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Ctenophthalmus (*Spalacoctenophthalmus*) *caucasicus* B&, Deliblatska Peščara: Šumarak, 26.4.1983, from *Nannospalax leucodon*, leg. A. Ružić
foto/*Photo*: Tomi Trilar

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Siphonaptera of the Lesser Mole Rat (*Nannospalax leucodon* (NORDMANN, 1840)) (Rodentia: Muridae: Spalacinae) from the Western and Central Balkans

Savo BRELIH[1] & Tomi TRILAR[2]

UDC(UDK) 595.775:599.32(497)

ABSTRACT

We examined the fleas from the Lesser Mole Rat (*Nannospalax leucodon*) of the Western and Central Balkans and found 16 species and two subspecies of Siphonaptera. In our survey we found the fleas *Rhadinopsylla* (*Actenophthalmus*) *sobrina*, *Ctenophthalmus* (*Spalacoctenophthalmus*) *caucasicus*, *Ct.* (*S.*) *ruris*, *Ct.* (*S.*) *monticola* and *Ct.* (*Euctenophthalmus*) *gratus*, typical of the host. Distributional results are shown on five maps.

Key words: Siphonaptera, *Nannospalax leucodon*, Ectoparasites, Balkans

IZVLEČEK

Bolhe zahodnih slepih kužet (*Nannospalax leucodon* (NORDMANN, 1840)) (Rodentia: Muridae: Spalacinae) zahodnega in osrednjega Balkanskega polotoka. - Iz zahodnega in centralnega Balkanskega polotoka je navedenih 16 vrst in 2 podvrsti bolh, najdenih na zahodnem slepem kužetu (*Nannospalax leucodon*). Razširjenost bolh *Rhadinopsylla* (*Actenophthalmus*) *sobrina*, *Ctenophthalmus* (*Spalacoctenophthalmus*) *caucasicus*, *Ct.* (*S.*) *ruris*, *Ct.* (*S.*) *monticola* in *Ct.* (*Euctenophthalmus*) *gratus*, ki so značilne za navedenega gostitelja, je prikazana na 5 geografskih kartah.

Ključne besede: bolhe, Siphonaptera, zahodno slepo kuže, *Nannospalax leucodon*, Balkanski polotok

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Introduction

Our paper examines the presence of Siphonaptera found on the Lesser Mole Rat (*Nannospalax leucodon* (NORDMANN, 1840) from the Western and Central Balkans (=former Yugoslavia). The present work is our sixth contribution on siphonapterofauna of mammals from this territory (BRELIH & PETROV, 1978; BRELIH, 1986; BRELIH & TRILAR, 2000a, 2000b, 2001). Previously, KOHAUT (1904), WAGNER (1928-1929, 1936a, 1936b, 1939), ROSICKÝ & TODOROVIĆ (1964), HOPKINS & ROTHSCHILD (1962, 1966, 1971) and SAVIĆ & RYBA (1975) have also published data on fleas of *N. leucodon* from the territory of the Western and Central Balkans. Host relationships are summarized from PETROV (1992), MITCHELL-JONES et al. (1999) and ĐULIĆ & MIRIĆ (1967). We follow the mammalian nomenclature according to MITCHELL-JONES et al. (1999).

Material and methods

Most of the material we used has been collected over the last 30 years from *N. leucodon* obtained during micromammalian faunistic studies.

Dead animals were removed from traps early in the morning, as ectoparasites leave host mammals soon after they are trapped. Specimens of each host species were stored in separate linen or plastic bags until examined and were attended to immediately after collection. Ectoparasites were stored in 70 % ethanol, separately with respect to each host. At this time, the survey site, altitude, and date were also recorded. In most cases, ecological examinations were not performed. We were very rarely in possession of information on the total number of host specimens examined.

The collected flea specimens were used to prepare microscopic slides using Canada balsam. All material without literature has been deposited in the Slovenian Museum of Natural History (PMSL Siphonaptera Collection - coll. S. Brelih, coll. T. Trilar). Species identification was made according to HOPKINS & ROTHSCHILD (1962, 1966, 1971), ROSICKÝ (1957) and SMIT (1963).

List of the hosts
Sorex araneus LINNAEUS, 1758
Neomys anomalus CABRERA, 1907
Talpa europaea LINNAEUS, 1758
Talpa stankovici V. MARTINO & E. MARTINO, 1931
Sciurus vulgaris LINNAEUS, 1758
Spermophilus citellus (LINNAEUS, 1766)
Clethrionomys glareolus (SCHREBER, 1780)
Dinaromys bogdanovi (MARTINO, 1922)
Arvicola terrestris (LINNAEUS, 1758)
Microtus arvalis (PALLAS, 1778)
Microtus duodecimcostatus DE SÉLYS-LONGCHAMPS, 1839
Microtus multiplex (FATIO, 1905)
Microtus rossiaemeridionalis (OGNEV, 1924)
Microtus subterraneus (DE SÉLYS-LONGCHAMPS, 1836)
Chionomys nivalis (MARTINS, 1842)
Nannospalax leucodon (NORDMANN, 1840)
Apodemus flavicollis (MELCHIOR, 1834)
Apodemus sylvaticus (LINNAEUS, 1758)

Apodemus uralensis (PALLAS, 1811)
Mus spicilegus PETÉNYI, 1882
Glis glis (LINNAEUS, 1766)
Dryomys nitedula (PALLAS, 1778)

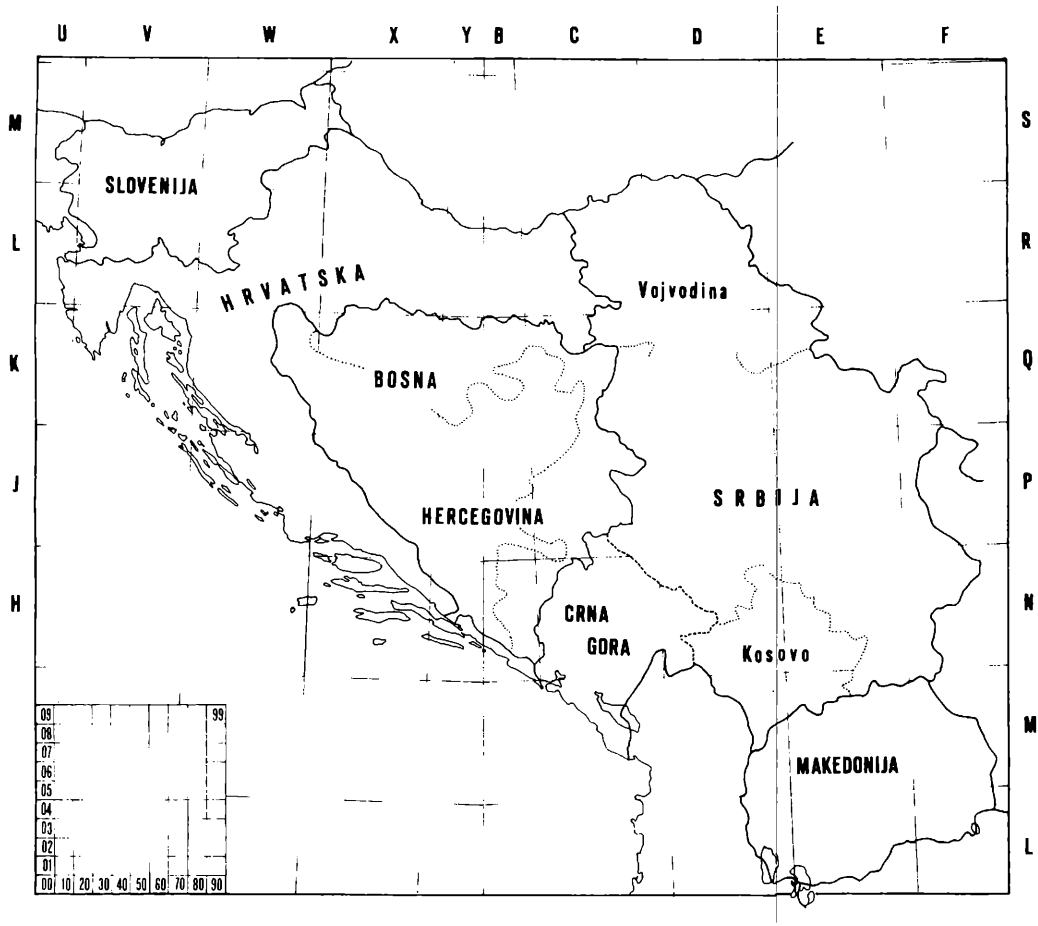

Fig. 1: Western and Central Balkans with indicated states, borders, and UTM (100 x 100 km grid)

Survey sites (localities):

Collecting sites are identified by number as indicated in Fig. 2 and coordinates of the UTM squares are given in the second column. The major localities (the province, mountain, etc.) are given first, followed by the exact survey site. If separated by a comma (,), the exact locality is situated close to the major one (e.g. Kupres, Gornji Malovan). If separated by a colon (:), the survey site is situated at the major locality or constitutes its component (e.g. Durmitor: Žabljak).

