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First record of *Sinanodonta woodiana* (Mollusca: Bivalvia) in the Czech Republic

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Abstract. In 1996 the first specimens of the bivalve *Sinanodonta woodiana* (Lea, 1834), which is native to East and South-East Asia, were found in the Czech Republic. One living specimen and two empty shells were found in an oxbow of the Dyje River near Břeclav (South Moravia, code of mapping square 7267).

First record, Mollusca, Bivalvia, *Sinanodonta woodiana*, South Moravia, Czech Republic

INTRODUCTION

Sinanodonta woodiana (Lea, 1834) is a species native to eastern and southeastern parts of Asia (Žadin 1952). In Europe, the first specimens were probably found in Roumania after 1970. In 1994 the first specimen (only one) was found in Slovakia near the village Čičov in the inundation area of the Danube (Košel 1995).

RESULTS

The first specimens of *Sinanodonta woodiana* (Lea, 1834) were found in an oxbow of the Dyje River near Břeclav (South Moravia, Danube River Basin, code of mapping square 7267). This oxbow is connected with the riverstream. On September 9, 1996, one living specimen in a shallow location and empty shells of two specimens, were found among empty shells of *Unio tumidus* Philipsson, 1788, *Unio pictorum* (Linnaeus, 1758), *Anodonta anatina* (Linnaeus, 1758), *Anodonta cygnea* (Linnaeus, 1758), *Pseudanodonta complanata* (Rossmässler, 1835) and *Dreissena polymorpha* (Pallas, 1771). Numerous shells of the first four bivalves were found, along with empty shells of 3 specimens of *Pseudanodonta complanata* and several shells of *Dreissena polymorpha*. Bivalves were probably eaten by *Ondatra zibethicus*. Both empty shells of *Sinanodonta woodiana* were colected and are in author's collection. The proportions of shells were as follows: 65×49×31 mm, 85×62×35 mm and 132×85×48 mm.

Sinanodonta woodiana was probably transported to Europe by the fishes *Hypophthalmichthys molitrix* and *Aristichthys nobilis* which are hosts of glochidia of this species (Sárkány-Kiss 1986). Therefore the occurrence of this bivalve depends on the presence of these two species of fishes. *Aristichthys nobilis* occurs in the lowest part of the Dyje River Basin (Lusk et al. 1996). Information about hosts among our native fishes has not been documented. It is possible that other localities, especially in the Dyje River Basin, will be found.

Acknowledgements

I would like to thank my wife Lenka for her help with the research at this locality.

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Results of the Czech Biological Expedition to Iran. Part 1. *Notes on the distribution of amphibians and reptiles.*

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Abstract. Preliminary results of herpetological research carried out by the Czech Biological Expedition „Iran 96" to Western and Central Iran are presented. The expedition took place between April 20 and May 20, 1996. Material was collected in 34 localities distributed in 11 provinces of Iran and in a single locality in Eastern Turkey (the Kars vilayet). The localities were characterized by 30 environmental variables and grouped into following four distinct habitat types: (1) true deserts of Persian Gulf, (2) true deserts of Central Iran, (3) xerophilous woodlands including secondarily desertified landscapes, (4) mesophilous Hyrcanian woodland. A good correspondence between the habitat types and species composition of the herpetofauna is shown. We recorded 5 species of amphibians, 3 species of turtles, 34 species of lizards (8 agamids, 10 gekkonids, 10 lacertids, 4 scincids and 2 anguids) and 26 species of snakes. Habitat requirments and distribution of individual species are discussed.

Distribution, habitat requirments, Amphibia, Reptilia, Palaearctic Region

INTRODUCTION

Iranian herpetofauna was traditionally a subject of zoological research and thus a number of more or less extensive publications providing distributional data and keys to Iranian amphibians and reptiles is available (e. g. Anderson 1963, 1974, 1979, 1985, Bannikov et al. 1977, Forcart 1950, Latifi 1991, Leviton et al. 1992, Mertens 1940, 1956, 1957, Minton et al. 1970, Nilson & Andrén 1981, Schleich 1977, Schmidt 1939, Tuck 1971, Wetstein 1951 and others). These publications represent a solid scientific basis for herpetological research that has become increasingly popular in the course of the last few years. However, as evident from a number of recent publications (e. g., Bosch 1995, Eiselt 1995, Fritz 1994, Moravec 1994, Moravec & Černý 1994, Rastegar-Pouyani 1996, Schmidtler 1994, Schultschik & Steinfartz 1996a, b, Wischuf & Fritz 1996) there are still questions concerning the distribution and taxonomy of Iranian amphibians and reptiles that are to be resolved.

The aim of the present paper is to summarize the preliminary results of herpetological research carried out during the Czech Biological Expedition to Iran (from April 20 to May 20, 1996).

MATERIAL AND METHODS

Material

All the animals and records of their presence evaluated in this paper were collected by the authors and other participants of the expedition Iran 96. In the field, captured individuals were preliminarily determined and thoroughly recorded by the senior author (D. F.). Most of them were photographed and/or video-recorded. The specimens selected for museum collections (further refferred as specimens) were killed and stored in 80% alcohol. The remaining ones (further refferred as individuals captured) were either released on their native locality or transported to Prague and further studied in captivity. Later on the material was catalogued and determined by two authors (D. F. & J. Č.). The specific and/or subspecific determination and taxonomy were then extensively revised by the second author (J. M.).

The material is deposited in the collections of the National Museum in Prague (catalogue series NMP6V), and in the Collections of Department of Zoology, Faculty of Science, Charles University, Prague (catalogue series CUP/REPT/IRA, CUP/AMPH/IRA). Catalogue numbers for each specimen are listed below under the Species Account.

List of localities

Studied localities are described in the list below and depicted in Fig. 1. Transliteration of local Iranian names was adopted from Shenasi (1995). The final identification of localities in the field was revised by one of the authors (D. K.).

