly in a North - Northeastern direction, their speed (3-6 m/s) is two to three times higher than that common for the inland; during winter they are dry and cold and easily blow away the snow-cover causing icing and freezing of plants, while in the vegetation season the winds are dry and hot, bringing fine dust which covers the plants (Stoyanov, 1940, Naumov, 1955, Koprarev, 2002).

The rain conditions and their seasonal distribution are also continental. Here rainfalls (Angelova et al., 2002, Koprarev, 2002) are one of the lowest in Bulgaria: in eastern part of Southern Dobrudzha and notably along the coastline the annual rainfall is below 500 mm, and in the West can reach values close to the average for the country (with an annual amount of 640 mm). The rainfalls reach their peak in the summer (June, July) and minimum in the winter (January, February); and along the Dobrudzha coast we can see a modified Mediterranean distribution of rainfall with a maximum in December and a minimum in the end of summer and early autumn - in September.

### VEGETATION (degraded)

The native vegetation in Dobrudzha has been preserved to a small extent. In the past the larger part of Dobrudzha was covered with xerothermic forests of downy oak (*Quercus pubescens* Willd.) and turkey oak (*Quercus cerris* L.), and in some places in the Western part - with relic stands of silver lime (*Tilia tomentosa* Moench.) and other species. In the Eastern part, mainly between Dobrich and the coastline, existed forests dominated by pedunculate oak (*Quercus pedunculiflora* C. Koch), of which only certain regions remain (Koprarev, 2002). Forests in Southern Dobrudzha are only a few nowadays. Attention is drawn to plain forests of *Q. cerris*, *Q. pubescens*, *Quercus sessiliflora* Sal., *Q. pedunculiflora*, *Tilia tomentosa*, *Carpinus betulus* L., *Carpinus orientalis* Mill., *Acer campestre* L., *Acer tataricum* L. From West to East there is a passage from forest ecosystems to xerothermic grassland formations. The grassland communities are xeromesophytic in the Western part and xerophytic in the East (Kozhuharov et al., 1997). New data about Holocene plant history (Koprarev, 2002) show that from Atlantic to Subatlantic period (8000-3000 BP) in Southern Dobrudzha was established a continuous change of mixed oak forests in xeromesophytic and xerophytic communities, and a following degradation of forest vegetation which takes place during late Subboreal and early Subatlantic period (3000-2000 BP).

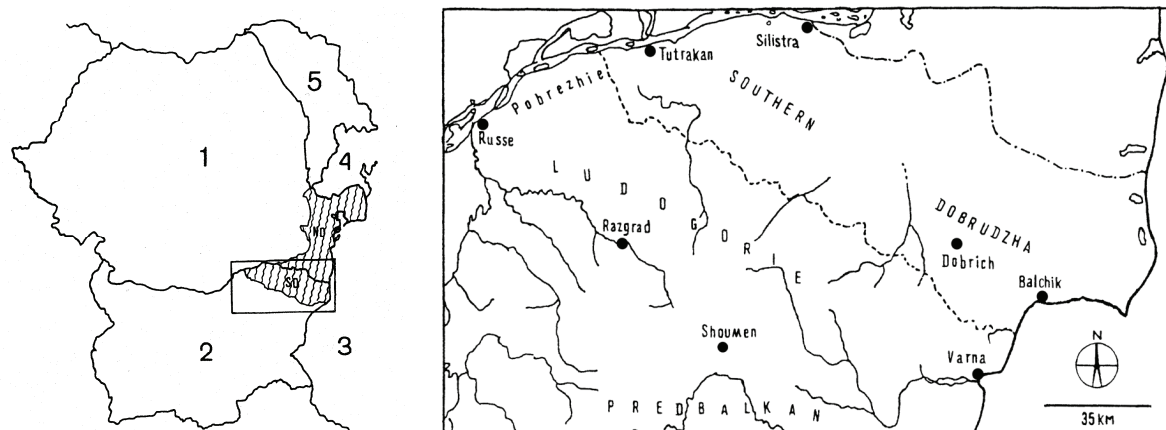


FIG. 1. Location of the study area and regions. 1. – Romania; 2. – Bulgaria; 3. – Black Sea; 4. – Ukraine; 5. – Moldova; ND – Northern Dobrudzha (Romania); SD – Southern Dobrudzha (Bulgaria).

Despite the anthropogenic factor Southern Dobrudzha harbors the last remnants of the extensive steppes and semi-steppes (for which it is assumed that they kept a part of the original grassland flora and fauna), which covered most of its territory in the past. Dry river valleys in inland Dobrudzha have preserved a considerable part of the former diversity of species, typical for the region (Angelova et al., 2002). Steppes vegetation in different parts of Dobrudzha has a different origin (Kozuharov et al., 1997). It is primary only at the coast regions and the borderline with Romania. In the eastern part of Southern Dobrudzha the vegetation was of semi-steppe type (9000 BP), while in the western part of the region the forest communities were replaced by grasslands because of human activity from the time of the Iron Era and the Roman Empire (3200-2051 BP).

#### CHARACTERISTICS OF THE ADJACENT REGIONS (Fig. 1)

Pobrezhie lowland (= the 40 km long area between Russe and Tutrakan):

Altitude: 23-44 m; Climate: moderate-continental; average January temperature: 0° (–2°) C; average July temperature: 23° C; annual rainfall is 500 mm; Dominating soil type: Eutric Fluvisols; Vegetation: Pastures with a dominance of *Cynodon dactylon* (L.) Pers., *Lolium perenne* L.; Former wetlands with hygro- and hydrophytic communities of *Typha* spp., *Phragmites australis* (Cav.) Trin. ex Steud., *Lemna minor* L., etc.

Ludogorie forest region (Mad Forests):

Altitude: 39-501 m; Climate: moderate-continental; average January temperature: 0° (–1°) C; average July temperature: 20° (23°) C; annual rainfall is 500-600/786 mm; Dominating soil type: Chernozems, Haplic Luvisols; Vegetation: Prevalence of mixed thermophilous forests of *Q. cerris*, *Quercus frainetto* Ten., *Quercus dalechampii* Ten., and *T. tomentosa*. Secondary grass communities of *Chrysopogon gryllus* (L.) Trin., *Dichanthium ischaemum* (L.) Roberty, and *Poa bulbosa* L.

Area between Ludogorie region and Predbalkan:

Altitude: 180-502 m; Climate: moderate-continental; average January temperature: 1° (–1.2°) C, average July temperature: 21.6° (23°) C; annual average temperature: 10.5° C; annual rainfall is 600-606 mm; Most rainfalls are in May, June; minimum – September, January, February; Dominating soil type: Calcic Chernozems, Haplic Luvisols; Vegetation: Thermophilous forests of *Q. cerris*, *Q. frainetto*, *Q. dalechampii*, *T. tomentosa*; and on the higher parts beech forests. Secondary grass vegetation – communities of *C. gryllus*, *D. ischaemum*, and *P. bulbosa*.

The above data are after Gulubov et al. (1956, 1977), Bondev (1991), Georgiev (1991), Radoslavova & Psychev (1998), Koprlev (2002).

Data about opilionid faunas of the southeastern adjacent territories of Southern Dobrudzha – Frangensko Plateau and Momino Plateau are not included in the present work (these will be published separately in a work dedicated to the Opiliones of Black Sea region); currently only faunistic data from the territory Lilyaksko Plateau, through Shoumensko Plateau and Madarsko Plateau, to Provadiysko Plateau are included.

#### Material and Methods

The material included in this work consists of 3083 specimens (618 males, 841 females, 1624 juv.) from 21 species of harvestmen (Table I). It was collected mainly with formaline pitfall traps (FPT), and a smaller part was collected by hand.

The material is deposited in the arachnological collection of the author and in the National Museum of Natural History, Sofia (NMNHS). The classification and nomenclature follow Starega (1976) and Martens (1978). The only exceptions are *Trogulus closanicus* Avram, 1971, treated after Chemini (1984), and the genus *Zacheus* C.L. Koch, 1839, for which we have adopted the spelling *Zachaeus* (after Crawford, 1992).

For facilitating a future comparative analysis of

the phenological data, summarized information (based on the material examined) about body length and the presence of eggs in the egg reservoir (=uterus internus) were also included.

For comparative purposes the following new records for two harvestmen species are also included here: – *Mitostoma chrysomelas* [Sofia, Loven Park, housing complex “Diana Bad”, 10 m from Dragalevska River, under *Pinus*-bark (collected from  $S=0.055 \text{ m}^2$ ), 10.IV.2004, leg. P. Mitov. – 43 juv. (L: 1.1-1.8 mm)]. – *Astrobumus laevipes* [Central Stara Planina Mts., in the region of Dobrilla Hut, 1600 m a. s. l., 20.VI.1995, FPT, leg. Ch. Deltshv. – 1♀ (L: 3.9 mm) (with eggs)].