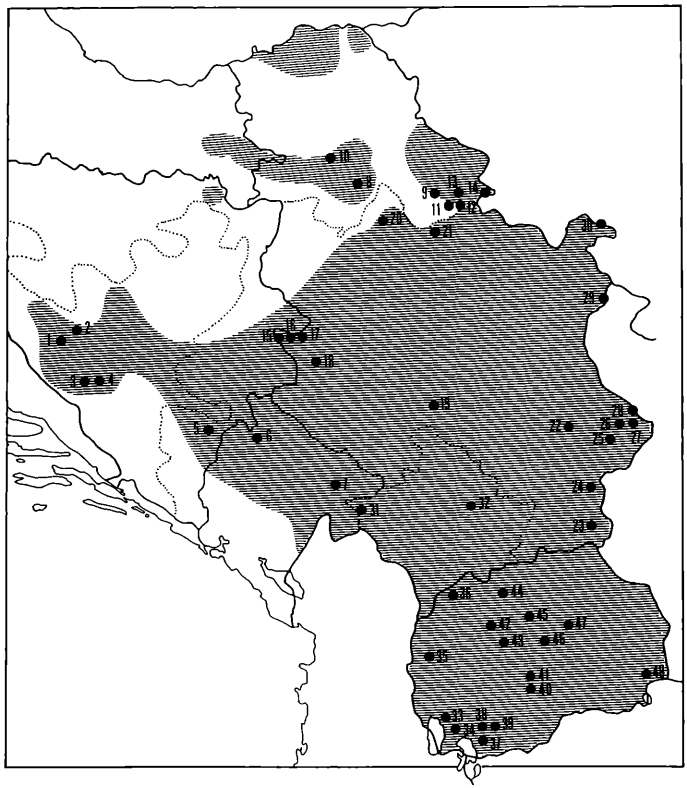

Fig. 2: Western and Central Balkans with indicated distribution of *Nannospalax leucodon* (NORDMANN) (adapted from PETROV, 1992), with numbers indicating survey sites (localities)

BOSNA I HERCEGOVINA (BOSNIA AND HERZEGOVINA):

01. XJ76 Kupres, Gornji Malovan
02. XJ87 Kupres
03. XJ93 Svinjača, Blidinje jezero
04. YJ03 Čvrsnica
05. CN09 Čemerno

CRNA GORA (MONTENEGRO):

06. CN48 Durmitor: Žabljak
07. DN04 Ivangrad, Lubnice

SRBIJA: VOJVODINA (SERBIA: VOJVODINA):

08. DQ38 Srem: Stara Pazova (this locality is wrongly cited in HOPKINS & ROTHSCHILD (1966) as »Zagreb, Croatia«)
09. DQ97 Deliblatska Peščara: Dolovo
DQ97 Marmorak (about 25 km E of Beograd), Deliblat, Temes-comitat
10. DR10 Sremski Karlovci
11. EQ06 Deliblatska Peščara: Deliblato

	EQ06	Deliblatska Peščara: Majur Bara
12.	EQ16	Deliblatska Peščara: Šumarak
13.	EQ17	Deliblatska Peščara: Šušara
14.	EQ37	Banat: Bela Crkva, Dragićev Hat

SRBIJA: (SERBIA):

15.	CP66	Tara Planina: Kremići
16.	CP76	Tara Planina: Mitrovac
17.	CP86	Tara Planina: Kaluderske Bare
18.	CP94	Čajetina
19.	DP80	Kopaonik: Jošanićka Banja
20.	DQ55	Beograd, okolica (environs)
	DQ55	Beograd, Topčider
	DQ55	Beograd, Voždovac
21.	DQ94	Smederevo
	DQ94	Udovice
22.	EN98	Suva Planina
23.	FN00	Besna Kobila
24.	FN03	Vlasina
25.	FN27	Pirot
26.	FN38	Vidlič: Basara
27.	FN48	Stara Planina
28.	FN49	Stara Planina: Kopren
29.	FP28	Rogljevo
30.	FQ24	Kladovo

SRBIJA: KOSOVO (SERBIA: KOSOVO):

31.	DN22	Rugovo, Bjeluha
	DN22	Rugovo, Kućište
32.	EN12	Priština

MAKEDONIJA (MACEDONIA):

33.	DL85	Ohrid
34.	DL94	Resen
35.	DM70	Bistra
36.	DM95	Šar Planina: Popova Šapka
37.	EL13	Pelister: Golemo jezero
38.	EL14	Pelister
39.	EL24	Bitola
40.	EL57	Prilep, Pletvar
41.	EL58	Babuna: Derven
42.	EM22	Karadžica
43.	EM31	Jakupica

	EM31	Jakupica: Begovo Pole
	EM31	Jakupica: Čeples
44.	EM35	Skopje
	EM35	Skopje, okolica (environs)
45.	EM53	Katlanovo
46.	EM61	Veles
47.	EM82	Ovče Pole
48.	FL48	Strumica, Dabilja

Survey by species and subspecies

HYSTRICHOPSYLLIDAE

1. *Rhadinopsylla* (*Actenophthalmus*) *pentacantha* (Rothschild, 1897)

Srbija:

1♂ Suva Planina, 18. 9. 1947, from *Spalax leucodon* (=*Nannospalax leucodon*), leg. A. Ružić (Rosický & Todorović, 1964)

The hosts of *Rh. pentacantha* are mainly mice, voles and moles. The finding on *N. leucodon* is coincidental.

2. *Rhadinopsylla* (*Actenophthalmus*) *sobrina* Peus, 1958

Srbija:

2♂ 5♀ Suva Planina, 1400 m, 18. and 19. 9. 1947, from *Nannospalax leucodon*, leg. B. Petrov

1♀ Besna Kobila, 23. 8. 1947, from *Nannospalax leucodon*, leg. B. Petrov

Makedonija:

1♂ Resen, 1000 m, 21. 9. 1972, from *Talpa stankovici*, leg. B. Petrov

1♂ 1♀ Bistra, 1800 m, 30. 10. 1971, from *Talpa stankovici*, leg. B. Petrov

2♀ ibidem, 18. 9. 1990, leg. B. Kryštufek

1♀ Babuna: Derven, 1100 m, 21. 4. 1971, from *Nannospalax leucodon*, leg. B. Petrov

Listed specimens of *Rh. sobrina* match in all characters with description of the species with the exception of a single character; the longest bristle of the second tarsus segment of the last leg, which extends to the middle of the 4th segment. In one specimen, the bristle exceeded the apex of the 4th segment and in the second case it slightly exceeded the apex of the 3rd segment. In the original description, the longest bristle extends to the apex of the 3rd segment or slightly beyond (Peus, 1958).

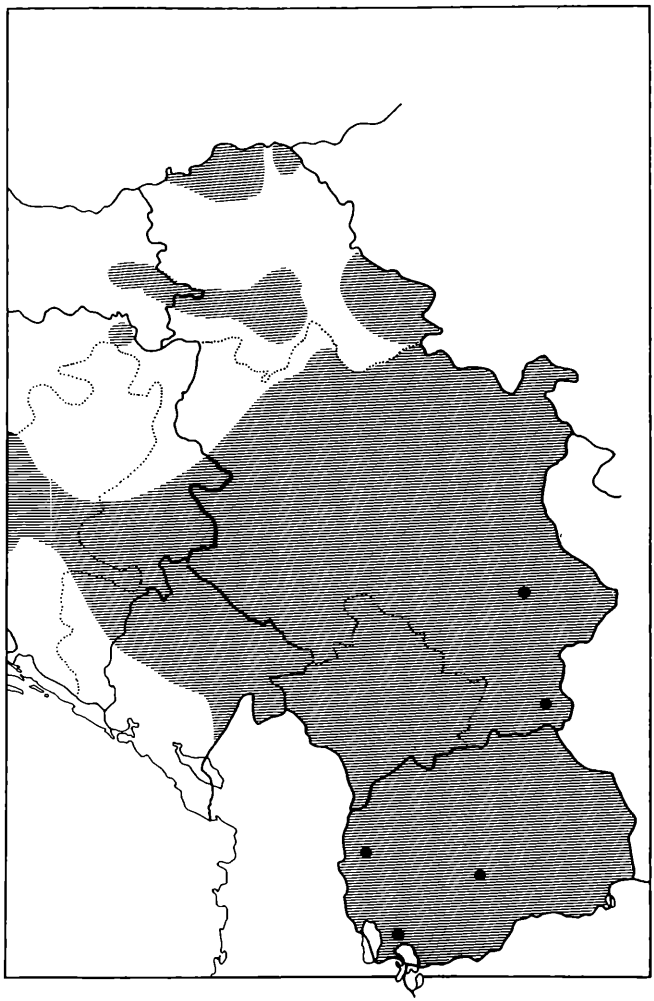

Fig. 3: Distribution of *Nannospalax leucodon* (NORDMANN) from the Central Balkans (adapted from PETROV, 1992) and survey sites of *Rhadinopsylla sobrina* PEUS

The single known specimen (a male) from the original description was collected from *N. leucodon*, but PEUS (1958) speculated that the major host was *M. duodecimcostatus*, which is very abundant at the type locality. Based on listed findings we conclude that the major host of *Rh. sobrina* is *N. leucodon*. This species was also found on *T. stankovici*.

In the Western and Central Balkans, *Rh. sobrina* is distributed in the western part of Macedonia and in southeastern Serbia, which matches with the geographic distribution of *Ctenophthalmus* (*Spalacoctenophthalmus*) *ruris* JORDAN, 1929 (Figs. 3 and 9).

3. *Rhadinopsylla* (*Actenophthalmus*) *integella integella* JORDAN & ROTHSCHILD, 1921

Bosna i Hercegovina:

1♂ Kupres, Gornji Malovan, 1140 m, 11. 9. 1983, from *Nannospalax leucodon*, leg. N. Tvrtković

Rhadinopsylla integella occurs mainly on mice but also on voles and moles. The passage to *N. leucodon* is coincidental.

4. *Ctenophthalmus* (*Ctenophthalmus*) *agyrtes serbicus* Wagner, 1930

Srbija:

Beograd, Voždovac, from *Spalax leucodon* (=*Nannospalax leucodon*), Wagner collection Zool. Mus. Hamburg

Srbija: Kosovo:

1♂ Rugovo, Bjeluha, 1400 m, 22. 9. 1967, from *Nannospalax leucodon*, leg. B. Petrov

As *Ctenophthalmus agyrtes* is one of the most common European fleas and parasites on almost all species of small ground mammals, its discovery on *N. leucodon* was expected.