1. Markan 8 km N Ev Oghly by road (38°52'N 45°18'E), Azarbaycjan-e-Gharbi province, 24 April and 13 May, 1000 m: 8, 12, 15, 17, 25, (20, 22, 27)
2. Jafar Abad SEE of Kashan (33°55'N 51°53'E), Esfahan province, 26–27 April, 800 m: 7, 10, 15, 16, 21, 24, 25, 26, 30
3. Natanz 25 km N by road (33°31'N 51°54'E), Esfahan province, 27 April, 800 m: 7, 10, 15, 25, (17)
4. Esfahan (32°39'N 59°40'E), Esfahan province, 27 April, 800 m: 7,10,15,25, (30)
5. Qamishlu (32°02'N 51°29'E), Zagros Mts., Esfahan province, 27–28 April, 2000–2200 m: 6, 10, 15, 17, 25, (21, 30)
6. Hane Houre (30°15'N 53°09'E), Fars province, 28 April, 1600 m: 6, 10, 15, 25
7. Qader Abad 8 km SSW by road (30°14'N 52°12'E, Fars province, 28–29 April, 2100 m: 6, 11, 20, 25, 27, 28, (16, 26)
8. Pasargat (30°12'N 53°10'E), Fars province, 29 April, 1 800 m: 6, 12, 15, 24, 26, (30)
9. Persepolis (Takht-e-Jamshid village) (29°56'N 52°54'E), Fars province, 29 April, 1500 m: 6, 12, 15, 17, 24, 26
10. Sivand 10 km E by road (30°05'N 52°55'E), Fars province, 29–30 April, 1700 m: 5, 12, 17, 31, (20, 27, 28)
11. Qareh Aghaj river E of Dasht-e-Arzhan by road (29°45'N 52°09'E), Fars province, 30 April, 1500 m: 6, 12, 15, 20, 26, 27, (25)
12. Dasht-e-Arzhan 10 km E by road (29°40'N 51°59'E), Fars province, 1 May, 1800 m: 3, 12, 15, 25, 31, (17)
13. Yasuj 10 km N by road (30°39'N 51°36'E), Kuh-e-Dinar ridge, Zagros Mts., Boyerahmad-va-Kuhgiluyeh province, 1–2 May, 1800–2300 m: 3, 12, 31, (15, 17)
14. Abshar (30°23'N 51°30'E), Fars province, 2–3 May, 1000 m: 4, 12, 17, 20, 30, 31
15. Qar Sharon (29°44'N 51°34'E), Bishapur env., Fars province, 3 May, 800 m: 4, 12, 15, 17, 20, 23, 25, 26, 30
16. Bishapur cave (29°44'N 51°34'E), Qar Sharon env., 3 May, 1000 m
17. Bandar-e-Gonaveh (29°34'N 50°31'E), Bushehr province, 3 May, 20 m: 9, 11, 23, 30
18. Borazgan (29°16'N 51°13'E), Bushehr province, 3 May, 20 m
19. Chahak 15 km NW Bandar-e-Gonaveh by road (29°40'N 50°25'E), Bushehr province, 3–5 May, 20 m: 9, 11, 16, 18, 26
20. Choqa-Zanbil (zikkurat) (32°00'N 48°31'E), Khuzestan province, 5–6 May, 100 m: 9, 11, 16, 25, 26, 31, (21, 28)
21. Shush (32°11'N 48°14'E), Khuzestan province, 6 May, 100 m: 9, 11, 16, 24, 26, 30, (23)
22. Gholaman 30 km W Khorram Abad by road (33°25'N 48°12'E), Zagros Mts., Lorestan province, 6–7 May, 1000 m: 3, 12, 17, 26, 28, 31, (20)
23. Gonbad 35 km SE of Hamadan (34°40'N 48°45'E), Hamadan province, 7–8 May, 2000 m
24. Avaj 50 km NNE by road to Takestan (35°34'N 49°13'E), Zanjan province, 8 May, 1800 m: 7, 10, 15, 17, 25, 30
25. Vali Abad (36°14'N 51°18'E), Alborz Mts. N slopes, Mazandaran province, 8–10 May, 1800–2500 m: 2, 13, 17, 21, 28, 29, 31, 32, (23)
26. Chalus 45 km S by road (36°20'N 51°22'E), Alborz Mts. N slopes, Mazandaran province, 10 May, 800 m: 2, 13, 17, 20, 23, 31
27. Chalus 25 km S by road (36°28'N 51°24'E), Alborz Mts. N slopes, Mazandaran province, 10 May, 200 m: 1, 13, 17, 20, 21, 32
28. Chalus (36°38'N 51°25'E), Caspic Sea coast, Mazandaran province, 10 May, –20 m: 1, 13, 21, 22, 28
29. Chorti 10 km NEE by road (36°46'N 50°30'E), Alborz Mts. N slopes, Mazandaran province, 10–11 May, 480 m: 1, 13, 32, (17, 21)
30. Ramsar (36°54'N 50°40'E), Mazandaran province, 11 May, –20 m: 1,13, 19, 22, 28
31. Langarud (37°11'N 50°09'E), Gilan province, 11 May, –20 m: 1, 13, 19, 22, 27, 30
32. Asalem 12 km W by road (37°44'N 48°57'E), Talesh Mts., N slopes, Gilan province, 11–12 May, 280 m: 1, 14, 20, 21, 23, 28, 29, 32, (17, 30)

Fig 1. Map of the Iran with localities of the records. For legend see List of localities.

33. Asalem 26 km W by road (37°46'N 48°59'E), Talesh Mts., N slopes, Gilan province, 12 May, 1890 m: 2, 14, 29, 32, (23)

34. Khalkhal 32 km W of Asalem by road (37°36'N 48°32'E), Talesh Mts., N slopes, Gilan province, 12 May, 2050 m: 2, 14, 29, (23).

35. Kivi (37°40'N 48°22'E), Azarbayejan-e-Sharqi province, 12 May, 1000 m: 4, 12, 15, 25, 26, (23).

36. Sarab 20 km NE (37°55'N 47°39'E), Azarbayejan-e-Sharqi province, 12–13 May, 1000 m

37. Marand 25 km SE by road (38°25'N 45°46'E), Azarbayejan-e-Sharqi province, 13 May, 900 m. 8, 11, 15, 25.

38. Ev Oghly (38°58'N 45°01'E), Azarbayejan-e-Garbi province, 13 May, 1000 m: 8, 12, 15, 25.

39. Karakurt env (40°10'N 42°36'E), Kars province, Turkey, 14 May, 1800 m: 8, 12, 17, 20, 25, 26, 28.

Habitat

The description of habitat was performed by a botanist (J. S.). The habitat parameters were selected without any *a priori* reference to fauna and/or knowledge about the composition of animal species on a given locality. Each locality was characterized by the presence or absence of 30 habitat features. The list of habitat features with ascribed numbers is given in the Appendix 1 The habitat of each locality is described by the sequence of appropriate numbers. The numbers of features of only local, small-scale, and/or marginal importance are given in parentheses. The results of habitat description are given under the List of Localities (see the above list).

Data processing

Faunistic data concerning localities in Iran are presented as Species Account commented by taxonomic remarks The data obtained in a single locality in Eastern Turkey, which was excluded from further analysis, are given in Appendix 2.

The relationship between habitats and fauna is presented in synoptical tables We adopted the method of synoptical tables which was used for processing both faunistic and habitat data (performed by J. S.). This classification method is widely used in Zurich-Montpellier approach of phytosociology.

Two independent classifications of localities were made and their results were compared. The localities were classified according to (a) their habitat features, and (b) recorded species of reptiles and amphibians. Both classification procedures were performed „blind". The results were used for the evaluation of relationship between habitat type and herpetofauna.

SPECIES ACCOUNT

EXPLANATION. locality numbers are followed by abbreviated locality names (for full names see List of locatics Catalogue numbers and names of collectors are given in parentheses.

AMPHIBIA

Anura

Bufonidae

Bufo surdus luristanicus K. Schmidt, 1952

MATERIAL. 53 spec.

RECORDS. **9.** Persepolis, 1 ind. captured (Sádlo); **10.** Sivand, mass occurrence of juveniles, 41 spec. (CUP/AMPH/IRA/015–55, Frynta); **13.** Yasuj, 3 spec. (NMP6V 35677/1–3, Kodym & Král), **14.** Abshar, juveniles observed (Frynta); **17.** Bandar-e-Gonaveh, 1 ind captured (Frynta), **19.** Chahak, 6 spec. (CUP/AMPH/IRA/001–006, Frynta), **20.** Choqa-Zanbil, 2 spec (CUP/AMPH/IRA/007, CUP/AMPH/IRA/009, Frynta); **21.** Shush, 1 ind. observed (Král); **22.** Gholaman, 1 spec (CUP/AMPH/IRA/014, Voříšek).