The faunistic similarity between coenoses was determined with the Czekanowski-Sørensen index (Ics) (after Pesenko, 1982), calculated by the formula:

$$I_{cs} = \frac{2a}{(a+b)+(a+c)}$$

which is the ratio of the doubled number of shared species to the sum of the species number of both lists (after Pesenko, 1982), and computed in the R environment (R Development Core Team, 2006).

Abbreviations used:

a. s. l. = above sea level; d = interocular distance in *Trogulus*; Distr. = District; FPT = pitfall traps filled with formalin (4%) (unbaited); inv. № = museum inventory number; juv. = juvenes;  $L \bar{x}$  = body length; L = average body length; n = number of individuals (not in Table I); NMNHS = National Museum of Natural History, Sofia; V.P. = Vasil Popov; subad. = subadultus; v. = village;  $\bar{x}$  = mean;  $\pm$  = standard error of the mean.

## Results

As a result of our study and the summarized data from literature (Starega, 1976, Mitov, 1998) it was determined that in the area of Southern Dobrudzha there are 17 species of harvestmen (Table I), which is about 28 % of the species found in Bulgarian harvestmen fauna (Deltshv et al., 2005). 12 of them are new for the studied area and 3 of them for the Srebarna Biosphere Reserve. From the territory of its adjacent regions 18 opiloid species were recorded, four of them new to this regions. Also, a new record from the Sofia Kettle is presented.

### LIST OF THE SPECIES, FOUND IN SOUTHERN DOBRUDZHA, AND ITS ADJACENT REGIONS

#### FAMILY NEMASTOMATIDAE

##### *Nemastoma bidentatum sparsum* Gruber et Martens, 1968 (Fig. 2)

*Nemastoma bidentatum sparsum*: Starega 1976: pp. 27-29 (Ludogorie: “Sveštari bei Isparih”).

New localities: S. Dobrudzha: Distr. Alphatar, Forestry Karakuz, 50 m a. s. l., deciduous forest of mesophilous type, 02.-29.IX.1986, FPT, leg. L. Penev. – 6♂♂ (L: 1.65-1.75 mm), 7♀♀ (L: 1.6-2.15 mm) (without eggs);

Distr. Dobrich, v. Senokos, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 04.V.-19.VI.1987. – 1♂ (L: 1.9 mm); 08.VII.–21.VIII.1987. – 1♂ (1.8 mm); Distr. Balchik: near the road Albena–Kranevo, longos (swamp) forest in nature reserve “Baltata”, leg. P. Mitov: under trunk, 11.VIII.1993. – 2♂♂ (L: 1.85 mm); under bark, 04.VII.2006. – 1♂ (L: 1.7 mm); Nature reserve “Baltata”: (BLF) (= Swamp (longos) forest of field elm (*Ulmata minoris*) and field ash-tree (*Fraxineta oxycarpae*) of downstream flood plain of the river Batova; wet clayey or sandy soils, covered with a more or less thick layer of leaf litter and numerous trunks in every stage of decomposition, covered with moss; considerable shade; parts of these sites were inundated seasonally (spring, autumn, winter)), 07.IV.1996, FPT, leg. V.P. – 1♂, 9♀♀ (L: 2.1-2.8 mm).

##### *Carinostoma elegans* (Sørensen, 1894) (Fig. 2)

*Carinostoma elegans*: Starega 1976: pp. 54-56 (Ludogorie: “Pisanec und Tabačka bei Ruse”, “Zavet bei Razgrad, Sveštari bei Isparih”).

New localities: S. Dobrudzha: Distr. Alphatar, Forestry Karakuz, 50 m a. s. l., deciduous forest of mesophilous type, 02.-29.IX.1986, FPT, leg. L. Penev. – 1♂ (L: 1.6 mm); Distr. Silistra, Srebarna Biosphere Reserve, buffer zone, 8-10 m a. s. l., 03.IX.-04.X.2005, FPT, leg. P. Mitov. – 3♂♂, 4♀♀; Distr. Turgovishte: v. Prolaz, 500 m a. s. l., Carpinetum litter, 02.VI.2002, leg. B. Petrov. – 1♂ (L: 1.5 mm); Adjacent regions: Shoumensko Plateau: walk under “Orbita”, under stones, 16.V.1992, leg. B. Tsenov. – 1♂.

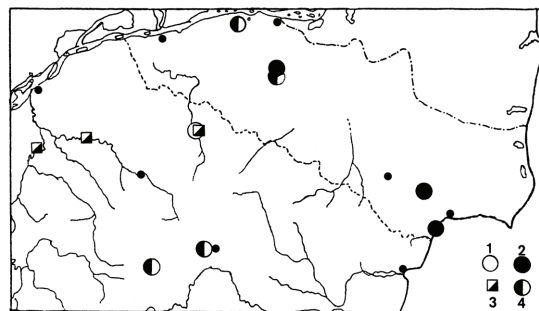


Fig. 2. Records of *Nemastoma bidentatum sparsum* (1, 2) and *Carinostoma elegans* (3, 4) in Southern Dobrudzha and its adjacent regions. 1, 3 – literature data; 2, 4 – new collection data.

##### *Mitostoma chrysomelas* (Hermann, 1804) (Fig. 3)

*Mitostoma chrysomelas*: Starega 1976: pp. 49-51 (Ludogorie: “Pisanec bei Ruse”).

##### *Mitostoma gracile* (Redikorzev, 1936) (Fig. 3)

*Mitostoma gracile*: Starega 1976: pp. 51-53 (“Madara bei Šumen”).

New localities: S. Dobrudzha: Balchik, Botanical Garden, 45-60 m a. s. l., by stream, under piece of bark, 05.VI.2006, leg. P. Mitov. – 2♂♂ (L: 1.3 mm); Distr.



Balchik: near the road Albena–Kranevo, longos (swamp) forest in nature reserve “Baltata”, under trunk, 11.VIII.1993, leg. P. Mitov. – 2♂♂ (L: 1.3-1.85 mm), 3♀♀ (L: 2.0-2.6 mm), 1 juv. (L: 0.7 mm); Nature reserve “Baltata”: (BLF) (see above), 23.VI.1996, FPT, leg. V.P. – 1♂ (L: 1.85 mm), 1♀ (L: 2.25 mm); Adjacent regions: Distr. Turgovishte: v. Prolaz, 500 m a. s. l., under stones, 20.VI.1997, leg. B. Petrov. – 1♂ (L: 2.0 mm), 1♀ (L: 2.75 mm); v. Prolaz, Prolazka Peshtera cave, guano-clay, 02.VI.2002, leg. B. Petrov. – 2 juv. (L: 1.2-1.5 mm); Shoumensko Plateau, cave Zandana (Biserna), 404 m a. s. l., under stones in clay, annual average temperature of the cave is 10° C, 23.I.2000, leg. B. Petrov & T. Ivanova. – 1 juv. (L: 1.25 mm).

#### FAMILY DICRANOLASMATIDAE

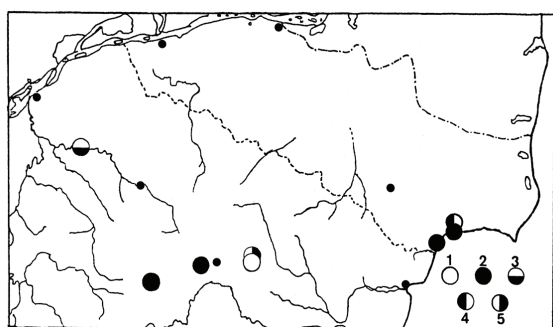
##### *Dicranolasma giljarovi* Šilhavý, 1966 (Fig. 3)

New locality: S. Dobrudzha: Balchik, Botanical Garden, by stream, under piece of bark, 45-60 m a. s. l., leg. P. Mitov: 11.VIII.1993. – 1♂, 1♀, 2 juv. (L: 1.2-2.8 mm); 05.VI.2006. – 3♀♀ (L: 5.5-5.8 mm) (with eggs).

Note: This is the northern border for this species (compare with Starega, 1976). Probably its northern distribution is favoured by the climate conditions of the Black Sea coast and especially in the region of Balchik or it is a result of anthropochory.

##### *Dicranolasma thracium* Starega, 1976 (Fig. 3)

New locality: Adjacent regions: Distr. Shoumen, Madara, loc. “Madarski Konnik”, under stones, 07.IX.2000, leg. B. Petrov. – 2♂♂.