5. *Ctenophthalmus* (*Spalacoctenophthalmus*) *caucasicus* (TASCHENBERG, 1880)

Fig. 4: *Ctenophthalmus caucasicus* (TASCHENBERG): sternum VII of female and outline of sternum VII of female: Šumarak, Deliblatska Peščara, Vojvodina; b. Šušara, Deliblatska Peščara, Vojvodina

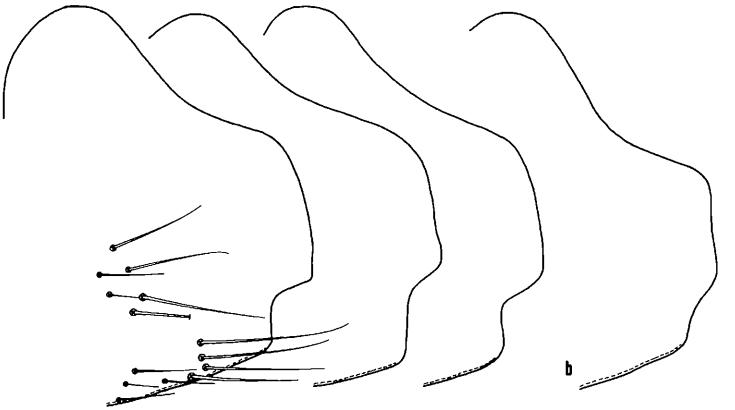

Fig. 5: *Ctenophthalmus caucasicus* (TASCHENBERG): sternum VII of female and outline of sternum VII of female: Dragićev Hat, Bela Crkva, Vojvodina; b. Suva Planina Mt., Srbija

Srbija: Vojvodina:

8♂	4♀	Srem: Stara Pazova, probably 12 and 13 May 1902, from *Spalax typhlus* (=*Nannospalax leucodon*), leg.: probably A. Rupp & A. Langhoffer, don.: director of Zoological Department of National Museum, Zagreb, Croatia, (»Zagreb, Croatia, 16 May 1902 and 13 Jun 1902, from *Spalax typhlus*, leg.: A. W. G. Langhoffer« wrongly cited in HOPKINS & ROTHSCHILD, 1966)
5♂	5♀	Srem: Stara Pazova, 84 m, 6. 6. 1948, from *Nannospalax leucodon*, leg. B. Petrov Sremski Karlovci, from *Spalax monticola* (=*Nannospalax leucodon*), leg. J. Wagner (WAGNER, 1939) Dolovo, Velika Peščara, Banat (=Deliblatska Peščara: Dolovo), from *Spalax leucodon* (=*Nannospalax leucodon*), Wagner collection Zool. Mus. Hamburg
15♂	23♀	Marmorak (about 25 km E of Beograd), Deliblat, Temes-comitat (now in Vojvodina Province), July 1908, from *Spalax* (*leucodon*) *hungaricus* (=*Nannospalax leucodon*), leg.: F. A. Cerva (HOPKINS & ROTHSCHILD, 1966)
1♂		Deliblatska Peščara: Deliblato, 100 m, May 1945, from *Mus spicilegus*, leg. A. Ružić
7♂	2♀	ibidem, 7. 5. 1947, from *Nannospalax leucodon*
16♂	10♀	Deliblatska Peščara: Majur Bara, 80 m, 14. Sep 1975, from *Nannospalax leucodon*, leg. N. Tvrtković, G. Džukić & B. Kryštufek
1♂	1♀	ibidem, from *Nannospalax leucodon*, leg. S. Brelih & B. Kryštufek
10♂	16♀	Deliblatska Peščara: Šumarak, 110 m, 26 Apr 1983, from *Nannospalax leucodon*, leg. A. Ružić
	6♀	ibidem, 29 Apr 1983
1♂		Deliblatska Peščara: Šušara, 170 m, 1964, from *Nannospalax leucodon*, leg. Đ. Heneberg & N. Heneberg

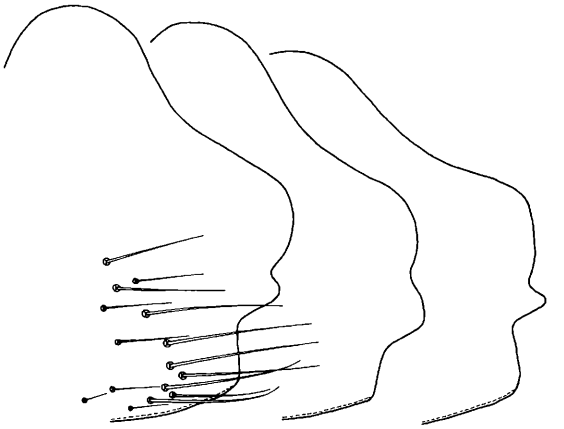

Fig. 6: *Ctenophthalmus caucasicus* (TASCHENBERG): sternum VII of female and outline of sternum VII of female: Stara Pazova, Srem, Vojvodina

1♂	2♀	ibidem, 4 Jun 1964
22♂	9♀	ibidem, 6 Nov 1986, leg. B. Kryštufek
178♂	124♀	Šušara (=Deliblatska Peščara: Šušara), from 41 individuals of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
50♂	97♀	ibidem, from 2 nests of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
14♂	7♀	Banat: Bela Crkva, Dragićev Hat, 27 Jun 1988, from *Nannospalax leucodon*, leg. B. Kryštufek

Srbija:

	1♀	Beograd, okolica (environs), ~ 80 m, from *Spalax monticola* (=*Nannospalax leucodon*), leg. J. Wagner (WAGNER, 1928-29, 1939) Beograd, (=Beograd, okolica) from *Spalax leucodon* (=*Nannospalax leucodon*), Wagner collection Zool. Mus. Hamburg Topčider nr. Beograd, (=Beograd, Topčider) from *Spalax leucodon* (=*Nannospalax leucodon*), Wagner collection Zool. Mus. Hamburg Beograd, Voždovac, from *Spalax leucodon* (=*Nannospalax leucodon*), Wagner collection Zool. Mus. Hamburg
1♂		Smederevo, 75 m, 15 Jun 1988, from *Nannospalax leucodon*, leg. B. Kryštufek
1♂	2♀	Udovice, from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
	2♀	Suva Planina, 1400 m, 18 Sep 1947, from *Nannospalax leucodon*, leg. A. Ružić
8♂	7♀	Rogljevo, from 3 individuals of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
3♂	5♀	Kladovo, from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)

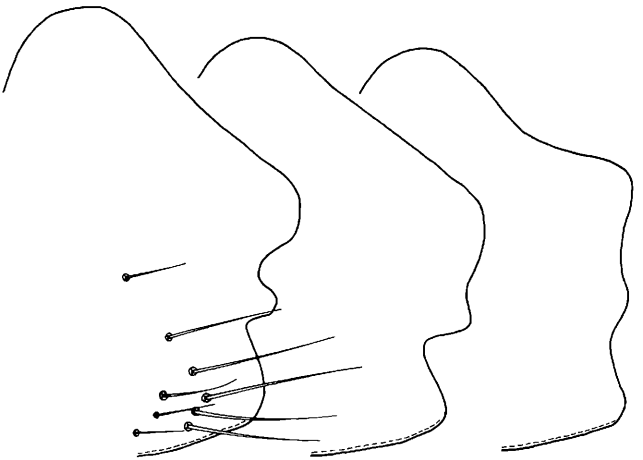

Fig. 7: *Ctenophthalmus ?caucasicus* (TASCHENBERG): sternum VII of female and outline of sternum VII of female: Begovo Pole, Jakupica, Makedonija

Makedonija *(Ct. caucasicus* or *Ct. monticola):*

1 ♀ Karađica (=Karadžica), 2000 m, from *Spalax monticola* (=*Nannospalax leucodon*), leg. J. Wagner (WAGNER, 1939)

3 ♀ Jakupica: Begovo Pole, 1980 m, 28 Jun 1989, from *Nannospalax leucodon,* leg. B. Kryštufek

The major host of *Ct. caucasicus* is *N. leucodon*. The passage of this flea species to another host is very rare. There is only one record from *M. spicilegus* from Vojvodina. In the Western and Central Balkans, *Ct. caucasicus* is the single specific flea of *N. leucodon*, which is distributed all over the northern part of its distribution area (north of the line Valjevo – Kraljevo – Niš). In the Suva Planina Mt.it occurs sympatrically with *Ct. ruris*. Outside this densely packed range, the species *Ct. caucasicus* was registered at Karađica in Macedonia at an altitude of 2000 m (WAGNER, 1939). This particular locality is situated deep in the distribution range of *Ct. ruris,* which is highly unexpected. Here, Wagner recorded a single female of this species. In 1989, B. Kryštufek found another three females of most probably the same species at the neighbouring Jakupica (Begovo Pole) (Fig. 7). As males are lacking, it cannot be ascertained whether these females belong to the species *Ct. caucasicus* or *Ct. monticola.* In view of the outer edge of sternite VII, both species are usually well distinguished between each other which, however, is not the case as far as this particular Macedonian population is concerned. In this feature, the Begovo Pole population is very close to the population of *Ct. caucasicus* from Stara Pazova in Srem (Fig. 6).

Females of the species *Ct. caucasicus* from Srem and Macedonia are, on the other hand, very similar to the females of the species *Ct. monticola* from eastern Serbia.

It is interesting that the Jakupica – Karadžica Mountains stand out as a relict area also as far as the Ground Squirrel with its specific flea *Ctenophthalmus orientalis jakupicae* is concerned (BRELIH & TRILAR, 2000).