Bufo viridis ssp. Laurenti, 1768

RECORDS **7.** Qader Abad, 1 ind. captured (Král & Kaftan); **25.** Vali Abad, 1 ind. captured (Kaftan).

Hylidae

Hyla savignyi Audouin, 1827

RECORDS. **10.** Sivand, 2 ind. captured (Hrdý & Frynta); **11.** Qareh Aghaj river, vocalisation (Frynta), **14.** Abshar, vocalisation (Frynta), **22.** Gholaman, 1 spec. (Frynta).

Ranidae

***Rana „ridibunda“* Pallas, 1771**

MATERIAL. 4.

RECORDS. **11**. Qarch Aghaj river, vocalisation (Frynta); **14**. Abshar, 1 spec. (Frynta); **15**. Bishapur, 3 spec. (CUP/AMPH/IRA/010–012, Frynta); **20**. Choqa-Zanbil, 1 spec. (CUP/AMPH/IRA/008, Frynta); **22**. Gholaman, 1 ind. captured (Kaftan); **31**. Langarud, observation (Frynta & Kaftan).

NOTE. The Iranian marsh frog has been traditionally assigned to *Rana ridibunda* Pallas, 1771 (trinomen *R. r. susana* Boulenger, 1905 has been occasionally used for the population from SW Iran). Recently, populations from western Turkey, Israel and the Nile delta were recognized as *Rana levantina* Schneider et al., 1993, which is probably the younger synonym of *Rana bedriagae* Camerano, 1882. Before the elucidation of the taxonomy of *R. ridibunda* complex in the Middle East we prefer to use the traditional name.

***Rana macrocnemis* Boulenger, 1885**

MATERIAL. 1.

RECORDS. **25**. Vali Abad, 1 ind. captured (Kaftan); **29**. Chorti, 1 spec. (CUP/AMPH/IRA/013, Frynta).

NOTE. Subspecies *R. m. pseudodalmatina* Eiselt et Schmidtler, 1971 was described from the Mazanderan province.

REPTILIA
Testudines
Emydidae

***Emys orbicularis* (Linnaeus, 1758)**

RECORD. **31**. Langarud, observation (Kodym).

NOTE. According to Fritz (1994) the population inhabiting south coast of the Caspian Sea belong to the subspecies *E. o. orientalis* Fritz, 1994.

***Mauremys caspica* (Gmelin, 1774)**

RECORDS. **7**. Qader Abad, observation (Král); **20**. Choqa-Zanbil, observation (Vohralík).

NOTE. Because a new subspecies *M. c. ventrimaculata* Wischuf et Fritz, 1996 was recently described from the southern Iran we prefer to use the binomen here.

Testudinidae

***Testudo graeca* Linnaeus, 1758**

MATERIAL. 1.

RECORDS. **7**. Qader Abad, 1 spec. (CUP/REPT/IRA/069, Leikepová), 1 ind. (Šejna); **10**. Sivand, 1 ind. captured (Hradský); **13**. Yasuj, 2 ind. captured (Kaftan, Čiháková).

NOTE. Adults from Sivand and Yasuj had an elongate more or less uniformly brown shell with upturned, emarginate posterior margin. In these characters they correspond to the subspecies *T. g. zarudnyi* Nikolskij, 1896.

Squamata
Lacertilia
Agamidae

***Laudakia caucasia* (Eichwald, 1831)**

MATERIAL. 2.

RECORDS. **24.** Avaj, 1 ind. captured (Rohlena), 1 spec (CUP/REPT/IRA/030, Leikepová & Frynta); **25.** Vali Abad, 1 spec. (NMP6V 35679, Král & Kodym).

NOTE. Juvenile specimens with 170 (locality 21) and 150 scales (locality 22) around the body.

Laudakia nupta nupta (De Filippi, 1843)

MATERIAL. 2 spec.
RECORDS. **5.** Qamishlu, 1 spec. (NMP6V 35678, Kaftan & Leikepová), **9.** Persepolis, 1 ind. captured (CUP/REPT/IRA/004, Král), **12.** Dasht-e-Arzhan, 1 ind. observed and videotaped (Flegr); **13.** Yasuj, 2 ind captured (Leikepová), 1 ind. observed (Frynta & Čihákova), 1 ind. captured (Pitule), **14.** Abshar, 1 ind captured (Pitule); **15.** Qar Sharon, 1 ind. observed (Frynta & Čiháková); **19.** Chahak, 1 ind. captured. (Lundák); **22.** Gholaman, 1 ind. observed (Kaftan & Frynta).

Phrynocephalus persicus de Filippi, 1863

MATERIAL. 1
RECORD. **38.** Ev Oghly, 1 spec. (CUP/REPT/IRA/003, Šejna).

Phrynocephalus scutellatus (Olivier, 1807)

MATERIAL. 4.
RECORDS. **2.** Jafar Abad, 1 spec. (NMP6V 35680/1, Kaftan), 1 spec. (CUP/REPT/IRA/001, Kaftan); **5.** Qamishlu, 2 ind captured, 2 spec. (NMP6V 35680/2, CUP/REPT/IRA/002, Rohlena).

Trapelus agilis (Olivier, 1804)

MATERIAL. 4.
RECORDS. **2.** Jafar Abad, 1 spec (CUP/REPT/IRA/008, Kaftan); **3.** Natanz, 2 spec. (NMP6V 35552, CUP/REPT/IRA/005, Šejna & Hrdý); **19.** Chahak, 1 spec. (CUP/REPT/IRA/009, Šejna), 3 ind captured (Kaftan).

NOTE. With respect to the difficult taxonomy of the complex *T. agilis-isolepis-sanquinolentus*, we use *T. agilis* sensu lato.

Trapelus persicus persicus (Blanford, 1881)

MATERIAL. 1
RECORDS. **20.** Choqa-Zanbil, 1 ind. observed (Hrdý), 1 spec. (CUP/REPT/IRA/010, Kaftan).

Trapelus ruderatus (Olivier, 1804)

MATERIAL. 5.
RECORDS. **5.** Qamishlu, 2 spec (NMP6V 35553/1–2, Šejna), 2 spec. (NMP6V 35553/3, CUP/REPT/IRA/006, Frynta & Čiháková); **8.** Pasargat, 1 spec. (CUP/REPT/IRA/007, Kaftan); **13.** Yasuj, 1 ind. captured (Kaftan).

Uromastyx loricata (Blanford, 1874)

RECORDS. **19.** Chahak, 2 ind. captured (Frynta & Čiháková), 2 ind. captured (Král), 2 ind captured. (Pitule), 1 ind captured. (Leikepová), 1 ind. captured (Voříšek), 5 ind. captured (Kodym & Kaftan); **20.** Choqa-Zanbil, 1 ind. observed (Král).