**Fig. 3.** Records of *Mitostoma gracile* (1, 2), *Mitostoma chrysomelas* (3), *Dicranolasma giljarovi* (4), and *Dicranolasma thracium* (5) in Southern Dobrudzha and its adjacent regions. 1, 3 – literature data; 2, 4, 5 – new collection data.

#### FAMILY TROGULIDAE

##### *Trogulus tricarinatus* (Linnaeus, 1758) (Fig. 4)

*Trogulus tricarinatus*: Starega 1976: pp. 12-13 (Ludogorie: “Sveštari bei Ispcrih”; “Šumen”).

New localities: S. Dobrudzha: Distr. Tutrakan, v. Nova

Cherna, Biological Experimental Station (BES) “Kalimok”, 23 m a. s. l., FPT, leg. P. Mitov: 01.-31.V.2005. – 3♀♀ (L: 5.7-6.0 mm) (with eggs); 31.V.-05.VII.2005. – 1♀ (L: 5.8 mm) (with eggs); Distr. Alphatar, Forestry Karakuz, 50 m a. s. l.: 02.-29.IX.1986. – 1♀ (L: 5.2 mm); *Q. cerris*-forest, FPT, leg. L. Penev: 13.V.-29.VI.1986. – 1♀ (L: 5.9 mm) (with eggs); 29.VI.-31.VIII.1986. – 2♀♀ (L: 5.4-5.7 mm) (without eggs); deciduous forest of mesophilous type (Tilieto-Fraxinetum), 04.VII.-02.IX.1986. – 2♀♀ (L: 5.4-5.7 mm) (without eggs); Distr. Dobrich: v. Senokos, deciduous forest of xerophilous type (Quercetum roboris et pedunculiflorae), FPT, leg. L. Penev: 19.VI.1987. – 1♀ (L: 5.7 mm) (with eggs); 19.VI.-08.VII.1987. – 1♀ (L: 5.6 mm) (with 1 egg) (infested with gregarines); 21.VIII.-28.X.1987. – 1 juv. (L: 3.5 mm); v. Dubrava, deciduous forest of xerophilous type (Quercetum roboris et pedunculiflorae), 08.VII.-21.VIII.1987, FPT, leg. L. Penev. – 1♀ (L: 5.5 mm); in the region of Albena, FPT, leg. V.P.: Short-grass dry steppe on poor soils on the limestone margin of the Dobrudzha’s Plateau, 02.IX.1996. – 1 juv. (L: 5.0 mm); Dry mixed oak (*Q. pubescens*) and oriental hornbeam (*C. orientalis*) forest with Mediterranean elements, 06.IV.1996. – 1♂ (L: 4.4 mm), 1♀ (L: 5.6 mm); In the region of Kranevo Village: (K) (= Hedgerows (shrubs of *Prunus spinosa* L., *Rosa* sp., etc.) and occasional trees (*Juglans regia* L., *Prunus cerasifera* Ehrh., *Acer tataricum* L.) between cultivated (wheat, maize) on clayey soils, on the place of the primary wet forests reduced by drainage and agriculture), FPT, leg. V.P.: 07.IV.1996. – 1♀ (L: 5.4 mm) (with eggs); 23.VI.1996. – 1♀ (L: 5.5 mm) (with eggs); Adjacent regions: Veliki Preslav, Quercetum, 15.X.1970, leg. P. Beron, (NMNHS: inv. № 199). – 1♀ (L: 5.7 mm).

Note: This sex ratio (1♂ : 16♀♀) suggests a tendency to parthenogenesis also in this region (see Martens, 1978; Weiss, 1984, 1996).

##### *Trogulus nepaeformis* (Scopoli, 1763) (Fig. 4)

*Trogulus nepaeformis*: Starega 1976: pp. 14-15 (Ludogorie: “Pisanec bei Ruse”).

New locality: S. Dobrudzha In the region of Kranevo Village: (K) (see above), 31.VIII.1996, FPT, leg. V.P. – 1♂ (L: 7.7 mm, d=0.574 mm);

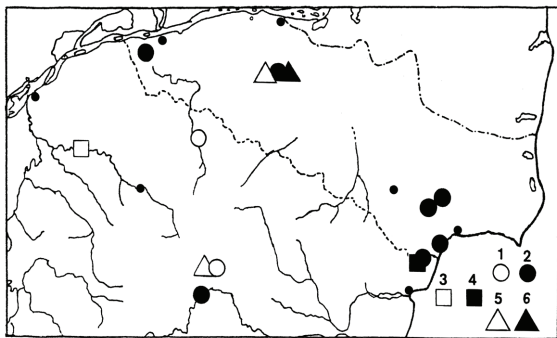
##### *Trogulus closanicus* Avram, 1971 (Fig. 4)

New localities: S. Dobrudzha: Distr. Alphatar, Forestry Karakuz, 50 m a. s. l., deciduous forest of mesophilous type, FPT, leg. L. Penev: 2♂♂ (L: 7.2-7.3 mm, d = 0.686 mm); 3♀♀ (L: 8.5-9.0 mm, d = 0.756-0.798 mm) (with eggs) (1♂, 1♀ - in the collection of Leoš Klimeš, Třeboň); Tilietum, 1986. – 1♂ (L: 7.9 mm, d=0.70 mm); Tilieto-Fraxinetum, 14.V.-28.VI.1986. – 2♂♂ (L: 7.4-7.5 mm, d = 0.658 mm); Adjacent regions: Shoumensko Plateau, “Luvcheto”, III.1991, leg. B. Tsenov. – 1♂ (L: 7.8 mm, d=0.672 mm).

***Trogulus cf. closanicus* Avram, 1971 (Fig. 4)**

New localities: S. Dobrudzha: Karakuz, 50 m a. s. l., deciduous forest of mesophilous type (Tilieto-Fraxinetum): 14.V.-29.VI.1986. – 1♂ (L: 7.6 mm, d=0.672 mm); 04.VII.-02.IX.1986. – 2♂♂ (L: 7.8-7.9 mm, d=0.70 mm); 02.-29.IX.1986. – 1♂ (L: 7.0 mm, d=0.644 mm), 1♀ (L: 8.9 mm, d=0.742 mm).

Note: Here are included transitional forms similar to *Trogulus closanicus*, which have the penis characters intermediate between *closanicus* and *nepaeformis* (according to Avram, 1971 and Chemini, 1984).



**Fig. 4.** Records of *Trogulus tricarinatus* (1, 2), *Trogulus nepaeformis* (3, 4), *Trogulus closanicus* (5), and *Trogulus cf. closanicus* (6) in Southern Dobrudzha and its adjacent regions. 1, 3 – literature data; 2, 4, 5, 6 – new collection data.

## FAMILY PHALANGIIDAE

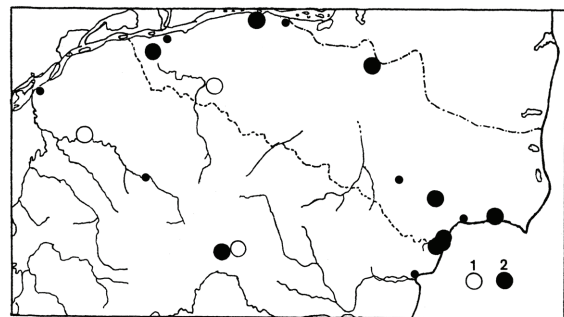
***Phalangium opilio* Linnaeus, 1758 (Fig. 5)**

*Eudasylobus unicolor* Roewer, 1911: pp 58-59 (“Rumänien”); Roewer 1956: 259 (“Dobrudzja”); (synonymy after Starega, 1976).

*Phalangium opilio*: Starega 1976: pp. 82-85 (Ludogorie: “Bezirk Ruse: Pisanec”; S. Dobrudzha: “Bezirk Razgrad: Podles”; “Bezirk Šumen: Madara”).