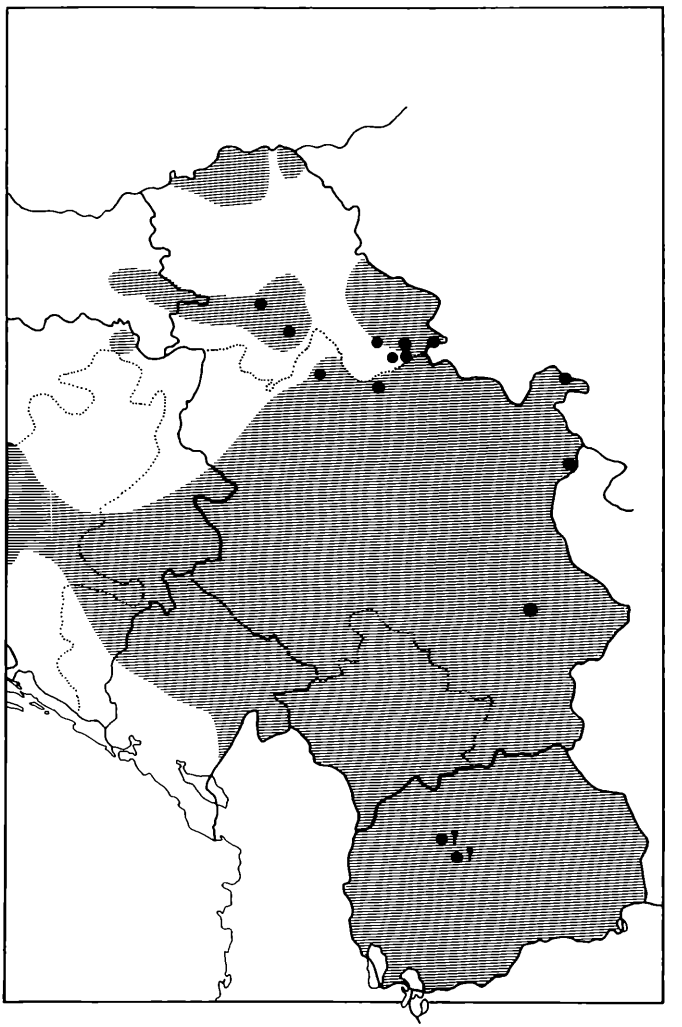

Fig. 8: Distribution of *Nannospalax leucodon* (NORDMANN) from the Central Balkans (adapted from PETROV, 1992) and survey sites of *Ctenophthalmus caucasicus* (TASCHENBERG)

6. *Ctenophthalmus* (*Spalacoctenophthalmus*) *ruris* JORDAN, 1929

Srbija:

5♂	7♀	Vidlič: Basara, 1080 m, 17. 8. 1981, from *Nannospalax leucodon*, leg. B. Petrov
10♂	10♀	Suva Planina, 1400 m, 18. 9. 1947, from *Nannospalax leucodon*, leg. A. Ružić
2♂	1♀	Pirot, 10. 10. 1947, from *Nannospalax leucodon*, leg. B. Petrov

Srbija: Kosovo:

	1♀	Priština, 950 m, 1 Nov 1969, from *Microtus arvalis*, leg. B. Petrov

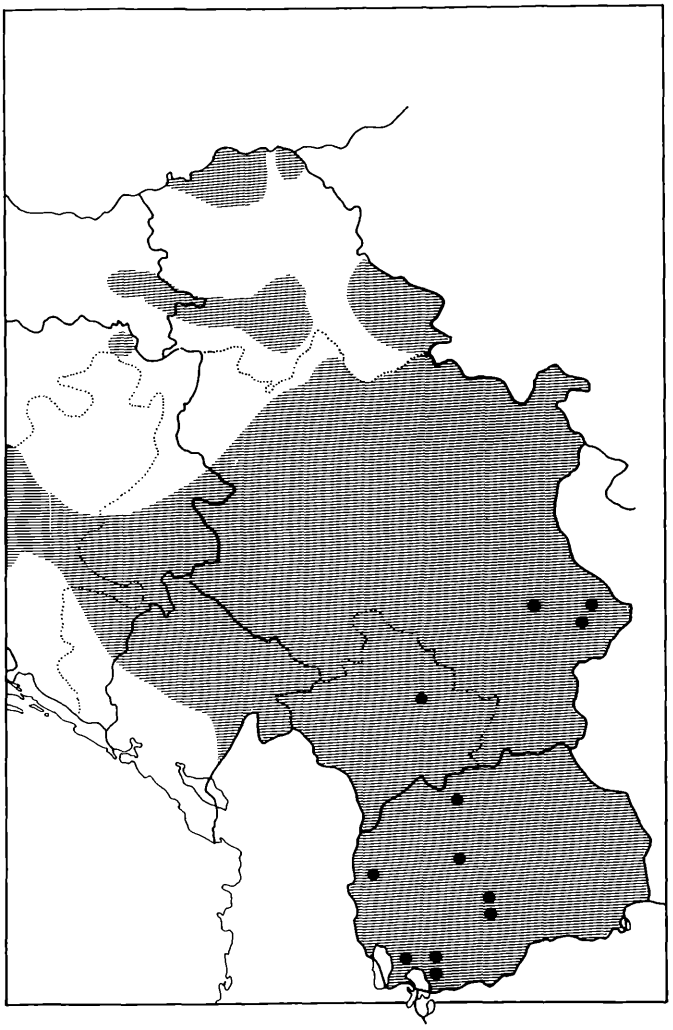

Fig. 9: Distribution of *Nannospalax leucodon* (NORDMANN) from the Central Balkans (adapted from PETROV, 1992) and survey sites of *Ctenophthalmus ruris* JORDAN

Makedonija:

1♂		Resen, 860 m, 21 Sep 1972, from *Talpa stankovici*, leg. B. Petrov
1♂	3♀	Bistra, 1800 m, 30 Oct 1971, from *Talpa stankovici*, leg. B. Petrov
1♂		ibidem, 20 Auug 1978, from *Nannospalax leucodon*
1♂	2♀	ibidem, 3 Jun 1989, from *Nannospalax leucodon*, leg. B. Kryštufek
	1♀	Pelister: Golemo jezero, 2200 m, 21 Jul 1972, from *Nannospalax leucodon*, leg. B. Petrov
	2♀	Pelister, 1430 m, 13 Sep 1990, from *Nannospalax leucodon*, leg. B. Kryštufek
	1♀	Babuna: Derven, 1100 m, 21 Apr 1971, from *Talpa stankovici*, leg. B. Petrov
2♂	1♀	ibidem, from *Nannospalax leucodon*

2♂ 5♀ Jakupica, from 3 individuals of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)

2♂ 4♀ Jakupica: Čeples, 1400 m, 14 Jul 1970, from the nest of *Nannospalax leucodon*, leg. M. Košir

Skopje, okolica (environs), ~ 330 m, 14 May 1931, small series of ♂♀ from *Spalax* sp. (=*Nannospalax leucodon*), leg. S. Karaman (»*Ctenophthalmus ruris karamani*« - holotype and paratypes) (WAGNER 1936a, 1936b, 1939) (included 1♂ and 1♀ paratype from Rothschild collection in the British Museum (HOPKINS & ROTHSCHILD, 1966))

4♀ Prilep, Pletvar, 890 m, 24 Aprl 1971, from *Nannospalax leucodon*, leg. B. Petrov

The major host of *Ct. ruris* is *N. leucodon* as well. Within the Western and Central Balkans we found it on three occasions on *T. stankovici* and once on *M. arvalis*. *Ctenophthalmus ruris* is distributed in the western part of Macedonia, in the Priština surroundings and in southeastern Serbia. In the Suva Planina Mt. area it occurs sympatrically with *Ct. caucasicus*. In southeastern Serbia and Macedonia its geographic range overlaps with *Ct. monticola,* but it was never found at the same locality.

We found no significant morphological differences among populations of this species. We did notice minor variability in the movable process of the clasper of males and the outline of sternum VII of females within the same population.

7. *Ctenophthalmus* (*Spalacoctenophthalmus*) *monticola* (KOHAUT, 1904)

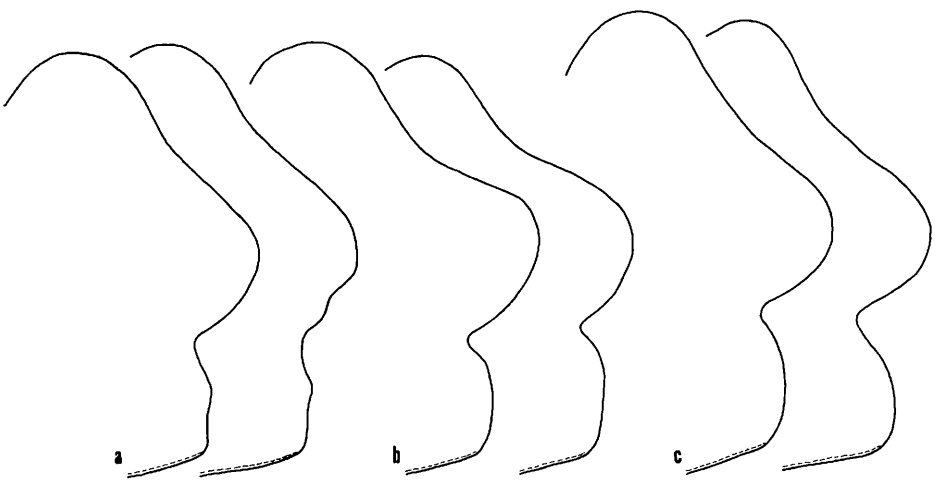

Fig. 10: *Ctenophthalmus monticola* (KOHAUT): outline of sternum VII of female: a. Gornji Malovan, Kupres, Bosna; b. Jošanićka Banja, Srbija; c. Popova Šapka, Šar Planina, Makedonija