Gekkonidae

Agamura persica (Duméril, 1856)

RECORDS. **4.** Esfahan, 1 ind captured (Pitule); **5.** Qamishlu, 3 ind. captured (Pitule, Pitulová & Šejna).

Asaccus cf. *elisae* (F. Werner, 1895)

MATERIAL. 8
RECORDS. **20.** Choqa-Zanbil, 4 ind. captured (Pitule), 2 ind. captured (Šejna), 8 spec (NMP6V 35681/1–4, CUP/REPT/IRA/041–044, Frynta)

NOTE. This gecko is related to *Asaccus elisae* and *Asaccus kermanshaensis* Rastegar-Pouyani, 1996. However, it differs in pholidotic characters from both these taxa. A thorough description will be given elsewhere.

Bunopus tuberculatus Blanford, 1874

MATERIAL. 6.

RECORDS. **19.** Chahak, 2 spec. (NMP6V 35682/1–2, Kaftan), 2 ind. captured (Čiháková), 2 spec. (CUP/REPT/IRA/027–028, Frynta), 4 ind. captured (Šejna), 2 spec. (NMP6V 35682/3–4, Král); **20.** Choqa-Zanbil, 1 ind. captured (Frynta).

Cyrtopodion agamuroides (Nikolskij, 1899)

MATERIAL. 3

RECORDS. **10.** Sivand, 1 spec. (NMP6V 35683, Šejna); **14.** Abshar, 2 spec. (NMP6V 35684, CUP/REPT/IRA/029, Šejna)

NOTE. According to Ščerbak & Golubjev (1986), this species has been reported from the Kerman province only. Our localities are situated further westwards in the Fars province.

Cyrtopodion gastropholis (F. Werner, 1917)

MATERIAL. 2

RECORDS. **19.** Chahak, 2 spec. (NMP6V 35685, CUP/REPT/IRA/026, Šejna).

Cyrtopodion scaber (Heyden, 1827)

MATERIAL. 2

RECORDS. **2.** Jafar Abad, 4 spec. (NMP6V 35686, CUP/REPT/IRA/034, Frynta)

NOTE. Although a widespread species throughout the Middle East, it has not previously been reported from the Esfahan province (Anderson 1974, Ščerbak & Golubjev 1986).

Hemidactylus persicus J. Anderson, 1872

MATERIAL. 1

RECORD. **14.** Abshar, 1 spec. (NMP6V 35545, Šejna)

Tropiocolotes helenae (Nikolskij, 1907)

RECORDS. **20.** Choqa-Zanbil, 1 ind. captured (Pitule), **22.** Gholaman, 2 ind. captured (Šejna), 2 ind. captured (Hrdý), 1 ind. captured (Král)

NOTE. Subspecies *T. helenae fasciatus* Schmidtler et Schmidtler, 1972 was described from the ostans Kordestan-Kermanshah and Khuzestan-Lorestan.

Tropiocolotes latifi Leviton et Anderson, 1972

MATERIAL. 1

RECORD. **10.** Sivand, 1 spec. (CUP/REPT/IRA/059, Kaftan).

NOTE. The distribution of this species is poorly known (cf. Moravec & Černý 1994), our record considerably extends the range in the southwest direction. In the locality No. 5 (Qamishlu) an additional *Tropiocolotes* with coloration resembling our specimen of *T. latifi* was observed and photographed.

Tropiocolotes persicus persicus (Nikolskij, 1903)

MATERIAL. 1.

RECORD. **19.** Chahak, 1 spec. (NMP6V 35687, Šejna)

Lacertidae

Eremias persica Blanford, 1874

MATERIAL. 3.

RECORDS. **3.** Natanz, 1 spec. (CUP/REPT/IRA/023, Frynta), 2 spec. (NMP6V 35549/1–2, Kodym & Král).

Eremias sp.

MATERIAL. 8.

RECORDS. **5.** Qamishlu, 4 ind. captured, 8 spec. (NMP6V 35689/1–4, CUP/REPT/IRA/036–038, CUP/REPT/IRA/066, Frynta & Čiháková), 3 ind. captured (Leikepová)

NOTE. Undetermined species related to *E. persica*. A thorough description will be given elsewhere.

Lacerta chlorogaster Boulenger, 1908

MATERIAL 7

RECORDS **29.** Chorti, 5 ind captured (Hrdý), 2 ind captured (Sádlo), 3 spec. (NMP6V 35548/1–3, Čiháková), 2 ind captured (Pitule), 4 spec. (CUP/REPT/LAC/104–106, CUP/REPT/LAC/147, Frynta).

Lacerta defilippi (Camerano, 1877)

MATERIAL 57

RECORDS **25.** Vali Abad, 8 spec (NMP6V 35547/1–8, Král); 4 ind. captured (Pitule); 8 ind. captured and 45 spec. (CUP/REPT/LAC/9–53, Frynta, Čiháková & Flegr)

Lacerta princeps princeps Blanford, 1874

MATERIAL 3

RECORDS **13.** Yasuj, 2 spec (NMP6V 35688/1–2, Kaftan), 1 spec. (CUP/REPT/IRA/024, Flegr).

Lacerta strigata Eichwald, 1831

MATERIAL 1

RECORDS **25.** Vali Abad, 1 juv ind captured (Šejna), 1 spec (CUP/REPT/IRA/067, Zitková); **28.** Chalus, sea coast, 1 ind observed (Flegr); **29.** Chorti, 1 ind observed (Flegr), 1 ind observed (Šejna), **31.** Langarud, 5 ind observed (Frynta).

Lacerta sp.

MATERIAL 1

RECORDS **34.** Khalkhal, 1 spec (CUP/REPT/IRA/060, Kaftan)

NOTE. Undetermined species resembling *L. raddei* Boettger, 1892. A thorough description will be given elsewhere Rostral shield in contact with the frontonasal one. Nostrils are not in contact with rostral shield. 10 preanal shields are arranged in a symmetric manner. Two of them (medial) are enlarged.

Mesalina cf. *watsonana* Stoliczka, 1872

MATERIAL 3

RECORDS **2.** Jafar Abad, 1 spec (CUP/REPT/IRA/047, Zitková), 1 spec (NMP6V 35550, Frynta); **6.** Hane Houre, 1 spec (CUP/REPT/IRA/046, Frynta)

NOTE. The specimens examined have a free collar with enlarged marginal scales.

Ophisops elegans Ménétriés, 1832

MATERIAL 16.

RECORDS **1.** Markan, 1 ind. captured (Frynta); **5.** Qamishlu, 1 ind captured (Flegr), 7 spec. (NMP6V 35554/1–7, Frynta, Čiháková, Flegr & Sádlo), **7.** Qader Abad, ind captured (Frynta); **8.** Pasargat, 1 spec (CUP/REPT/IRA/048, Frynta); **12.** Dasht-e-Arzhan, 1 ind captured (Frynta), 3 spec (CUP/REPT/IRA/057–058, Frynta); **13.** Yasuj, 4 spec (CUP/REPT/IRA/041–044, Frynta), 1 ind captured (Leikepová), **22.** Gholaman, 1 spec (CUP/REPT/IRA/049, Frynta); **37.** Marand, 1 spec (CUP/REPT/IRA/050, Sádlo).