New localities: S. Dobrudzha: Distr. Tutrakan, v. Nova Cherna, Biological Experimental Station (BES) “Kalimok”, 23 m a. s. l., 03.IX.-03.X.2005, FPT, leg. P. Mitov. – 1♂ (L: 4.0 mm); Distr. Silistra: near Biosphere Reserve Srebarna, locality “Papratta”, Querceto-Tilietum, 17.VIII.-22.X.1987, FPT, leg. L. Penev. – 1♂ (L: 4.1 mm); v. Kapitan-Dimitrovo, 435.5 m a. s. l., 21.VIII.2005, leg. A. Gromov. – 1♂ (L: 5.2 mm); Kavarna, Oil-station, on walls, 13.VII.2006, leg. P. Mitov. – 1 juv. (male) (L: 4.0 mm); Distr. Balchik: In the region of Albena, FPT, leg. V.P.: Short-grass dry steppe on poor soils on the limestone margin of the Dobrudzha’s Plateau, 20.IX.1995. – 1♂ (L: 5.5 mm); Dry mixed oak (*Q. pubescens*) and oriental hornbeam (*C. orientalis*) forest with Mediterranean elements: 06.IV.1996. – 5♂♂ (L: 4.3-5.6 mm), 2♀♀ (with many eggs); 02.IX.1996. – 2♂♂ (L: 5.5 mm), 2♀♀ (L: 6.0 mm) (with eggs); near the road Albena–Kranevo, swamp (longos) forest in nature reserve “Baltata”, under bark, 04.VII.2006, leg. P. Mitov. – 1 juv. (L: 4.5 mm); Nature reserve “Baltata”: (BLF) (see *Nemastoma biden-*

*tatum sparsum*), 11.VIII.1995, FPT, leg. V.P. – 1♂ (L: 4.0 mm), 1♀ (L: 7.6 mm) (with eggs); In the region of Kranevo Village: (K) (see *Trogulus tricarinatus*), 07.IV.1996, FPT, leg. V.P. – 1♂ (L: 4.3 mm); Two year-old clearing at the fringe of the wet forest (“Baltata”), overgrown with mesic dense shrubs, tall grasses, and new growth of elm and ash tree, FPT, leg. V.P.: 11.VIII.1995. – 1♀ (L: 4.0 mm); 20.IX.1995. – 3♂♂ (L: 3.9-4.9 mm), 1♀ (L: 7.0 mm) (with eggs); 07.IV.1996. – 9♂♂ (L: 4.6 mm), 2♀♀ (L: 6.1-6.9 mm) (with eggs); 31.VIII.1996. – 8♂♂ (L: 3.3-5.0 mm), 5♀♀ (L: 5.5-7.4 mm) (with eggs); Distr. Dobrich, v. Senokos, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), 08.VII.-21.VIII.1987, FPT, leg. L. Penev. – 3♂♂ (L: 3.9 mm), 2♀♀ (L: 3.8-6.2 mm) (with eggs); Adjacent regions: Shoumen, a residential district “Divdyadovo”, 29.VII.1990, leg. (?). – 2 juv. (L: 2.0-4.5 mm).



**Fig. 5.** Records of *Phalangium opilio* in Southern Dobrudzha and its adjacent regions. 1 – literature data; 2 – new collection data.

***Opilio parietinus* (De Geer, 1778) (Fig. 6)**

*Opilio parietinus*: Starega 1976: pp. 111-113 (S. Dobrudzha: “Bezirk Razgrad: Paisievo”, “Bezirk Silistra: Srebyrna,”); Mitov 1998: p. 68 (S. Dobrudzha: “Srebarna”).

***Opilio saxatilis* C.L. Koch, 1839 (Fig. 6)**

*Gyas* sp.: Šilhavý 1965: p. 378 (Pobrezhie: “S Marten, Rusensko”) (synonymy after Starega, 1976).

*Opilio saxatilis*: Starega 1976: pp. 114-118 (Ludogorie: “Razgrad”; S. Dobrudzha: “Bezirk Razgrad: Poljana”, “Bezirk Silistra: Sracimir, Srebyrna; Bezirk Tolbuhin: Balčik, Tal von Batova reka, General-Toševo, Obročičšte, Kap Šabla, Tuzlata,”); Mitov 1998: p. 68 (S. Dobrudzha: “Srebarna”).

New localities: S. Dobrudzha: Distr. Tutrakan, v. Nova Cherna, Biological Experimental Station (BES) “Kalimok”, 23 m a. s. l., 31.V.-05.VII.2005, FPT, leg. P. Mitov. – 1 juv. (L: 2.1 mm); Distr. Dobrich: v. Dubrava, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 08.VII.-21.VIII.1987. – 2♂♂ (L: 3.2 mm), 1♀ (L: 4.2 mm); 21.VIII.-28.X.1987. – 1♂ (L: 3.2 mm), 2♀♀ (L: 3.2 mm, without eggs; L: 4.3 mm, with eggs); Durankulak, under stones in grassland, 25.VI.1997, leg. B. Petrov. – 1♂ (L: 4.8 mm), 1 juv. (L: 3.9 mm); in the region of Durankulak Village: 4 km before the border with Romania, open area, grasslands, near the shore, 8-10 m a. s. l.,

27.IX.2006, leg. P. Mitov. – 2♂♂ (L: 3.7-4.2 mm); in the region of Durankulak lake: *Fraxinus*-forest patches near the coast, 13.VII.-27.IX.2006, FPT, leg. P. Mitov. – 5♂♂ (L: 2.6- 3.8 mm), 2♀♀ (L: 4.2-4.5 mm) (with eggs), 1 juv. (L: 2.7 mm); Protected site Shabla Lake: open area, grasslands, under stones, 0 m a. s. l., 06.X.2006, leg. P. Mitov. – 1♂; Ezeretzko lake: open area, grasslands, under stones near the coast, 0 m a. s. l., 06.X.2006, leg. P. Mitov. – 4♂♂ (L: 3.4-4.0 mm); Cape Kaliakra, open area, under stones, 70 m a. s. l., 16.VII.2004, leg. P. Mitov. – 1 juv.; Distr. Balchik, loc. Byalata Laguna–Balchishka Tuzla, 0-28 m a. s. l., open area, shrubs, under plastic piece, 30.IX.2006, leg. P. Mitov. – 3 juv. (L: 3.0-3.3 mm); Village Topola, 30.IX.2006, leg. P. Mitov: Bus station, on walls, open area, 133 m a. s. l. – 4♂♂ (L: 2.8-4.1 mm), 3♀♀ (L: 5.3-5.6 mm) (with eggs), 3 juv. (L: 2.2 mm); near the road, 129 m, under stones and paper, open area, leg. P. Mitov. – 3♂♂ (L: 3.7-4.3 mm), 1 juv. (L: 2.9 mm); Balchik, Botanical Garden, 45-60 m a. s. l.: 11.VIII.1993, leg. P. Mitov. – 1♀ (without eggs) (L: 5.0 mm); leaf litter, 23.VI.1997, leg. B. Petrov. – 1 juv. (L: 4.1 mm); Distr. Balchik: In the region of Albena, FPT, leg. V.P.: Short-grass dry steppe on poor soils on the limestone margin of the Dobrudzha's Plateau: 11.VIII.-20.IX.1995. – 7♂♂ (L: 2.5-4.2 mm), 4♀♀ (L: 4.4-5.4 mm) (with eggs); 06.IV.1996. – 11♂♂ (L: 2.9-4.1 mm), 6♀♀ (L: 5.2 mm), 1 juv. (L: 4.7 mm); 03.IX.1996. – 4♂♂, 3♀♀, 1 juv. (L: 1.35 mm), Shrubs (*Paliureta spina-christi*, *Amygdaleta nanae*), combined with xerothermal grass communities on well drained marl substrate with poor soils, large exposures of bare ground, 04.-30.VIII.1996. – 22♂♂, 9♀♀ (L: 3.5-4.9 mm) (with many eggs), 2 juv. (L: 1.8-3.0 mm), Dry mixed oak (*Q. pubescens*) and oriental hornbeam (*C. orientalis*) forest with Mediterranean elements, 06.IV.1996. – 3♂♂ (L: 4.3-5.6 mm), Willow grove and temporal marsh in site with high water table: 11.VIII.1995. – 1♂ (L: 4.0 mm); 30.VIII.1996. – 1♀; In the region of Kranevo Village: (K) (see *Trogulus tricarinatus*), FPT, leg. V.P.: 11.VIII.1995. – 1♂ (L: 2.5 mm); 07.IV.1996. – 1♂, 3♀♀ (L: 5.8 mm) (with eggs); 23.VI.1996. – 2♀♀ (L: 3.4-4.0 mm) (with eggs); Confirmed localities: S. Dobrudzha: Distr. Silistra, Srebarna Biosphere Reserve, buffer zone, 8-10 m a. s. l., 03.IX.-04.X.2005, FPT, leg. P. Mitov. – 3♂♂ (L: 2.4-3.9 mm), 4 juv. (2.5-3.5 mm); In the region of Shabla: Tuzlata Lake, open area with shrubs, near the coast, under stones, paper, penopolystyrol pieces, 0 m a. s. l., 06.X.2006, leg. P. Mitov. – 4♂♂ (L: 3.0-5.0 mm); v. Obrochiste, open dry habitats, on walls, 13.VII.2006, leg. P. Mitov. – 2♀♀ (L: 2.5 mm, without eggs; L: 5.2 mm, with eggs).