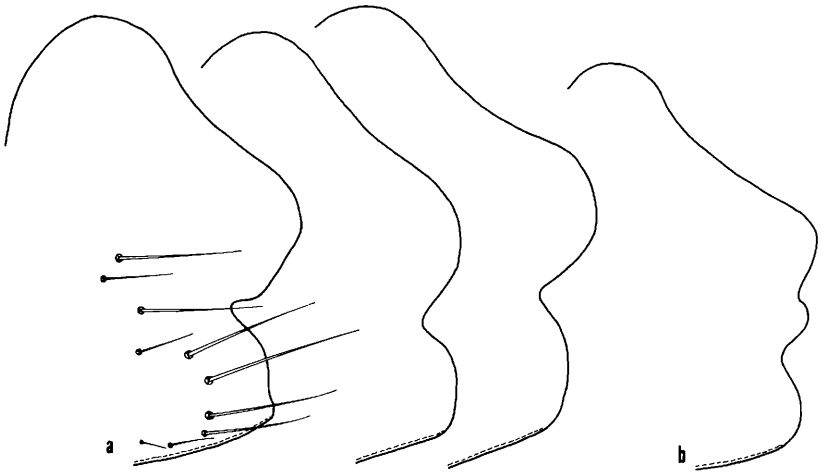

Fig. 11: *Ctenophthalmus monticola* (KOHAUT): sternum VII of female and outline of sternum VII of female: Čajetina, Srbija; b. Vlasina, Srbija

Fig. 12: *Ctenophthalmus monticola* (KOHAUT): sternum VII of female and outline of sternum VII of female: Kopren, Stara Planina, Srbija; b. Besna Kobila, Srbija

Bosna i Hercegovina:

	1♀	Čemerno, 12 Jun 1986, from *Nannospalax leucodon*, leg. B. Kryštufek
3♂	5♀	Kupres, Gornji Malovan, 1140 m, 11 Sep 1983, from *Nannospalax leucodon*, leg. N. Tvrtković
4♂	3♀	Kupreš (=Kupres), from *Spalax monticola* (=*Nannospalax leucodon*), leg. M. L. Méhely (»*Typhlopsylla monticola* «) (KOHAUT, 1904)
		Kupreš, Bosnia (=Kupres), from *Spalax leucodon* (=*Nannospalax leucodon*), Wagner collection Zool. Mus. Hamburg

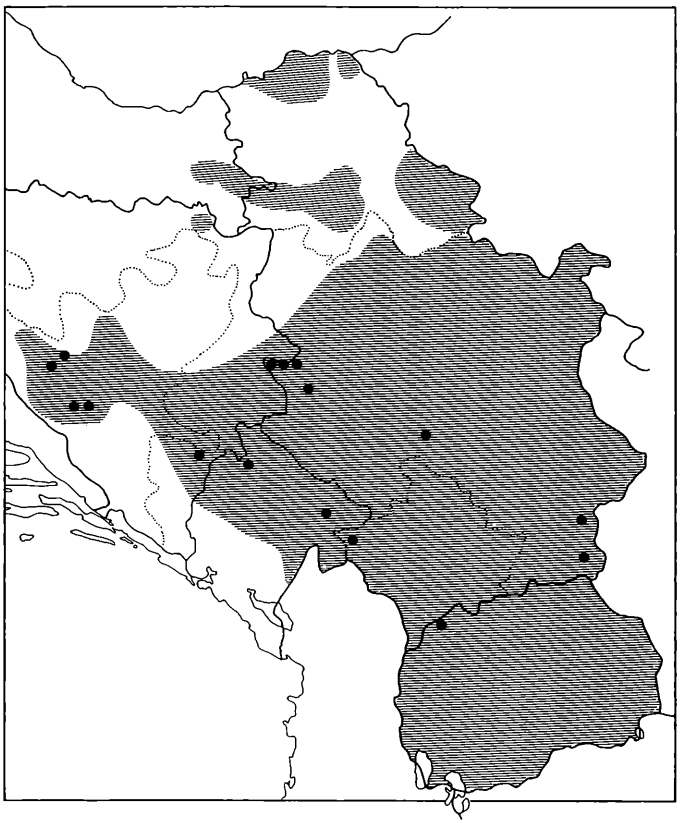

Fig. 13: Distribution of *Nannospalax leucodon* (NORDMANN) from the Western and Central Balkans (adapted from PETROV, 1992) and survey sites of *Ctenophthalmus monticola* (KOHAUT)

	1♀	Kupres, from *Spalax monticola* (=*Nannospalax leucodon*), leg. J. Wagner (WAGNER, 1939)
2♂		Kupres, 15 Sep 1983, from *Nannospalax leucodon*, leg. B. Kryštufek
1♂		Svinjača, Blidinje jezero, 1170 m, 20 Jun 1971, from *Nannospalax leucodon*, leg. G. Džukić
	2♀	ibidem, from *Talpa europaea*
2♂	3♀	Čvrsnica, 9 Jun 1986, from *Nannospalax leucodon*, leg. B. Kryštufek

Crna Gora:

4♂	5♀	Durmitor: Žabljak, 1520 m, 15 Sep 1984, from *Nannospalax leucodon*, leg. B. Kryštufek
1♂	1♀	Ivangrad, Lubnice, 24 Jul 1976, from *Nannospalax leucodon*, leg. B. Kryštufek

Srbija:

46♂	24♀	Tara Planina: Kremići, 950 m, 18 Jun 1949, from *Nannospalax leucodon*, leg. B. Petrov

	1♀	ibidem, 20 Jun 1949, from *Glis glis*, leg. B. Petrov (Brelih & Trilar, 2000b)
1♂		Tara Planina: Mitrovac, 1100 m, 31 Oct 10. 1968, from *Talpa europaea*, leg. B. Petrov
8♂	2♀	ibidem, 25 Oct 1969, from *Nannospalax leucodon*
4♂	7♀	Tara Planina: Kaluđerske Bare, 1100 m, 23 Jun 1949, from *Nannospalax leucodon*, leg. B. Petrov
1♂	10♀	Čajetina, from 3 individuals of *Spalax leucodon* (=*Nannospalax leucodon*) (Savić & Ryba, 1975)
	3♀	ibidem, 2 Jun 1972, from *Nannospalax leucodon*, leg. J. Hanzak
11♂	10♀	Kopaonik: Jošanićka Banja, 560 m, 28 Oct 1973, from *Nannospalax leucodon*, leg. B. Petrov
8♂	2♀	Besna Kobila, 1600 m, 23 Aug 1947, from *Nannospalax leucodon*, leg. A. Ružić
	1♀	Vlasina, 1250 m, 27 Sep 1946, from *Nannospalax leucodon*, leg. B. Petrov
7♂	3♀	Stara Planina: Kopren, 1850 m, 29 Jun 1947, from *Nannospalax leucodon,* leg. B. Petrov
1♂		Stara Planina, October 1947, from *Glis glis*, leg. B. Petrov & A. Ružić (Brelih & Trilar, 2000b)

Srbija: Kosovo:

5♂	3♀	Rugovo, Bjeluha, 1400 m, 22 Sep 1966, from *Nannospalax leucodon*, leg. B. Petrov
1♂		ibidem, 24 Sep 1966, from *Apodemus flavicollis*
1♂	1♀	Kućište, near Peć (=Rugovo, Kućište), 1100 m, August 1939, from *Spalax (leucodon) hercegovinensis* (=*Nannospalax leucodon*), leg.: E. Martino, presented by Zool. Mus. Hamburg (Hopkins & Rothschild, 1966) (Some more material in Wagner collection in Zool. Mus. Hamburg)

Makedonija:

1♂	1♀	Šar Planina: Popova Šapka, 1800 m, August 1948, from *Talpa europaea*, leg. B. Petrov
1♂		ibidem, from *Nannospalax leucodon*
1♂		ibidem, from *Chionomys nivalis*
	1♀	ibidem, 1750 m, 6 Jun 1971, from *Talpa stankovici*
	1♀	ibidem, 1900 m, 27 Aug 1978, from *Nannospalax leucodon*
	2♀	Šar Planina (Šar Planina: Popova Šapka), from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (Savić & Ryba, 1975)

Ctenophthalmus monticola is the third species from the subgenus *Spalacoctenophthalmus* occurring in the Balkans, whose major host is *N. leucodon*. Passage to another host is quite common. It was also found on four additional species of mammals in the Western and Central

Balkans, including: *T. europaea*, *T. stankovici*, *G. glis*, *A. flavicollis* in *Ch. nivalis*. Geographic range of *Ctenophthalmus monticola* spreads between the distribution areas of *Ct. caucasicus* and *Ct. ruris* extending from Kupres in Bosnia over Tara Mt. to Stara Planina Mt. and Besna Kobila Mt. in eastern Serbia and Šar Planina Mt. in Macedonia.

There are no significant morphological differences between males of different populations of *Ct. monticola*. We also found no significant interpopulation variation in morphology among males from different populations of *Ct. monticola*. However, we did notice variability in the outline of sternum VII (Figs 10 to 12) among females. The greatest differences were between specimens from Vlasina and Besna Kobila Mt. in eastern Serbia (Figs 11b and 12b). The population from Kopreno at Stara Planina Mt. includes individuals, which are intermediate in character for sternum VII (Fig. 11a). All other populations from Bosnia, Herzegovina, Montenegro, Kosovo, western and central Serbia and Macedonia are in principal morphologically similar to populations from Kupres (type locality) (Figs 10 and 11a).

Females of *Ct. monticola* from eastern Serbia are very similar to females of *Ct. caucasicus* from Srem and Macedonia. For identification purposes we relied only on males collected from the same host.

8. *Ctenophthalmus* (*Mediocteno phthalmus*) *nifetodes nifetodes* Wagner, 1933

Crna Gora:

1♂ Durmitor: Žabljak, 1520 m, 15 Sept 1984, from *Nannospalax leucodon*, leg. B. Kryštufek

The finding of *Ct. nifetodes* on *N. leucodon* is very surprising. Its major host is *D. bogdanovi* (Hopkins & Rothschild, 1966), which, unlike *N. leucodon*, lives in rocky habitats.