NOTE. All specimens have two postnasals. Dark vertebral line is usually inconspicuous or absent. In animals from the localities 8, 12, and 37 a short vertebral line reaches maximally shoulder.

Scincidae

Ablepharus pannonicus (Fitzinger in Lichtenstein, 1823)

MATERIAL 2.

RECORDS **5.** Qamishlu, 1 ind. observed (Hrdý); **10.** Sivand, 1 spec (CUP/REPT/IRA/056, Frynta), **12.** Dasht-e-Arzhan, 1 spec (NMP6V 34556, Kodym), **13.** Yasuj, 2 ind. captured (Hrdý), 1 ind observed (Frynta).

Eumeces schneideri princeps **Eichwald, 1839**
MATERIAL. 1
RECORD **1.** Markan, 1 spec (Kaftan)

Mabuya „aurata" **(Linnaeus, 1758)**
MATERIAL. 1
RECORDS **1.** Markan, 1 spec. (NMP6V 35555, Obuch); **14.** Abshar, 2 ind captured (Šejna & Kaftan), 4 ind observed (Čiháková & Frynta); **22.** Gholaman, observation (Frynta & Kaftan), 1 ind captured (Šejna).

NOTE. Awaiting a clarification of the complex taxonomy of *M. aurata* complex we give a tentative determination. It should be mentioned that scincids of the genus *Mabuya*, most probably *M „aurata"* were observed in additional five localities:
7. Qader Abad (Šejna); **10.** Sivand (Flegr), **12.** Dasht-e-Arzhan (Flegr); **13.** Yasuj (Kaftan & Leikepová); **15.** Qar Sharon (Kral)

Ophiomorus persicus **(Steindachner, 1867)**
MATERIAL 2
RECORDS **10.** Sivand, 2 spec. (NMP6V 35557, CUP/REPT/IRA/062, Král).

Anguidae

Anguis fragilis colchicus **(Nordmann, 1840)**
MATERIAL 4
RECORDS **29.** Chorti, 1 ind observed (Pitule), 5 ind observed (Kaftan), **32.** Asalem 12 km W, 1 spec (NMP6V 35557, Král), **33.** Asalem 26 km W, 2 spec (CUP/REPT/IRA/021–022, Kaftan), 1 spec. (CUP/REPT/IRA/068, Šejna).

Ophisaurus apodus **(Pallas, 1775)**
RECORDS **26.** Chalus 45 km S, 1 ind captured and 1 dead found on the road (Král & Kaftan), **27.** Chalus 25 km S, 1 ind observed (Obuch), **29.** Chorti, 1 ind. observed (Šejna); **32.** Asalem 12 km W, 1 ind. captured (Hrdy).

Serpentes
Typhlopidae

Typhlops vermicularis **Merrem, 1820**
MATERIAL. 5
RECORDS **8.** Pasargat, 1 spec. (NMP6V 35558, Král); **10.** Sivand, 1 spec. (CUP/REPT/IRA/032, Kaftan), **14.** Abshar, 1 ind. captured (Šejna); **22.** Gholaman, 1 ind. captured (Šejna), 1 ind. captured (Hrdý), 1 ind captured, 1 spec (NMP6V 35559, Kral), **24.** Avaj, 1 ind captured (Frynta), **27.** Chalus 25 km S, 1 spec. (CUP/REPT/IRA/045, Kaftan); **35.** Kivi, 2 ind. captured, 1 spec. (CUP/REPT/IRA/040, Šejna).

Leptotyphlopidae

Leptotyphlops macrorhynchus **(Jan, 1861)**
MATERIAL. 1.
RECORDS. **22.** Gholaman, 1 spec. (CUP/REPT/IRA/039, Král), 2 ind captured. (Hrdý).

Boidae

Eryx jaculus **(Linnaeus, 1758)**
RECORD **10.** Sivand, 1 ind observed (Hrdý)

NOTE. *Eryx jaculus familiaris* Eichwald, 1831 is recognized from NW Iran by some authors.

Colubridae

***Coluber najadum najadum* (Eichwald, 1831)**
MATERIAL 2
RECORDS **5.** Qamishlu, 1 spec (CUP/REPT/IRA/031, Kaftan), **13.** Yasuj, 1 ind captured (Šejna), **24.** Avaj, 1 spec (NMP6V 35563, Šejna),

***Coluber ravergieri* Reuss, 1834**
MATERIAL 1
RECORD **25.** Vali Abad, 1 spec (CUP/REPT/IRA/011, Král).

***Coluber rhodorachis* (Jan, 1865)**
MATERIAL 1
RECORD **5.** Qamishlu, 1 spec (CUP/REPT/IRA/015, Sadlo & Frynta)

NOTE The specimen collected has a distinct longitudinal reddish stripe Populations of this pattern are often understood as nominoptypical subspecies

***Coluber schmidti* Nikolskij, 1909**
MATERIAL 1
RECORD **24.** Avaj, 1 spec (CUP/REPT/IRA/016, Hrdy)

***Coronella austriaca austriaca* Laurenti, 1768**
MATERIAL 3
RECORDS **25.** Vali Abad, 1 spec (NMP6V 35562/1–2, Král), 1 spec (CUP/REPT/IRA/014, Komarek), **27.** Chalus 25 km S, 1 ind captured (Hrdy), **32.** Asalem 12 km W, 1 ind observed (Kral)

***Eirenis punctatolineatus* (Boettger, 1892)**
MATERIAL 4
RECORDS **1.** Markan, 1 ind captured (Šejna) 1 spec (NMP6V 35565, Šejna), 1 spec (CUP/REPT/IRA/020, Kaftan), **7.** Qader Abad, 1 ind captured (Kaftan), **14.** Abshar, 2 ind captured (Kaftan), **22.** Gholaman, 1 spec (NMP6V 35566, Kral) **24.** Avaj, 1 spec (CUP/REPT/IRA/025, Šejna)

***Elaphe persica* Werner, 1913**
MATERIAL 1
RECORDS **29.** Chorti, 1 ind captured (Kaftan), 1 juv spec (NMP6V 35561, Kodym)

***Lytorhynchus ridgewayi* Boulenger, 1887**
MATERIAL 1
RECORD **6.** Hane Houre, 1 spec (CUP/REPT/IRA/035, Hrdy)

***Malpolon monspessulanus insignitus* (Geoffroy St. Hilaire, 1809)**
MATERIAL 1
RECORD **22.** Gholaman, 1 spec (NMP6V 35676, Kral), 1 ind observed (Šejna)

***Psammophis lineolatum* Brandt, 1838**
RECORD **5.** Qamishlu, 1 ind captured (Kodym)

***Psammophis schokari* (Forskal, 1775)**
MATERIAL 1
RECORDS **2.** Jafar Abad, 1 ind captured (Kaftan), **14.** Abshar, 1 spec (CUP/REPT/IRA/013, Kaftan)

***Natrix natrix* (Linnaeus, 1758)**
MATERIAL 2
RECORDS **29.** Chorti, 1 ind with coloration „*persa*" captured (Kaftan), **31.** Langarud, 2 spec with a standard slightly melanistic coloration (CUP/REPT/IRA/017–018, Frynta)