#### *Rilaena buresi* (Šilhavý, 1965) (Fig. 7)

New locality: Adjacent regions: Shoumensko Plateau, leg. B. Tsenov: 31.III.-15.IV.1994. – 4 juv. (L: 3.2-4.3 mm); 15.IV.-29.IV.1994. – 3♀♀ (without eggs) (L: 4.8-5.2 mm), 1 juv. (L: 4.4 mm); 29.IV.-12.V.1994. – 1♀ (with eggs) (L: 6.5 mm);

Note: This locality is the northern border for the species.

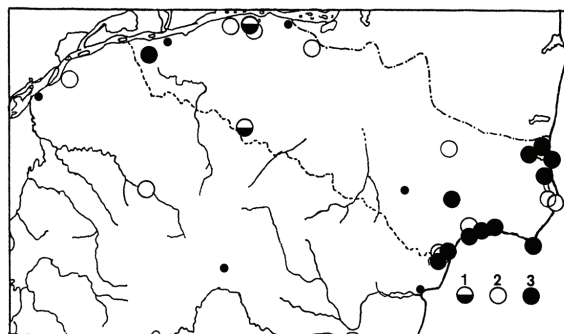


Fig. 6. Records of *Opilio parietinus* (1) and *Opilio saxatilis* (2, 3) in Southern Dobrudzha and its adjacent regions. 1, 2 – literature data; 3 – new collection data.

#### *Eudasylobus beschkovi* Staręga, 1976 (Fig. 7)

New locality: Adjacent regions: Shoumensko Plateau: walk above “Luvcheto”, under stones, 02.V.1992, leg. B. Tsenov. – 1 juv. (L: 2.0 mm).

Note: This locality is the northern border for the species (compare with Staręga, 1976).

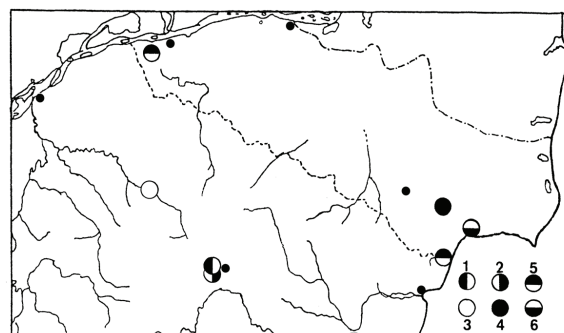


Fig. 7. Records of *Rilaena buresi* (1), *Eudasylobus beschkovi* (2), *Odiellus lendli* (3, 4), *Astrobunus laevipes* (5), and *Nelima aladjensis* (6) in Southern Dobrudzha and its adjacent regions. 3, 6 – literature data; 1, 2, 4, 5 – new collection data.

#### *Zachaeus crista* (Brullé, 1832) (Fig. 8)

*Paropilio lineatus* Roewer, 1956: p. 297 (“Dobrudzja”) (synonymy after Staręga, 1976).

*Zachaeus crista*: Staręga 1976: pp. 86-90 (Ludogorie: “Bezirk Ruse: Pisanec, Tabačka”, “Bezirk Razgrad: Voden”; “Bezirk Šumen: Černoglavci, Jasenkovo, Palamara, Venec”; “Šumen”; S. Dobrudzha: “Bezirk Tolbuhin: Kočmar, Kap Šabla”).

New localities: S. Dobrudzha: Distr. Tutrakan, v. Nova Cherna, Biological Experimental Station (BES) “Kalimok”, 23 m a.s.l., FPT, leg. P. Mitov: 01.-05.V.2005. – 18 juv. ( $L\bar{x}$  : 3.46±0.27 mm (2.4-5.3 mm), n=12)); 05.–31.V.2005. – 1♂ (L: 6.0 mm), 67 juv. ( $L\bar{x}$  : 4.67±0.24 mm (2.7-7.1 mm), n=26)); 31.V.-05.VII.2005. – 3♂♂ ( $L\bar{x}$  : 5.2-6.5 mm), 7♀♀ (without eggs) ( $L\bar{x}$  : 7.61±0.45 mm (6.0-8.5 mm), n=6)), 15 juv. ( $L\bar{x}$  : 4.83±0.36 mm (3.0-7.2 mm), n=11)); Distr. Alphatar, Forestry Karakuz, 50 m a.s. l., FPT, leg. L. Penev: deciduous forest of mesophilous type (Tilieto-Fraxinetum),



14.V.-29.VI.1986. – 17♂♂ ( $L\bar{x}$ : 7.43±0.75 mm (5.6-10.5 mm, n=6)), 25♀♀ ( $L\bar{x}$ : 9.42±0.37 mm (8.0-11.1 mm, n=9)) (with/without eggs), 672 juv. ( $L\bar{x}$ : 6.23±0.5 mm (3.7-9.3 mm, n=16)); *Quercus cerris*-forest: 13.V.-29.VI.1986. – 16♂♂ (L: 6.0-8.8 mm), 47♀♀ ( $L\bar{x}$ : 9.21±0.44 mm (6.2-11.0 mm, n=13) (without/with eggs); 379 juv. ( $L\bar{x}$ : 6.47±0.49 mm (4.3-7.5 mm, n=6)); 29.VI.-31.VIII.1986. – 6♂♂ (L: 6.8-8.8 mm), 15♀♀ (L: 8.7-10.3 mm) (with eggs); 31.VIII.-01.X.1986. – 14 juv. (L: 5.2-7.4 mm); Distr. Silistra: near Biosphere Reserve Srebarna, locality “Papratka”, Querceto-Tilietum, 11.VII.-17.VIII.1987, PTF, leg. L. Penev. – 7♂♂ (L: 6.1-7.5 mm), 25♀♀ ( $L\bar{x}$ : 9.77±0.38 mm (8.0-11.1 mm, n=25)) (with eggs); General-Toshevo city, leg. B. Tsenov – 1♀; Distr. Dobrich: v. Senokos, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 04.V.-19.VI.1987. – 1♀ (L: 9.3 mm) (with eggs), 1 juv. (L: 3.9 mm); 19.VI.-08.VII.1987. – 9♂♂ ( $L\bar{x}$ : 6.86±0.34 mm (5.8-8.5 mm, n=8)), 18♀♀ ( $L\bar{x}$ : 7.62±0.53 mm (6.5-9.2 mm, n=5)) (with eggs), 08.VII.-21.VIII.1987. – 4♂♂ ( $L\bar{x}$ : 6.45±0.42 mm (5.2-7.0 mm, n=4)), 12♀♀ ( $L\bar{x}$ : 8.16±0.22 mm (7.5-8.8 mm, n=5)) (with eggs); v. Dubrava, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 19.VI.-08.VII.1987. – 3♂♂ (L: 4.7-6.4 mm), 65 juv. ( $L\bar{x}$ : 2.74±0.39 mm (1.2-5.5 mm, n=12)); 08.VII.-21.VIII.1987. – 10♂♂ ( $L\bar{x}$ : 6.76 ±0.26 mm (6.1-7.6 mm, n=6)), 12♀♀ (L: 7.9-9.9 mm) (with eggs); in the region of Durankulak lake: *Fraxinus*-forest patches near the coast, 13.VII.-27.IX.2006, FPT, leg. P. Mitov. – 1♂ (L: 8.5 mm); Distr. Balchik: In the region of Albena, FPT, leg. V.P.: Short-grass dry steppe on poor soils on the limestone margin of the Dobrudzha’s Plateau: 11.VIII.1995. – 22♂♂ ( $L\bar{x}$ : 7.47±0.51 mm (6.3-8.7 mm, n=4)), 12♀♀ (L: 9.0-11.7 mm) (with many eggs); 20.IX.1995. – 1♀ (L: 8.5 mm) (with eggs); 23.VI.1996. – 1♀ (L: 6.7 mm); 02.IX.1996. – 20♂♂, 14♀♀ (L: 10.0 mm) (with many eggs), Shrubs (*Paliureta spina-christi*, *Amygdaleta nanae*), combined with xerothermal grass communities on well drained marl substrate with poor soils, large exposures of bare ground, 11.VIII.1995. – 4♂♂ (parasitized by Acari), 2♀♀ (with eggs), Dry mixed oak (*Q. pubescens*) and oriental hornbeam (*C. orientalis*) forest with Mediterranean elements, 02.IX.1996, FPT, leg. V.P. – 3♂♂, 2♀♀, Willow grove and temporal marsh in site with high water table, 30.VIII.1996. – 1♂, 2♀♀; near the road Albena-Kranevo, swamp (longos) forest in nature reserve “Baltata”, under bark, 04.VII.2006, leg. P. Mitov. – 1♂ (L: 7.7 mm); in the region of Kranevo Village: (K) (see *Trogulus tricarinatus*), FPT, leg. V.P.: 11.VIII.1995. – 63♂♂ (L: 6.1-9.5 mm), 48♀♀ (L: 8.5-11.3 mm) (with many eggs); 23.VI.1996. – 21♂♂ (L: 5.4-6.0 mm), 22♀♀ (L: 9.7 mm) (with many eggs), 126 juv.; 31.VIII.1996. – 120♂♂ (L: 5.2-8.1 mm), 143♀♀ (L: 9.9-10.1 mm) (with eggs); Adjacent regions: a residential district “Divdyadovo” of Shoumen (=“Šumen”): 29.VII.1990, leg. (?). – 3♂♂ (L: 6.5-7.0 mm), 4♀♀