9. *Ctenophthalmus* (*Euctenophthalmus*) *congener troilus* Peus, 1954

Makedonija:

5♂ 3♀ Ohrid, from 3 individuals of *Spalax leucodon* (=*Nannospalax leucodon*) (Savić & Ryba, 1975)

Savić & Ryba (1975) recognized these specimens as *Ct. congener levadianus* Peus, 1958. In our opinion the determination of subspecies is incorrect. Our conclusion is based on large holdings of *Ct. congener* from Macedonia (25 localities), including sites around Ohrid (Struga, Prespa, Resen). All these populations belong to the subspecies *troilus* Peus, 1954, based on our identification that was confirmed by the author of original description (Peus, in litt.).

Among its many hosts, *Ct. congener troilus* are most common on voles, mice and moles, especially *M. rossiaemeridionalis*, *A. sylvaticus*, *T. europaea* and *T. stankovici.* As this flea is quite common, its discovery on *N. leucodon* was expected.

10. *Ctenophthalmus* (*Euctenophthalmus*) *assimilis assimilis* (TASCHENBERG, 1880)

Srbija: Vojvodina:

1♂ Deliblatska Peščara: Šušara, 170 m, 6 Nov 1986, from *Nannospalax leucodon*, leg. B. Kryštufek

1♂ Stara Planina, 18 Sep 1947, from *Spalax leucodon* (=*Nannospalax leucodon*), leg. A. Ružić (ROSICKÝ & TODOROVIĆ, 1964)

1♂ Bosnia, 1 Jun 1903, from *Spalax* [*leucodon*] *monticola* (=*Nannospalax leucodon*), received from R. Kohaut: 1B& intermediate (HOPKINS & ROTHSCHILD, 1966)

Ctenophthalmus assimilis inhabits open lowland areas, where it is very common. It parasites many species of small ground mammals (Rodentia, Insectivora), which live in the same or similar habitats as *N. leucodon*, therefore this finding was expected.

11. *Ctenophthalmus* (*Euctenophthalmus*) *assimilis erectus* SMIT & ROSICKÝ, 1965

Bosna i Hercegovina:

1♂ Bosnia, 1 Jun 1903, from *Spalax monticola* (=*Nannospalax leucodon*), received from R. Kohaut: 1B& paratype (HOPKINS & ROTHSCHILD, 1966)

1♂ Svinjača, Blidinje jezero, 1170 m, 20 Jun 1971, from *Nannospalax leucodon*, leg. G. Džukić

Srbija:

1♂ Suva Planina, 1400 m, 18 Sep 1947, from *Nannospalax leucodon,* leg. A. Ružić

1♀ Vlasina, from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)

Ctenophthalmus assimilis erectus is a relatively rare form, which appears always in small numbers at the same localities as nominate subspecies. The taxonomic status of the subspecies *erectus* is unclear. Among its hosts, *N. leucodon* is probably the most common.

12. *Ctenophthalmus* (*Euctenophthalmus*) *gratus gratus* JORDAN & ROTHSCHILD, 1920

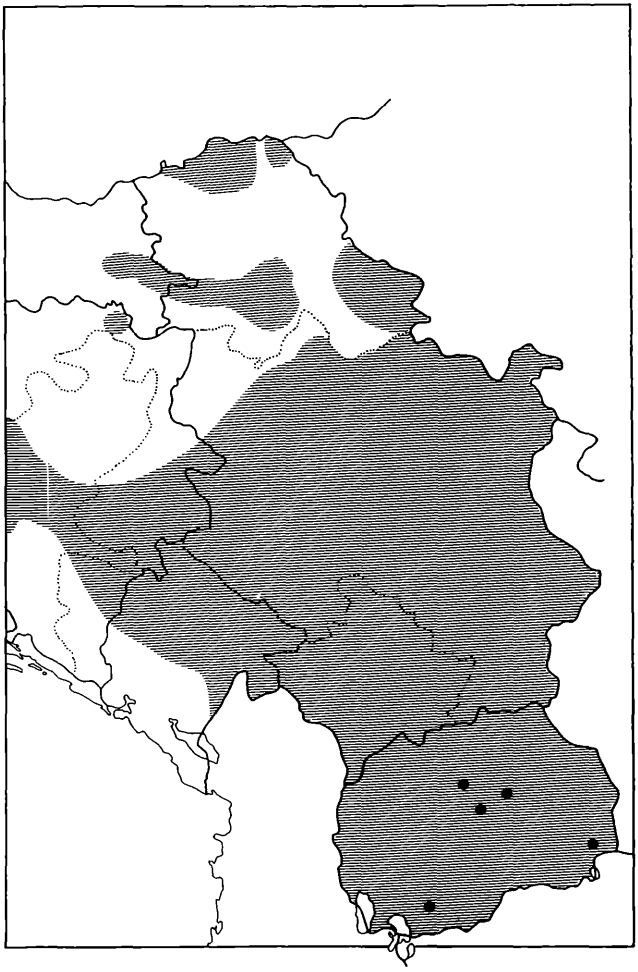

Fig. 14: Distribution of *Nannospalax leucodon* (NORDMANN) from the Central Balkans (adapted from PETROV, 1992) and survey sites of *Ctenophthalmus gratus* JORDAN & ROTHSCHILD

Makedonija:

6♂	1♀	Bitola, from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
1♂	1♀	ibidem, 580 m, 15 Jun 1970, from *Nannospalax leucodon*, leg. J. Hanzak
4♂	3♀	Katlanovo, 224 m, 4 Apr 1968, from *Nannospalax leucodon*, leg. B. Petrov
1♂	2♀	Ovče Pole, 400 m, 15 Aug 1950, from *Nannospalax leucodon*, leg. B. Petrov
1♂	1♀	Dabilja (=Strumica, Dabilja), from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
1♂	2♀	Strumica, Dabilja, 225 m, 16 May 1970, from *Nannospalax leucodon*, leg. J. Hanzak

Ctenophthalmus gratus is distributed over almost the entire Former Yugoslav Republic of Macedonia and is missing only in the western and northern parts (Fig. 14). Its type locality is Samli near Saloniki (=Thessalonica) in Greek Macedonia. Both subspecies *Ct. g. menoetius* PEUS, 1954 (type locality Lianokladi in Lamia) and *Ct. g. elaeus* PEUS, 1958 (type locality Eläon near Theben in Böotien) are also described from Greece. Based on the distribution of both subspecies in Greece (PEUS, 1958; HOPKINS & ROTHSCHILD, 1966), one would only expect the nominate subspecies in FYR Macedonia. Nevertheless, the subspecies *menoetius* appears there as well. There is not a clear geographic separation in the distribution of these subspecies in the region. Representatives of the subspecies *menoetius* occur together with the nominate subspecies in the region of FYR Macedonia but not in other parts of the geographic range of nominate subspecies. The subspecies *menoetius* is more abundant in the area around Veles, while nominate subspecies occupies the rest of the territory. As we lack sufficient material, we cannot as yet present a realistic sex ratio for these two subspecies. The partial table of male abundance is as follows:

Subspecies Locality	ssp. *gratus*	intermediate form	ssp. *menoetius*
Strumica, Dabilja	1	0	0
Katlanovo	4	1	0
Ovče Pole	1	2	0
Bitola	1	2	1
Veles	0	1	2

The table above only includes specimens from the PMSL Siphonaptera Collection. Our illustration of the distribution of both subspecies from FYR Macedonia (Fig. 14) includes additional data from the literature (SAVIĆ & RYBA, 1975).

Within the territory of the Former Yugoslav Republic of Macedonia, *Ct. gratus* was found only on its major host, *N. leucodon*.

Ctenophthalmus (*Euctenophthalmus*) *gratus gratus* JORDAN & ROTHSCHILD, 1920 ⇆ *menoetius* PEUS, 1954

2♂ Bitola, 580 m, 15 Jun 1970, from *Nannospalax leucodon*, leg. J. Hanzak
1♂ Katlanovo, 224 m, 4 Apr 1968, from *Nannospalax leucodon*, leg. B. Petrov
1♂ Veles, 15 Jun 1970, from *Nannospalax leucodon*, leg J. Hanzak
2♂ Ovče Pole, 400 m, 15 Aug 1950, from *Nannospalax leucodon*, leg. B. Petrov

See the comment under nominate subspecies.

13. *Ctenophthalmus* (*Euctenophthalmus*) *gratus menoetius* PEUS, 1954

Makedonija:

5♂	1♀	Titov Veles (=Veles), from 1 individual of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)
2♂	1♀	Veles, 15. 6. 1970, from *Nannospalax leucodon*, leg J. Hanzak
1♂		Bitola, 580 m, 15 Jun 1970, from *Nannospalax leucodon*, leg. J. Hanzak

See the comment under nominate subspecies.

14. *Ctenophthalmus* (*Euctenophthalmus*) *orientalis orientalis* (WAGNER, 1898)

Srbija: Vojvodina:

	1♀	Deliblatska Peščara: Šumarak, 110 m, 7 Feb 1983, from *Nannospalax leucodon*, leg. A. Ružić (BRELIH & TRILAR, 2000b)
	2♀	ibidem, 29 Apr 1983
1♂		Šušara (=Deliblatska Peščara: Šušara), from 41 individuals of *Spalax leucodon* (=*Nannospalax leucodon*) (SAVIĆ & RYBA, 1975)

The major host of *Ct. orientalis* is *S. citellus* (BRELIH & TRILAR, 2000b). In the areas where *S. citellus* and *N. leucodon* occur sympatrically, *Ct. orientalis* at times changes its host. The passage of fleas in the opposite direction, from *N. leucodon* to *S. citellus*, has not been documented.