Natrix tessellata **(Laurenti, 1768)**
MATERIAL 2
RECORDS **10.** Sivand, 1 spec (NMP6V 35568, Voříšek), **25.** Vali Abad, 1 ind captured (Kaftan), **30.** Ramsar, 1 ind observed (Frynta); **31.** Langarud, 1 spec (CUP/REPT/IRA/019, Sádlo)

Pseudocyclophis persica **(Anderson, 1872)**
MATERIAL 3
RECORDS **7.** Qader Abad, 2 spec (NMP6V 35560, CUP/REPT/IRA/033, Frynta); **12.** Dasht-e-Arzhan, 1 spec. (CUP/REPT/IRA/064, Čihakova & Frynta)

NOTE. Regarding mainly the colour pattern 2–3 subspecies are distinguished by some authors (see e. g. Bannikov et al. 1977). The coloration of two subadult specimens from loc. 7 corresponds to the nominotypical form (head and neck with three more or less fused dark bands, body uniformly light). However, the adult specimen from loc 12 differs from the previous ones in having unicolored head, which is only slightly darker than the body. This colour pattern is reported for the males of the eastern subspecies *P. p walteri* (Boettger, 1888), nevertheless the mentioned specimen has lower number of subcaudals (70 versus 75–110 given by Bannikov et al. 1977 for *walteri*). Thus the current knowledge of the taxonomy of *P. persica* seems not to be sufficient.

Spalerosophis diadema schiraziana **Jan, 1865.**
RECORD 7. Qader Abad, fragments of the skin (Kodym)

Spalerosophis microlepis **(Jan, 1865).**
RECORD **5.** Qamishlu, 1 ind captured (Kaftan)

Viperidae

Agkistrodon intermedius caucasicus **(Nikolskij, 1907)**
MATERIAL 1
RECORDS **25.** Vali Abad, 1 spec (NMP6V 35563, Král), 1 ind captured (Kaftan), 1 ind observed (Obuch), **29.** Chorti, 1 ind captured (Šejna)

Echis carinatus **(Schneider, 1801)**
RECORDS **19.** Chahak, 2 ind captured (Kaftan), 1 ind. captured (Šejna)

NOTE. The subspecific status has not been determined.

Vipera lebetina obtusa **Dwigubsky, 1832**
RECORDS 7. Qader Abad, fragments of the skin (Kodym); **22.** Gholaman, 1 ind captured (Kaftan)

ECOLOGICAL REQUIRMENTS AND BIOGEOGRAPHIC PATTERN

When classified according to habitat parameters, the localities split into the four well-defined groups (Tab. 1). Parameters of both landscape (Landscape vegetation units, Rainfall) and local (Local habitat features) level contributed to the classification, however, the former level played the major role. Resulting groups of localities are characterized as follows: A-area of the Persian Gulf, B-areas of „true" deserts, C-areas of xerophilous woodland including secondarily deforested desert landscapes, D-area of mesophilous Hyrcanian woodland in the Alborz Mts, the Talesh Mts, and the Caspian coast.

In spite of the limited amount of our material and also the fact that some localities were selected unintentionally (e.g., some camping or resting sites), the distribution of amphibian and reptile species in individual localities showed a clear pattern. The same distinct groups of locali-

Table 1 Synoptical table of environmental features in the individual localities Abbreviations Groups of localities A – area of the Persian gulf B – areas of „true' deserts, C – areas of xerophilous woodland including secondary deforested desert landscapes, D – area of mesophilous Hyrcanian woodland in Alborz Mts, Talesh Mts and the Caspian coast, x – large scale features, a – small scale or marginal features For localities and environmental features see list of localities

Number of locality / Habitat features	A 20	A 21	A 19	A 17	B 7	B 9	B 2	B 8	B 24	B 4	B 3	B 5	B 38	B 6	B 37	C 15	C 35	C 11	C 12	C 1	C 22	C 13	C 14	C 10	D 32	D 25	D 26	D 27	D 33	D 34	D 29	D 31	D 28	D 30
11	x	x	x	x											x																			
9	x	x	x	x																														
16	x	x	x		a		x																											
25	x	x	x		a	x	x	x								x	x	x			x													
24	x				x		x		x	x	x	x	x	x	x	x	x	a	x	x														
15						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		a												
10					x		x		x	x	x	x		x																				
6					x	x		x				x		x				x																
7							x		x	x	x																							
23		x				x	x	x																										
12						x		x					x			x	x	x	x	x	x	x	x	x										
4																x	x						x											
3																			x		x	x												
20					x											x		x		a	a		x	a	x		x	x						
29	x																		x		x	x	x	x		x	x							
26	a				x																x			a	x	x								
13																										x	x	x			x	x	x	x
1																									x			x			x	x	x	x
30																									x	x		x	x		x			
22		a		x												x	a								x	a	x		a	a		x	x	x
21	a						x					a													x	x		x			a		x	
27																									x	x			x	x				
2																										x	x		x	x				
14																									x				x	x				
17						x			x		a	x				x			a	x	x	a	x	x	a	x	x	x			a			
28		x		x			x	a	x	a		a				x							x		a							x	x	x
19					x													x		a				a								x		x
8													x		x					x														
5																								x										
18			x																															

ties as above (A-D) and six main groups of species were obtained by an independent procedure (classification according to species) Thus, both classifications produced unequivocal and, moreover, mutually corresponding results These facts can be attributed to considerable contrasts among landscapes and zoogeographical regions in studied area

Clustering of localities according to species corresponds well with the vegetation regions according to Zohary (1973), and with incidental rainfall It seems that Zohary's classification of Iran area into vegetation units has a good explanatory value also for the herpetofauna The most interesting example that can be demonstrated by our data is Zohary's differentiation between primary desert areas and desert areas resulting from anthropogenous deforestation In spite of the general features of both desert types, herpetofauna of the former areas is characterized by specific forms (e g , *Phrynocephalus* spp , *Eremias* spp , *Mesalina* cf *watsonana Agamura persica*), while the herpetofauna of the latter ones fairly resembles that of the territories still covered by xerophilous forest

Table 2 Synoptical table of animal species in the individual localities For abbreviations see Table 1