(with eggs) (L: 7.0-8.8 mm); 03.-08.VIII.1990, leg. (?). – 2♂♂ (L: 5.9-6.0 mm), 3♀♀ (with eggs) (L: 8.0-8.7 mm); Shoumensko Plateau, leg. B. Tsenov: under stones, 07.-16.V.1992. – 3 juv.; 31.III.-15.IV.1994. – 1 juv. (L: 2.2 mm); 15.IV.-29.IV.1994. – 1 juv. (L: 2.8 mm); 29.IV.-12.V.1994. – 1 juv. (L: 2.3 mm).

#### *Zachaeus cf. anatolicus* (Kulczyński, 1903) (Fig. 8)

New locality: S. Dobrudzha: Shabla, fields, 27.X.1943, leg. (?), (PNM). – 1 juv. (L: 3.5 mm).

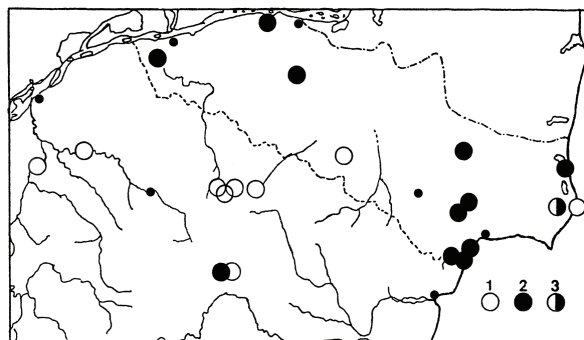


Fig. 8. Records of *Zachaeus crista* (1, 2) and *Zachaeus cf. anatolicus* (3) in Southern Dobrudzha and its adjacent regions. 1 – literature data; 2, 3 – new collection data.

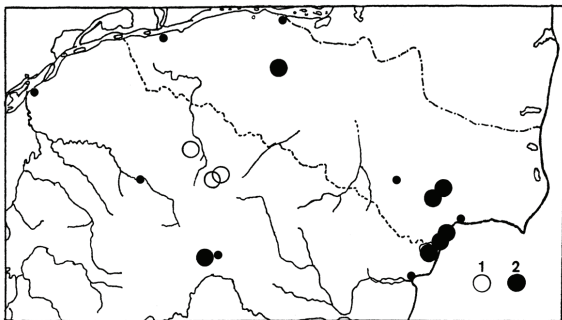
#### *Egaenus convexus* (C.L. Koch, 1835) (Fig. 9)

*Egaenus convexus*: Starega 1976: pp. 122-125 (Ludogorie: “Bezirk Razgrad: Voden”, “Bezirk Šumen: Palamara, Venec”).

New localities: S. Dobrudzha: Distr. Alphatar, Forestry Karakuz, 50 m a. s. l., FPT, leg. L. Penev: deciduous forest of mesophilous type (Tilieto-Fraxinetum): 14.V.-29.VI.1986. – 7♂♂ ( $L\bar{x}$ : 8.65±0.47 mm (6.6-9.9 mm, n=6)), 39♀♀ ( $L\bar{x}$ : 11.36±0.31 mm (9.5-13.2 mm, n=13)) (with many eggs /without eggs); 04.VII.-02.IX.1986. – 6♀♀ (L: 9.8-12.1 mm) (without/with eggs); *Quercus cerris*-forest: 13.V.-29.VI.1986. – 27♂♂ ( $L\bar{x}$ : 8.5±0.34 mm (6.8-10.5 mm, n=10)), 78♀♀ ( $L\bar{x}$ : 10.3±0.38 mm (8.2-11.7 mm, n=11)) (with many eggs); 29.VI.-31.VIII.1986. – 1♂ (L: 8.1 mm), 1♀ (10.5 mm) (with eggs); 31.VIII.-01.X.1986. – 10♀♀ (L: 8.4-10.8 mm) (with eggs); Distr. Dobrich: v. Senokos, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 04.V.-19.VI.1987. – 3♂♂ (L: 8.0-8.5 mm), 9♀♀ ( $L\bar{x}$ : 8.8±0.32 mm (7.5-10.5 mm, n=9)) (without and with eggs), 6 juv. ( $L\bar{x}$ : 7.42±0.12 mm (7.0-7.9 mm, n=6)); 19.VI.-08.VII.1987. – 2♀♀ (L: 9.0-10.0 mm) (with eggs), 08.VII.-21.VIII.1987. – 1♀; v. Dubrava, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), 19.VI.-08.VII.1987, FPT, leg. L. Penev. – 5♂♂ ( $L\bar{x}$ : 7.32±0.27 mm (6.7-8.1 mm, n=5)), 24♀♀ ( $L\bar{x}$ : 8.0±0.20 mm (7.5-8.5 mm, n=4)), 1 juv. (L: 5.0 mm); Distr. Balchik: In the region of Albena, FPT, leg. V.P.: Short-grass dry steppe on poor soils on the limestone margin of the Dobrudzha’s Plateau: 11.VIII.1995. – 1♂



(parasitized by Acari), 3♀♀ (with eggs) (parasitized by Acari); 06.-23.IV.1996. – 1♂ (subadultus) (L: 7.4 mm), 7 juv. (L: 4.5 mm); 23.VI.1996. – 2♂♂, 6♀♀, 9 juv. (L: 4.0-7.5 mm), Shrubs (*Paliureta spina-christi*, *Amygdaleta nanae*), combined with xerothermal grass communities on well drained marl substrate with poor soils, large exposures of bare ground: 11.VIII.1995. – 1♀ (with eggs); 30.VIII.1996. – 7♂♂ (L: 8.0-9.9 mm), 7♀♀ (L: 10.5-11.4 mm) (with many eggs), 3 juv. (L: 7.7-8.8 mm), Dry mixed oak (*Q. pubescens*) and oriental hornbeam (*C. orientalis*) forest with Mediterranean elements: 06.IV.1996. – 27 juv. (L: 2.6-5.8 mm); 23.VI.1996. – 2♂♂ (L: 8.6 mm), 6♀♀ (L: 6.4 mm) (with eggs), 12 juv. (L: 6.4-8.0 mm); 23.VI.1996. – 6♂♂, 6♀♀ (with many eggs), 1 juv. (L: 5.8 mm); 02.IX.1996. – 2♂♂, 4♀♀ (L $\bar{x}$ : 9.5 mm) (with eggs), Willow grove and temporal marsh in site with high water table: 11.VIII.1995. – 1♂ (L: 10.0 mm), 4♀♀ (L: 8.3-11.5 mm) (with many eggs); 06.IV.1996. – 3 juv. (L: 3.2-4.8 mm); 30.VIII.1996. – 3♂♂, 11♀♀ (L: 10.4 mm) (with many eggs); Nature reserve "Baltata": (BLF) (see *Nemastoma bidentatum sparsum*), 07.IV.1996, FPT, leg. V.P. – 1 juv. (L: 3.1 mm); In the region of Kranevo Village: (K) (see *Trogulus tricarinatus*), FPT, leg. V.P.: 11.VIII.1995. – 7♂♂ (8.4-9.3 mm), 24♀♀ (L: 8.8-11.6 mm) (with eggs) (parasitized by Acari); 07.IV.1996. – 5 juv. (L: 4.7 mm); 23.VI.1996. – 40♂♂ (L: 6.5-9.5 mm), 60♀♀ (10.7-11.0 mm) (with eggs), 50 juv. (L $\bar{x}$ : 6.38±0.57 mm (4.4-7.7 mm, n=5)); 31.VIII.1996. – 29♂♂ (L: 7.2 mm), 39♀♀ (L $\bar{x}$ : 6.7-9.8 mm) (without/with eggs); Two year-old clearing at the fringe of the wet forest ("Baltata"), overgrown with mesic dense shrubs, tall grasses, and new growth of elm and ash tree, FPT, leg. V.P.: 11.VIII.1995. – 1♂, 2♀♀ (with eggs); 23.VI.1996. – 5♂♂, 17♀♀ (L: 8.4-12.0 mm) (with



**Fig. 9.** Records of *Egaenus convexus* in Southern Dobrudzha and its adjacent regions. 1 – literature data; 2 – new collection data.

many eggs), 2 juv. (L: 6.2 mm); 31.VIII.1996. – 1♂, 10♀♀ (L: 9.0-9.2 mm) (with eggs); Adjacent regions: Shoumensko Plateau, Meteorological Station, 07.V.1992, leg. B. Tsenov. – 1♂ (L: 9.1 mm).