LEPTOPSYLLIDAE

15. *Peromyscopsylla bidentata bidentata* (KOLENATI, 1863)

Srbija:

3♂	Suva Planina, 1400 m, 18 Sep 1947, from *Nannospalax leucodon*, leg. B. Petrov

The major host of *P. bidentata* is *C. glareolus*. In the Western and Central Balkans, it was found also on *A. terrestris*, *D. bogdanovi*, *Ch. nivalis*, *M. subterraneus*, *M. multiplex*, *A. uralensis*, *N. anomalus* and *S. araneus* (data from PMSL - Siphonaptera Collection). As *P. bidentata* is quite common, its discovery on *N. leucodon* was expected.

16. *Peromyscopsylla silvatica* (MEINERT, 1896)

Srbija:

1♀	Suva Planina, 1400 m, 18 Sep 1947, from *Nannospalax leucodon*, leg. B. Petrov

Within the territory of the Western and Central Balkans, *P. silvatica* was found in Serbia, Montenegro and Macedonia on *C. glareolus*, *M. arvalis*, *Ch. nivalis*, *M. subterraneus* and *A. flavicollis* (data from PMSL - Siphonaptera Collection). Its discovery on *N. leucodon* is coincidental.

17. *Leptopsylla* (*Leptopsylla*) *sciurobia* (WAGNER, 1934)

Srbija: Kosovo:

1♂ 1♀ Kućište, near Peć (=Rugovo, Kućište), 1100 m, August 1939, from *Spalax leucodon* (=*Nannospalax leucodon*), leg.: E. Martino, Wagner collection in Zool. Mus. Hamburg

The hosts of *L. sciurobia* are most commonly *S. vulgaris*, *G. glis*, *D. nitedula* and species from the genus *Apodemus*. Its discovery on *N. leucodon* is coincidental.

CERATOPHYLLIDE

18. *Megabothris* (*Gebiella*) *turbidus* (ROTHSCHILD, 1909)

Srbija:

1♂ Stara Planina: Kopren, ~ 850 m, 7 Oct 1947, from *Spalax leucodon* (=*Nannospalax leucodon*), leg. A. Ružić (ROSICKÝ & TODOROVIĆ, 1964)

Megabothris turbidus is a very common species, which parasites many small ground mammals. The finding on *N. leucodon* is coincidental, but expected.

Discussion

Within the territory of Western and Central Balkans, five species of fleas (*Rh. sobrina*, *Ct. caucasicus*, *Ct. ruris*, *Ct. monticola* and *Ct. gratus*) parasite *N. leucodon* as their major host. The last of these five species is represented by the nominate subspecies and subspecies *menoetius*. The following species also pass to *N. leucodon*: *Rh. pentacantha*, *Rh. integella integella*, *Ct. agyrtes serbicus*, *Ct. nifetodes nifetodes*, *Ct. congener troilus*, *Ct. assimilis assimilis*, *Ct. assimilis erectus*, *Ct. orientalis orientalis*, *P. bidentata bidentata*, *P. silvatica*, *L. sciurobia* and *M. turbidus*.

Rhadinopsylla sobrina does not match all characters from the original description of the species (PEUS, 1958). The longest bristle of the second tarsal segment of the last leg is longer and in most specimens extends to the middle of the 4th segment or may exceed the apex of the 4th segment. This flea occurs in the western part of Macedonia and in southeastern Serbia (Fig. 3). Its geographic range completely overlaps with the distribution of *Ct. ruris* (Figs. 3 and 9). On the basis of our findings from the Central Balkans, we conclude that the major host is *N. leucodon*.

The species *Ct. caucasicus* is distributed in the northern part of Serbia (including Vojvodina) north of the Valjevo-Kraljevo-Niš line. In the Suva Planina Mt. it occurs sympatrically with *Ct. ruris*. Outside this more or less contiguous distribution area we also found them at two isolated mountain localities: Karadžica and Jakupica, where, however, only 4 females were found (Fig. 7). It has not yet been ascertained whether they belong to the species *Ct. caucasicus* or *C. monticola*. In view of the shape of the outer edge of sternite VII, they are very similar to the species of *Ct. caucasicus* from Srem (Fig. 6) and are well distinguished from the females of this species from all other localities within the territory of the former Yugoslavia (Figs. 4 and 5). To study the Macedonian populations, however, males should be found as well. There are no major differences between males from the populations of Vojvodina and Serbia.

On the basis of the available data, distribution area of *Ct. ruris* completely overlaps with *Rh. sobrina* (Figs. 3 and 9) and in the west borders on *Ct. monticola* (Fig. 13), in the north on *Ct. caucasicus* (Fig. 8), and in the southeast on *Ct. gratus* (Fig. 14). *Ctenophthalmus monticola* is distributed from Kupres in Bosnia over Tara Mt. to Stara Planina Mt. and Besna Kobila Mt. in eastern Serbia and Šar Planina Mt. in Macedonia. To the northeast it shares the border with *Ct. caucasicus,* and in the southwest with *Ct. ruris*. In southeast Serbia the geographic range of *Ct. monticola* and *Ct. ruris* are presumed to overlap, but sympatry has not been demonstrated at any locality. Females of *Ct. monticola* from eastern Serbia clearly differ in sterna VII from other populations of this species and are very similar to the females of *Ct. caucasicus* from Srem and Macedonia.

Among the populations of *Ct. monticola* there are no significant morphological differences between males. We noticed variability in females in the outline of sternum VII (Figs 10 to 12). The greatest differences are between the populations from Vlasina and Besna Kobila Mt. in eastern Serbia (Figs 11b and 12b). The population from Kopreno at Stara Planina Mt. includes individuals that are intermediate in the expression of this trait (Fig. 11a). All other populations from Bosnia, Herzegovina, Montenegro, Kosovo, western and central Serbia and Macedonia are, in principal, morphologically similar to the populations from Kupres (type locality) (Figs 10 and 11a). *Ct. monticola* females from eastern Serbia are very similar to *Ct. caucasicus* females from Srem and Macedonia. We were able to make a proper determination based on males collected from the same host.

Ctenophthalmus gratus in the Western and Central Balkans is limited to the central and southern parts of Macedonia. The distribution of these two subspecies is mosaic. In the area

around Veles the subspecies *menoetius* prevails; elsewhere it is the subspecies *gratus*. Most populations include individuals representing both subspecies or at least transitional forms between the two. There is obviously an area of overlap.

All four species from the genus *Ctenophthalmus* occur allopatrically. Based on 55 surveyed localities only at one site, Suva Planina Mt., do *Ct. ruris* and *Ct. caucasicus* occur in sympatry. However, distribution area of *Rh. sobrina* fully overlaps with distribution of *Ct. ruris* (Figs 3 and 9). Our results provide the necessary background in terms of parasite distribution for a detailed investigation with regard to the six described subspecies of *N. leucodon*, which occur within the Western and Central Balkans (ĐULIĆ & MIRIĆ, 1967). The current taxonomic status of these six subspecies is considered questionable by many mammalogists. Within the range of the flea *Ct. caucasicus*, the following subspecies of the host have been described: *Nannospalax leucodon hungaricus* (NEHRING, 1898), *N. l. syrmiensis* (MÉHELY, 1909) and *N. l. petrovi* (PETROV, 1949), within distribution area of *Ct. ruris* the subspecies *N. l. serbicus* (MÉHELY, 1909), and from distribution area of *Ct. monticola* two subspecies, *N. l. monticola* (NEHRING, 1898) and *N. l. hercegovinensis* (MÉHELY, 1909). No subspecies of *Nannospalax leucodon* have been described from within the geographic range of *Ct. gratus*. Cytological studies, which are relevant to the taxonomic status of *N. leucodon*, have been reported for some but not all subspecies (SAVIĆ & RYBA, 1975; SAVIĆ & SOLDATOVIĆ, 1984). Therefore it would be useful to perform molecular analyses on all six subspecies of *N. leucodon* in order to obtain a clear understanding of the taxonomic status of what MITCHELL-JONES et al. (1999) consider to be a superspecies.

Fleas, whose major host is *N. leucodon*, are largely host specific and rarely pass from one host species to another. When they do, it is most frequently to *T. stankovici* and *T. europaea*. Both of these species, like *N. leucodon*, are fossorial spending most of their time underground and dig extensive systems of burrows. The probability of making contact with *N. leucodon* burrows is greater for these two species than it is with other small mammal species, which dig only shallow, short burrows.

Fleas specific to *N. leucodon* were also found on *M. spicilegus*, *A. flavicollis*, *M. arvalis* and *Ch. nivalis* and twice on *G. glis*. These discoveries were expected, except for *Ch. nivalis* and *G. glis,* which inhabit completely different habitats compared to *N. leucodon*. Fleas most probably pass to both of these hosts through an intermediate host.

Summary

We examined the presence of siphonapterofauna on the Lesser Mole Rat (*Nannospalax leucodon*) from the Western and Central Balkans (=former Yugoslavia). Some earlier papers reporting on the fleas from this host from this area were published by KOHAUT (1904), WAGNER (1928-1929, 1936a, 1936b, 1939), ROSICKÝ & TODOROVIĆ (1964), HOPKINS & ROTHSCHILD (1962, 1966, 1971) and SAVIĆ & RYBA (1975). All the material not found in the literature citations and reported in this paper is deposited in the Slovenian Museum of Natural History (PMSL Siphonaptera Collection - coll. S. Brelih, coll. T. Trilar).

Our discoveries include 16 species and two subspecies of fleas. For five species, *N. leucodon* is the major host and include: *Rhadinopsylla* (*Actenophthalmus*) *sobrina*, *Ctenophthalmus* (*Spalacoctenophthalmus*) *caucasicus*, *Ct.* (*S.*) *ruris*, *Ct.* (*S.*) *monticola* and *Ct.* (*Euctenophthalmus*) *gratus*. The last species is represented by the nominate subspecies and the subspecies *menoetius*.