	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	C	C	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D
Number of locality	20	21	19	17	7	9	2	8	24	4	3	5	38	6	37	15	35	11	12	1	22	13	14	10	32	25	26	27	33	34	29	31	28	30
Bunopus tuberculatus	x		x																															
Uromastyx loricata	x		x																															
Trapelus p. persicus	x																																	
Asaccus cf. *elisae*	x																																	
C. gastropholis			x																															
Tropiocolotes persicus			x																															
Echis carinatus			x																															
P. scutellatus							x					x																						
Agama persica										x		x																						
Mesalina cf. *watsonana*							x							x																				
Spalerosophis diadema					x																													
Cyrtopodion scaber							x																											
Coluber schmidti									x																									
Eremias persica											x																							
Eremias sp												x																						
Coluber rhodorachis												x																						
Psammophis lineolatum												x																						
Spalerosophis microlepis												x																						
Phrynocephalus persicus													x																					
Lytorhynchus ridgewayi														x																				
Ophisops elegans					x			x				x			x				x	x	x	x												
Mabuya aurata					x											x			x	x	x	x	x	x										
Eremias punctatolineatus					x				x											x	x		x											
Ablepharus pannonicus												x							x			x		x										
Testudo graeca					x																	x		x										
Trapelus ruderatus								x				x										x												
Coluber n. najadum									x			x										x												
Pseudocyclophis persica					x														x															
Psammophis schokari							x																x											
Vipera lebetina obtusa					x																x													
Hyla savignyi																		x			x		x	x										
C. agamuroides																							x	x										
Eumeces s. princeps																				x														
L. macrorhynchus																					x													
Malpolon m. insignitus																					x													
Lacerta p. princeps																						x												
Hemidactylus persicus																							x											
Tropiocolotes latifi																								x										
Ophiomorus persicus																								x										
Eryx jaculus																								x										
Lacerta strigata																										x					x	x	x	
Ophisaurus apodus																									x		x	x			x			
Anguis fragilis																									x				x		x			
Coronella austriaca																									x	x		x						
Rana macrocnemis																										x					x			
Agkistrodon intermedius																										x					x			
Natrix natrix																															x	x		
Coluber ravergieri																										x								
Lacerta defilippii																										x								
Lacerta sp																														x				
Lacerta chlorogaster																															x			
Elaphe persica																															x			
Emys orbicularis																																x		
Laudakia nupta			x			x						x				x			x		x	x	x											
Bufo s. luristanicus	x	x	x	x		x															x	x	x	x										
Trapelus agilis			x				x				x																							
Mauremys caspica	x				x																													
Tropiocolotes helenae	x																				x													
Bufo viridis spp					x																					x								
Laudakia caucasia									x																	x								
Natrix tessellata																								x		x						x		x
Rana ridibunda	x															x		x			x		x									x		
Typhlops vermicularis								x	x								x				x		x	x				x						

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WISCHUF T & FRITZ U 1996 Eine neue Unterart der Bachschildkrote (Mauremys caspica ventrimaculata subsp nov) aus dem Iranischen Hochland *Salamandra* 32 113–122

ZOHARY M 1973: *Geobotanical Foundations of the Middle East Vol. 1* Stuttgart, Amsterdam Gustav Fischer Verlag, Swets & Zeitlinger, 340 pp

APPENDIX 1

Survey of habitat features

LANDSCAPE VEGETATION UNITS (Zohary 1973) **1** Mesic woodland of *Zelkovo-Parrotietea*, **2** Mesic woodland of *Fagetea hyrcanica*, **3** Steppe woodland of *Quercetea brandtii*, **4** Deforested area of the latter unit, **5** Steppe woodland of *Junipero-Pistacietea*, **6** Deforested area of the latter unit, **7** Continental steppes of the *Artemisietea herbae-albae*, **8** Mountain steppes of the *Artemisietea fragrantis* with the *Quercetea brandtii* remnants, **9** Tropical deserts to savannas of *Acacietea flavae*
RAINFALL IN MM/YEAR (Zohary 1973) **10** 100–200, **11** 200–400, **12** 400–600, **13** 1200–200, **14** over 2000,
LOCAL HABITAT FEATURES **15** stony or gravely open surfaces, **16** clay open surfaces, **17** rocks and deep screes, **18** sand dunes on seaside, **19** wetland with reeds and/or rice fields, **20** river, **21** water spring, rillet, small basin, **22** recently settled buildings of villages or towns, **23** ruins of old (mostly ancient) buildings, **24** open semi-desert stands of sclerophyte dwarf-shrubs, **25** stands of annual weeds and ephemerals **26** xerophilous grassy pastures, **27** mesophilous high-mountain grassy pastures, **28** mosaic of gardens, corn fields and ruderal stands, **29** park-like mosaic of trees, shrubs and xerophilous herbaceous vegetation, **30** closed mesophilous wood

APPENDIX 2

Data collected in the locality 39. Karakurt, Turkey

Lacerta sp.
RECORD 1 spec (CUP/REPT/IRA/061, Frynta)

NOTE Juvenile specimen belonging to *Lacerta raddei* Boettger complex

Eryx jaculus (Linnaeus, 1758)
RECORD 1 ind captured (Pitulc)

Coluber najadum cf. *dahli* Schinz, 1833
MATERIAL 2
RECORDS 2 spec (NMP6V 35564/1–2, Kral)

NOTE The colour pattern of the 1st specimen corresponds to the pattern of *C n dahli* In the case of the 2nd specimen, the 1st pair of neck spots is fused and other spots are small and inconspicuous

Eirenis modestus (Martin, 1838)
MATERIAL 3
RECORDS 1 ind captured (Kaftan), 4 ind captured (Kral), 5 ind captured (Šcjna), 3 ind captured (Pitulc), 2 spec (CUP/REPT/IRA/012, CUP/REPT/IRA/063, Kaftan), 1 spec (NMP6V 35567, Kral)

Natrix tessellata (Laurenti, 1768)
MATERIAL 1
RECORD 1 spec (NMP6V 35569, Kodym), 1 ind captured (Frynta)

Vipera wagneri Nilson et Andrén, 1984
RECORDS 2 ind captured (Kaftan), 3 ind captured (Král, Šcjna, Pitulc)

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BOOK REVIEW

KÜHNEL W.: **Taschenatlas der Zytologie, Histologie und mikroskopischen Anatomie für Studium und Praxis.** Eight rewritten and expanded edition. Stuttgart-New York: Georg Thieme Verlag, 1992. VI+448 pp. Format 120×190 mm. Softcover, price DM 48.–. ISBN 3-13-348608-X.

The author is professor of anatomy at the University in Lubeck. First edition of this book has been published in 1950. In addition to German editions, translations into English (3 editions), Italian (3 editions), Spanish (4 editions), Japanese (2 editions), Greek, Portuguese and French appeared in print. As stated in the preface, in this edition the text has been updated, and modified according to the comments of readers. The volume is composed of 27 non-numbered chapters. Each chapter is arranged in the way that the left page is focused on textual part, and the right page presents the figures, composed (mostly of three) photomicrographs. In addition to light microscope photographs in colour, there are black-and-white transmission and scanning electronic microscope figures.

Introductory chapters examine the variety of cell forms. Described are the spinal ganglia, multipolar nerve cells, smooth muscle cells, fibrocytes and fibroblasts, Purkynje cell, oocyte, and vegetative ganglion cell. Following chapters discuss structures of the nucleus, the cytoplasm and cellular organelles – miscellaneous forms of ergastoplasm and endoplasmic reticulum, Nissl granules, Golgi apparatus, mitochondria, and lysosomes. Further on metaplasmatic and paraplasmatic substances – architecture of cytoskeleton, plasmalemma differentiation, cell-to-cell contact structures, cell division process and chromosomes are looked at.

Characterization of tissue and organ systems follows when describing the epithelial tissues, exocrine glands epithelium, fibrous and supporting cartilage and bone tissues, smooth, striated and cardiac muscle cells, nervous system tissues, blood vessels, lymphatic system, the blood, endocrine glands, the digestive, respiratory and urinary systems, reproductive organs, the skin and adnexa, sense organs, and central and autonomous nervous systems.