***Lacinius horridus* (Panzer, 1794) (Fig. 10)**

*Lacinius horridus*: Starega 1976: pp. 73-77 ("Šumen").

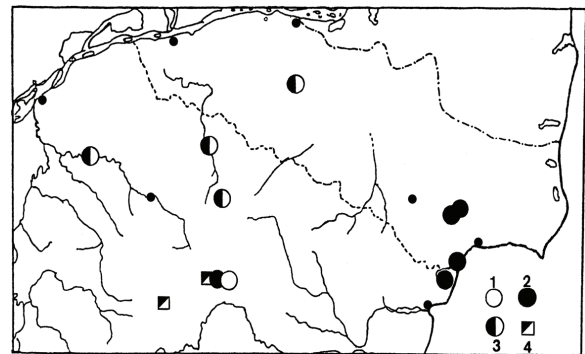
New localities: S. Dobrudzha: Distr. Dobrich: v. Senokos, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 19.VI.-

08.VII.1987. – 1 juv. (L: 3.4 mm), 08.VII.-21.VIII.1987. – 1 juv. (L: 3.8 mm), 21.VIII.-28.X.1987. – 1♀ (L: 8.3 mm) (with eggs), 1 juv. (L: 5.5 mm); v. Dubrava, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), FPT, leg. L. Penev: 19.VI.-08.VII.1987. – 11 juv. (L $\bar{x}$ : 2.35±0.22 mm (1.5-2.9 mm), n=6); 08.VII.-21.VIII.1987. – 15 juv. (L $\bar{x}$ : 4.46±0.45 mm (3.5-6.0 mm), n=5); 21.VIII.-28.X.1987. – 4♂♂ (L $\bar{x}$ : 3.72±0.39 mm (2.8-4.7 mm), n=4), 1♀ (L: 4.5 mm) (without eggs), 2 juv. (5.6-6.1 mm); In the region of Albena, FPT, leg. V.P.: Short-grass dry steppe on poor soils on the limestone margin of the Dobrudzha's Plateau, 20.IX.1995. – 1♀ (L: 7.5 mm) (with many eggs); 11.VIII.1995. – 1 juv. (L: 4.5 mm); 06.IV.1996. – 3♂♂ (L: 5.8 mm), 2♀♀ (L: 7.4-7.7 mm) (with eggs), Dry mixed oak (*Q. pubescens*) and oriental hornbeam (*C. orientalis*) forest with Mediterranean elements, 06.IV.1996. – 12♂♂ (L $\bar{x}$ : 3.7-5.5 mm); in the region of Kranevo Village: (K) (see above), 11.VIII.1995, FPT, leg. V.P. – 1 juv. (L: 4.0 mm); Adjacent regions: Shoumensko Plateau, rocks, 16.V.1992, leg. B. Tsenov. – 1 juv.

***Lacinius dentiger* (C.L. Koch, 1847) (Fig. 10)**

*Lacinius dentiger*: Starega 1976: pp. 79-81 (Ludogorie: "Bezirk Ruse: Pisanec", "Bezirk Razgrad: Sveštari", "Bezirk Šumen: Palamara"; S. Dobrudzha: "Bezirk Silistra: Car-Asenovo").

New localities: Adjacent regions: Distr. Turgovishte, v. Prolaz, 500 m a. s. l., under stones, 20.VI.1997, leg. B.



**Fig. 10.** Records of *Lacinius horridus* (1, 2) and *Lacinius dentiger* (3, 4) in Southern Dobrudzha and its adjacent regions. 1, 3 – literature data; 2, 4 – new collection data.

Petrov. – 1 juv. (L: 3.1 mm); Shoumensko Plateau, rocks, leg. B. Tsenov: 16.V.1992. – 2 juv.; 02.VII.1993. – 3 juv.

***Odiellus lendli* (Sørensen, 1894) (Fig. 7)**

*Odiellus bieniaszi*: Starega 1976: pp. 70-73 (Ludogorie: "Razgrad-Abritus") (for the synonymy see Martens, 1978).

New locality: S. Dobrudzha: Distr. Dobrich, v. Senokos, deciduous forest of xerophilous type (*Quercetum roboris et pedunculiflorae*), 21.VIII.-28.X.1987, FPT, leg. L. Penev. – 2♀♀ (L: 6.0-6.3 mm) (with eggs).

## FAMILY SCLEROSOMATIDAE

*Astrobonus laevipes* (Canestrini, 1872) (Fig. 7)

New localities: S. Dobrudzha: Distr. Tutrakan, v. Nova Cherna, Biological Experimental Station (BES) "Kalimok", in mixed forest patches of *Robinia pseudoacacia* L., *Tilia* sp., *Fraxinus* sp., 23 m a. s. l., 05.-31.V.2005, FPT, leg. P. Mitov. – 1♂ (L: 2.3 mm); in the region of Albena: Nature reserve "Baltata": (BLF) (see *Nemastoma bidentatum sparsum*), FPT, leg. V.P.: 11.VIII.1995. – 4♂♂ (L: 2.5-2.8 mm), 3♀♀ (L: 3.7 mm) (with eggs); 06.-07.IV.1996. – 49♂♂ (L: 2.5-2.7 mm), 72♀♀ (L: 3.6 mm) (with eggs).

Note: Until now this species was known only from the Kamchia Longos (see Mitov, 1995). The sites shown above are the second and third localities documented for this rare species for the Bulgarian fauna. *Astrobonus laevipes* may be found at one more (fourth) locality - Central Stara Planina Mts. (1600 m a. s. l.) (unpublished data), that is also the most elevated one for this species (see Martens 1978, Komposch 1999).

*Nelima aladjensis* Mitov, 1997 (Fig. 7)

*Nelima aladjensis*: Mitov 1997: p. 98 (S. Dobrudzha: "Baltschik, Botanischer Garten").

Confirmed locality: S. Dobrudzha: Balchik (= "Baltschik"), Botanical Garden, 45-60 m a. s. l., leg. P. Mitov: 11.VIII.1993. – 1♂ (L: 4.2 mm), 1♀ (L: 4.0 mm); by stream, under bridge: 16.VII.2004. – 2♂♂ (L: 4.2-4.5 mm); 05.VI.2006. – 1 juv. (L: 4.8 mm).

**Discussion**

With the destruction of the native forests in Southern Dobrudzha, the primary mesophilous fauna is replaced by a xerophilous one (Drenski, 1952) and by more flexible species. The outskirts of the isolated forest regions maintain these mesophilic conditions (Drenski, 1952) and shelter part of the primary fauna.

The opilionid fauna of Southern Dobrudzha is represented mainly by species restricted more or less to the low-mountain zone (see Staręga, 1976, Mitov & Stoyanov, 2005). Part of these species are ecologically tolerant (*C. elegans*, *T. tricarinatus*, *T. closanicus*, *O. parietinus*, *Z. crista*, *E. convexus*, *L. horridus*, *O. lendli*), and may be found in any habitat (open, forest, ecotones). From these, Weiss (1988) determines as characteristic for the South-European semi-steppes the species *C. elegans*, *Z. crista*, and *E. convexus*. The last two are also dominant in forest and ecotone communities in Southern Dobrudzha. These species can perform translocations by switching their habitat (forest, steppe, ecotone) according to seasons (Weiss, 1988). This strategy possibly gives them the opportunity to use the resources of the environment to a greater extent and to populate new plant communities (natural and man-made) easier (see Mitov & Stoyanov, 2004).

In the harvestmen fauna of Southern Dobrudzha there are also species preferring mainly open habitats (*P.*

*opilio*, *O. saxatilis*, *Z. cf. anaticus*), as well as thermophilous forest species (*C. elegans*, *M. gracile*, *D. giljarovi*, *L. dentiger*, *N. aladjensis*), and some with small size, living under stones, fallen wood and leaf litter, which provides condensed moisture and shade (*N. bidentatum sparsum*, *A. laevipes*). *M. gracile* and *D. giljarovi* also seem to be associated with moist riverside habitats.