The following fleas are not host specific to *N. leucodon* and pass from other hosts: *Rh.* (*A.*)

pentacantha, *Rh.* (*A.*) *integella integella*, *Ct.* (*Ctenophthalmus*) *agyrtes serbicus*, *Ct.* (*Mediocteno phthalmus*) *nifetodes nifetodes*, *Ct.* (*Euctenophthalmus*) *congener troilus*, *Ct.* (*E.*) *assimilis assimilis*, *Ct.* (*E.*) *assimilis erectus*, *Ct.* (*E.*) *orientalis orientalis*, *Peromyscopsylla bidentata bidentata*, *P. silvatica*, *Leptopsylla* (*Leptopsylla*) *sciurobia* and *Megabothris* (*Gebiella*) *turbidus*.

The distribution area of *Rh. sobrina* completely overlaps with *Ct. ruris* (Figs 3 and 9). Otherwise all four species from the genus *Ctenophthalmus* occur allopatrically. Only at two of the 55 surveyed localities (Suva Planina Mt., Jakupica Mt.) are *Ct. ruris* and *Ct. caucasicus* sympatric. The results of our survey provide a good starting point for a complementary molecularly based analysis of taxonomic status of the six described subspecies of the host species *N. leucodon*.

Povzetek

Raziskovala sva bolhe zahodnega slepega kužeta (*Nannospalax leucodon*) iz zahodnega in osrednjega Balkanskega polotoka (bivša Jugoslavija). O bolhah tega gostitelja so s tega območja poročali že Kohaut (1904), Wagner (1928–1929, 1936a, 1936b, 1939), Rosický & Todorović (1964), Hopkins & Rothschild (1962, 1966, 1971) in Savić & Ryba (1975). Vse gradivo, navedeno v tem delu, ki ni citirano iz literature, je shranjeno v Prirodoslovnem muzeju Slovenije (PMSL Siphonaptera Collection - coll. S. Brelih, coll. T. Trilar).

Na zahodnem slepem kužetu (*N. leucodon*) sva našla 16 vrst in dve podvrsti bolh. Za pet vrst je zahodno slepo kuže (*N. leucodon*) glavni gostitelj: *Rhadinopsylla* (*Actenophthalmus*) *sobrina*, *Ctenophthalmus* (*Spalacoctenophthalmus*) *caucasicus*, *Ct.* (*S.*) *ruris*, *Ct.* (*S.*) *monticola* in *Ct.* (*Euctenophthalmus*) *gratus*. Zadnja vrsta se na tem območju pojavlja kot nominatna podvrsta in kot podvrsta *menoetius*.

Na zahodnem slepem kužetu (*N. leucodon*) so bile najdene tudi neznačilne vrste bolh, ki so nanj prešle z drugih gostiteljev: *Rh.* (*A.*) *pentacantha*, *Rh.* (*A.*) *integella integella*, *Ct.* (*Ctenophthalmus*) *agyrtes serbicus*, *Ct.* (*Mediocteno phthalmus*) *nifetodes nifetodes*, *Ct.* (*Euctenophthalmus*) *congener troilus*, *Ct.* (*E.*) *assimilis assimilis*, *Ct.* (*E.*) *assimilis erectus*, *Ct.* (*E.*) *orientalis orientalis*, *Peromyscopsylla bidentata bidentata*, *P. silvatica*, *Leptopsylla* (*Leptopsylla*) *sciurobia* in *Megabothris* (*Gebiella*) *turbidus*.

Razširjenost bolhe vrste *Rh. sobrina* se popolnoma prekriva z razširjenostjo bolhe vrste *Ct. ruris* (Sliki 3 in 9), medtem ko se vse štiri vrste iz rodu *Ctenophthalmus* pojavljajo alopatrično. Le na dveh od 55 pregledanih lokalitet (Suva Planina, Jakupica) se bolhi vrste *Ct. ruris* in *Ct. caucasicus* pojavljata simpatrično. Rezultati raziskave bolh so dobra podlaga za primerjalno molekularno analizo taksonomskega statusa šestih opisanih podvrst zahodnega slepega kužeta (*N. leucodon*) s tega območja.

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References

BRELIH, S., & B. PETROV, 1978: Ectoparasitical entomofauna of Yugoslav mammals. I. Insectivora and Siphonaptera stated on them.- Scopolia **1**: 1-67.

BRELIH, S., 1986: Ectoparasitical entomofauna of Yugoslav mammals. II. Siphonaptera from *Dinaromys bogdanovi* and *Chionomys nivalis* (Rodentia: Cricetidae).- Scopolia **11**: 1-47.

BRELIH, S., & T. TRILAR, 2000a: New Data on Siphonaptera from *Dinaromys bogdanovi* (Rodentia: Muridae).- Scopolia **43**: 1-22.

BRELIH, S., & T. TRILAR, 2000b: Siphonaptera of squirrels and dormice (Rodentia: Sciuridae, Gliridae) from the Western and Central Balkans.- Acta Entomologica Slovenica **8** (2): 147-189.

BRELIH, S., & T. TRILAR, 2001: *Ceratophyllus* (*Monopsyllus*) *carniolicus* new flea species from the family Ceratophyllidae (Siphonaptera).- Acta Entomologica Slovenica **9** (2): 105-111.

ĐULIĆ, B., & Đ. MIRIĆ, 1967: Catalogus faunae Jugoslaviae: IV/4, Mammalia.- Academia Scientiarium et Artium Slovenica, Ljubljana, 46 pp.

HOPKINS, G. H. E., & MIRIAM ROTHSCHILD, 1962: An illustrated Catalogue of the Rothschild collection of Fleas (Siphonaptera) in the British Museum (Natural History): Volume III: Hystrichopsyllidae (Acedestiinae, Anomiopsyllinae, Hystrichopsyllinae, Neopsyllinae, Rhadinopsyllinae and Stenoponiinae).- The Trustees of the British Museum (Natural History). London. 560 pp., 10 pl.

HOPKINS, G. H. E., & MIRIAM ROTHSCHILD, 1966: An illustrated Catalogue of the Rothschild collection of Fleas (Siphonaptera) in the British Museum (Natural History): Volume IV: Hystrichopsyllidae (Ctenophthalminae, Dinopsyllinae, Doratopsyllinae and Listropsyllinae).- The Trustees of the British Museum (Natural History). London. 549 pp., 12 pl.

HOPKINS, G. H. E., & MIRIAM ROTHSCHILD, 1971: An illustrated Catalogue of the Rothschild collection of Fleas (Siphonaptera) in the British Museum (Natural History): Volume V: Leptopsyllidae and Ancistropsyllidae.- The Trustees of the British Museum (Natural History). London. 530 pp., 30 pl.

KOHAUT, R., 1904: Un Pulicide nouveau de Bosnie.- Annales Musei Nationalis Hungarici **2**: 87-89.

MÉHELY, L., 1909: A földi kutiák fajai srármazás-és rendszertani tekintetben (Species Generis *Spalax*). - Budapest.

MITCHELL-JONES, A.G., G. AMORI, W. BOGDANOWICZ, B. KRYŠTUFEK, P.J.H. REIJNDERS, F. SPITZENBERGER, M. STUBBE, J.B.M THISSEN, V. VOHRALÍK, J. ZIMA, 1999: Atlas of European Mammals.- The Academic Press, London. 496 pp.

PETROV, B.M., 1992: Mammals of Yugoslavia. Insectivores and Rodents.- Nat. Hist. Mus. in Belgrade, Suppl. **379**: 1-186. Spec. issues.

PEUS, F., 1954: Zur Kenntnis der Flöhe Griechlandes.- Bonner zool. Beitr., Sonderband 1954: 111-147.

PEUS, F., 1958: Flöhe aus dem Mittelmeergebiet (Ins., Siphonapt.). II. Griechenland.- Mitt. Zool. Mus. Berlin, **34** (1): 135-171.

ROSICKÝ, B., 1957: Fauna ČSR, Svazek 10: Blechy - Aphaniptera.- Nakladatelství Československé Akademie Vd., Praha, 446 pp.

ROSICKÝ, B., & M. TODOROVIĆ, 1964: Some species of fleas from southern regions of Yugoslavia.- Českoslov. parasitol. **11**: 207-216.

SAVIĆ, I., 1973: Ekologija slepog kučeta (*Spalax leucodon* NORDM.) u Jugoslaviji.- Zbornik za prirodne nauke Matice srpske Novi Sad **44**: 5-70.

SAVIĆ, I., & J. RYBA, 1975: Contribution to the study of fleas from different chromosomal Forms of the Mole rat, *Spalax*, in Yugoslavia.- Arhiv bioloških nauka **27** (3-4): 145-153.

SAVIĆ, I., & B. SOLDATOVIĆ, 1984: Karyotype evolution and taxonomy of the genus *Nannospalax* Palmer, 1903, Mammalia, in Europe.- Srbska akademija nauka i umjetnosti **560/59**: 1-104.

SMIT, F.G.A.M., 1963: Species-groups in *Ctenophthalmus* (Siphonaptera: Hystrichopsyllidae).- Bull. Brit. Mus. (Nat. Hist.), Ent. **14** (3): 105-152, pl. 1-58.

TASCHENBERG, O., 1880: Die Flöhe.- Halle

WAGNER, J., 1928-1929: Afanipterska fauna Jugoslavije.- Actis Societatis Entomologicae Jugoslavicae **III-IV** (1-2): 9-43.

WAGNER, J., 1936a: Beleška o afanipterama južne Srbije.- Bull. Soc. Sci. Skoplje **17**: 134-136

WAGNER, J., 1936b: Einige neue oder wenig bekannte Floharten.- Zeitsch. für Parasitenkunde **VIII**: 332-350.

WAGNER, J., 1939: Beiträge zur Kenntnis der Aphanipterenfauna Jugoslaviens.- Bull. Soc. Sci. Skoplje **20**: 155-163

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