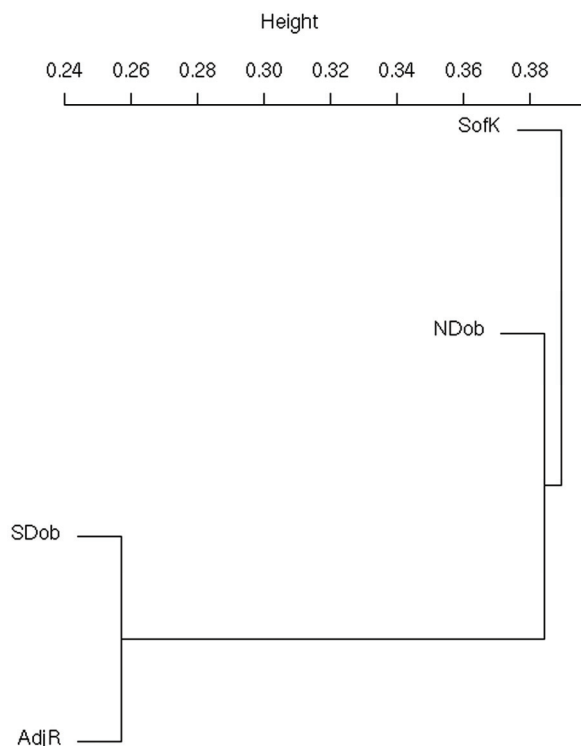
The clearing of forests in the Dobrudzha Valley has led to the appearance of species-poor and degrading forest patches and the replacing of the semi-steppe vegetation with an "agricultural steppe" (Stoyanov et al., 1955). As a result of that and the ongoing process of xerophytisation here the hygrophilous species of genus *Paranemastoma* Redikorzev, 1936 are absent.

The discovery of *A. laevipes* in Southern Dobrudzha (Fig. 7) is interesting here. The closest locality is in Northern Dobrudzha. Probably the distribution of this species southwards, in the territory of our country is due to the specific climate conditions in the coastal region and suitable habitats (moist and shady longos forests in the nature reserve "Baltata", at the outfalls of the Batova, and Kamchia rivers and forest patches along the Danube (in the region of Tutrakan) that are rich in underground water (Mitov, 1995)). A similar postglacial distribution of this species has been observed in Central Europe as well (Martens, 1978, Bliss, 1993, Höfer & Spelda, 2001). In Bulgaria *A. laevipes* was found also in Central Stara Planina Mts. (see "Material and Methods"). This phenomenon can possibly be explained by the relative likeness of the climate conditions of coastlines and high mountains (Josifov, 1988).

## EXPECTED SPECIES

In Northern Dobrudzha we can expect to find the species *C. elegans*, known from the Carpathian Mountains (Dumitrescu, 1972). As we know the geographic and climatic conditions of Southern Dobrudzha and the species of harvestmen in the area of the Ludogorie, we can expect to find several more species, usually found in moist and shady places, like *M. chrysomelas*, and *D. thracium*.

From the genus *Nemastoma* C.L. Koch, 1836 in Southern Dobrudzha has been found only *N. bidentatum sparsum*. Although the species *Nemastoma lugubre* (Müller, 1776) is found in Northern Dobrudzha, it was not found here. This species is very rare in Bulgaria and can be found in only one locality (Petrohan Pass, Stara Planina Mts.) (Staręga, 1976; the locality has been confirmed by P. Mitov). Probably it is a psychro- and hygrophilous species, attached to forest habitats and did not find the right conditions or went extinct due to the xerophylisation. Probably paleogeographical (and faunistic) links of the Carpathian Mts. and Stara Planina Mts. during Miocene-Pliocene (Georgiev, 1990) had considerable importance for the distribution of this species in Bulgaria (West Stara Planina Mts.), where thanks to suitable conditions [moisture and forest habitats (beech forests)] has survived.



**Fig. 11.** Cluster dendrogram of the similarity between harvestmen taxocenoses of Northern (NDob), and Southern Dobrudzha (SDob), the adjacent regions (AdjR) and the Sofia Kettle (SofK), determined by  $I_{CS}$ .

#### ENDEMISM AND CONSERVATION STATUS

There are no species of harvestmen protected by law (Deltshev et al., 2005). However among the Opiliones in Southern Dobrudzha, interest is drawn to the Bulgarian endemic harvestmen *N. aladjensis*, the Balkan subendemics (mainly anatolian-caucasian) *M. gracile*, *D. giljarovi* and *Z. cf. anatolicus*. Here we must add also the rare *C. elegans* and *A. laevipes*. Among the species from the adjacent regions of Southern Dobrudzha, most interesting are the opilionids *D. thracium* (Balkan endemic) and *E. beschkovi* (Bulgarian/Balkan endemic). In Bulgaria these species inhabit specific habitats and are found in several sites in low numbers. All this suggests special measures to be taken for their protection and conservation. All other species in the region are common and not endangered.

#### SIMILARITY OF THE HARVESTMEN FAUNAS OF NORTHERN, SOUTHERN DOBRUDZHA, ITS ADJACENT REGIONS, AND THE SOFIA KETTLE

So far the harvestmen fauna of Southern Dobrudzha (17 species) is richer than that of Northern Dobrudzha (15 species) (Table I), and 10 species are common for both. That number of species is also common between Southern Dobrudzha and the Sofia Kettle (along with parks in Sofia). The Sofia Kettle has a similar climate and fate concerning forest clearing and human activity (Mitov & Stoyanov, 2004). The closest similarity is between Southern Dobrudzha and its adjacent regions - 13 common species which may be due to the close climate conditions and plant communities. This is illustrated by the dendrogram of the faunistic similarity between taxocenoses of the given regions (Fig. 11). It also shows the

clear differentiation of the harvestmen fauna of the Sofia Kettle compared to others.

Common for the fauna of the four regions are eight, ecologically flexible species. These are *T. tricarinatus*, *O. lendli*, *L. horridus*, *P. opilio*, *O. parietinus*, *O. saxatilis*, *Z. crista*, and *E. convexus*. Because of this they can populate different types of natural habitats, as well some heavily disturbed by man.

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**Table I**

The opilionid fauna of Dobrudzha, adjacent regions of Southern Dobrudzha, and Sofia Kettle (with parks of Sofia city). + = previous records, **n** = new records, **S** = number of species, **(1)** – according to Mitov & Stoyanov (2004), **(2)** – Mitov (unpublished data).

<b>Species</b>	<b>Northern Dobrudzha</b>	<b>Southern Dobrudzha</b>	<b>Adjacent regions</b>	<b>Sofia Kettle <sup>(1)</sup></b>
<i>Nemastoma lugubre</i>	+	–	–	–
<i>Nemastoma bidentatum sparsum</i>	+	n	+	–
<i>Paranemastoma silli</i>	+	–	–	–
<i>Carinostoma elegans</i>	–	n	+	–
<i>Carinostoma ornatum</i>	–	–	–	+
<i>Mitostoma chrysomelas</i>	+	–	+	n <sup>(2)</sup>
<i>Mitostoma gracile</i>	–	n	+	–
<i>Dicranolasma giljarovi</i>	–	n	–	–
<i>Dicranolasma thracium</i>	–	–	n	–
<i>Trogulus tricarinatus</i>	+	n	+	+
<i>Trogulus nepaeformis</i>	–	–	+	–
<i>Trogulus closanicus</i>	–	n	n	–
<i>Phalangium opilio</i>	+	n	+	+
<i>Opilio parietinus</i>	+	+	+	+
<i>Opilio saxatilis</i>	+	+	+	+
<i>Opilio dinaricus</i>	–	–	–	+
<i>Opilio ruzickai</i>	–	–	–	+
<i>Rilaena triangularis</i>	+	–	–	–
<i>Rilaena buresi</i>	–	–	n	–
<i>Rilaena cf. serbica</i>	–	–	–	+
<i>Eudasylobus beschkovi</i>	–	–	n	–
<i>Zachaeus crista</i>	+	+	+	+
<i>Zachaeus cf. anatolicus</i>	–	n	–	+
<i>Egaenus convexus</i>	+	n	+	+
<i>Oligolophus tridens</i>	+	–	–	–
<i>Lacinius horridus</i>	+	n	+	+
<i>Lacinius dentiger</i>	–	+	+	+
<i>Odiellus lendli</i>	+	n	+	+
<i>Astrobunus laevipes</i>	+	n	–	–
<i>Nelima aladjensis</i>	–	+	–	–
<b>S</b>	<b>15</b>	<b>17/12 n</b>	<b>18/4 n</b>	<b>15/1 n</b>