In conclusion there is an annex of 17 tables overviewing histological staining solutions (Mayer, Heidenhain, Masson-Goldner, van Gieson, Weigert, Mann, Romeis), classification of various forms of superficial epithelial cells, morphological differentiation of serous and mucous salivary glands, morphological characteristics of salivary and tear glands, differential diagnosis and signs of miscellaneous fibres, muscle tissue, various sections of the digestive tract, kidney tubules, trachea and bronchial tree, lymphatic, cavity and glandular organs, and a variety of skin regions.

Based on a continuing tradition of eight editions and many international translations within more than 40 years, this handy pocket-sized volume represents a beatifully illustrated text-atlas. It provides a practically oriented guide to students and those who will update their knowledge of cytology, histology and microscopical anatomy.

Jindřich Jíra

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New *Clinidium* species from Ecuador (Coleoptera: Carabidae: Rhysodini)

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Abstract. *Clinidium mareki* sp. n. from Ecuador is described and the diagnostic characters illustrated. The species belongs to the *C. insigne* Grouvelle, 1903 -group of the nominotypical subgenus. The current determination key of subgenus *Clinidium* Kirby, 1835 is modified to include the new species.

Taxonomy, description, Coleoptera, Carabidae, Rhysodini, *Clinidium mareki* sp. n., Neotropical region

INTRODUCTION

A large material of carabid beetles, collected by J. Marek (Prague, Czech Republic) in South America and kindly donated by him to me, contents many interesting species, among them several undescribed. The only species belonging to the tribe Rhysodini was found in Ecuador, prov. Cotopaxi, on northern slopes of Mt Corazon. This species is apparently new and it is described below.

The rhysodid fauna of South America was recently studied only by Vulcano & Pereira (1975), and of course by Bell & Bell (1978, 1985) in their excellent revisions of the world fauna of Rhysodini.

The morphological terms used in this study are adopted from Bell & Bell (1978, 1985).

Clinidium (Clinidium) mareki sp. n.

TYPE MATERIAL. Holotype (male), allotype (female), and paratypes (1 male without antennae and 1 female) – all labelled „Ecuador, Mt. Corazon, 3500 m, 17.–21.vii. 1992, leg. J. Marek & P. Seidl". Holotype and allotype are deposited in the author's collection, paratypes in the collection of the University of Vermont, Burlington, Vermont, USA.

DESCRIPTION. Length 7.7–8.4 mm. Antennal stylet moderately long, about 0.2 as long as antennomere XI, acuminate; tufts of minor setae present on antennomeres VI–X, basal setae present on antennomeres VI–X, sparse on antennomere VI; antennomere I with dorsal pollinose subapical band. Head (Fig. 1) approximately as long as wide; frontal grooves narrow, deep, pollinose; median lobe narrow, triangular, it's tip slightly behind level of anterior margin of eye, narrowly but distinctly separated from antennal lobe; temporal lobes convergent posteriorly, forming obtuse median angles, posterior margin bordered with pollinosity; eyes crescentic, relatively large, about 0.55–0.60 length of temporal lobe; antennal groove complete, pollinose; one temporal seta arising from large pollinose puncture touching posterolateral pollinose border of temporal lobe; two pairs of postlabial setae.

Pronotum (Fig. 2) long, about 1.5 times longer than wide, widest behind middle; median groove deep, narrow, with slight expansion in basal 0.33 of length and with large, oval anterior median pit; basal impression narrow, deep, closed posteriorly; discal strioles deep, sligtly curved, extending anteriorly beyond middle of pronotum, marginal groove deep, visible in dorsal view, number of marginal setae varies from 3 to 5 (most often 5), angular seta absent, notopleural suture glabrous, sternopleural groove nearly complete, praecoxal setae absent, prosternal projection with apex shallowly bilobed, with deep U-shaped groove

Elytra moderately elongate, striae impressed, pollinose, punctate, elytral sutura deeply invaded in basal 0 15 of length, intercalary stria abbreviated posteriorly, ending blindly at level of anterior end of preapical tubercle (Fig 3), other striae entire, preapical tubercle truncate or slightly sinuate posteriorly, apical tubercle inflated, contiguous, sutural and parasutural striae with one seta each in posterior 0 25 of length, intercalary stria with row of 4–5 setae, intratubercular stria with 2–3 setae near apex, marginal stria with 3–4 setae posteriorly, preapical tubercle with one seta (rarely on one side with 2 setae), apical tubercle with one seta (in female allotype with 2 setae), metasternum with deep, complete median sulcus, this sulcus with deep pit in posterior 0 25 of length, female with transverse sulci complete in sternites III–IV, interrupted on midline in V–VI (Fig 4), female with large lateral pit in sternite IV, male with transverse sulci complete in sternites III–VI or interrupted on midline in sternite V, transverse sulcus in sternum VI not joined with submarginal groove (but almost joined in the female paratype), sternite VI with 2 setae, female with two V-shaped, short grooves near posterior margin of sternite VI, delimiting a median tubercle, which is visible in lateral view, tibial spurs slightly unequal, male's mesotibial calcar narrower at basis than metatibial one, but generally of the same shape (Figs 5, 6), male without ventral tooth in anterior femur and without proximal tooth in protibia

DIFFERENTIAL DIAGNOSIS The new species belongs to the *C insigne* group of the nominotypical subgenus, which differs from other species groups of this subgenus by the following combination of characters (Bell & Bell, 1985) tufts of minor setae are present on antennomeres VI–X and eyes are crescentic The group was formed up to the present time by four species

Clinidium dubium Grouvelle, 1903 from Ecuador is morphologically very different from remaining species of *C insigne* group (including *C mareki*) It differs by shape of temporal lobes, which are divergent posteriorly, by very long antennal stylet, by presence of tubercle in very large anterior median pit and by acute proximal tooth on male's protibia

C boroquense Bell, 1970 from Puerto Rico differs from remaining species by metasternum not sulcate and by intercalary stria entire

C insigne Grouvelle, 1903 from Ecuador and *C howdenorum* Bell & Bell, 1985 from Trinidad are according to Bell & Bell (1985) closely related species and they seem to be most closely related (or the most similar) to the *C mareki* sp n , sharing the diagnostic combination of characters intermediate between them *C howdenorum* has narrow head, which is longer than wide, median and antennal lobes are not connected, three temporal setae are present, marginal groove bearing 8 setae, parasutural stria bearing 10 setae, intercalary stria with 9 setae, marginal stria with 10–12 setae, four setae are present in sternite VI, male with lateral pit in sternite IV, female with median tubercle in sternite VI, delimited by short, broadly U-shaped groove, which is parallel to submarginal groove (R T Bell, pers comm) *C insigne* has connected median and antennal lobes, head is as long as wide, bearing only one temporal seta, marginal groove with 6 setae, parasutural stria without setae, intercalary stria bearing 3–5 setae and marginal stria 6–7 setae, sternite VI with 2 setae, male without lateral pit in sternite IV, female without median tubercle in sternite VI *C mareki* shares with *C insigne* reduced number of setae on head, pronotum, elytrae and sternite VI, and proportions of head Differences are in not connected median and antennal lobes and in the presence of median tubercle in sternite VI in female, which is delimited by V-shaped grooves (x *C howdenorum*) in the former species

COLLECTION CIRCUMSTANCES. The type specimens were found on northern slopes of Mt. Corazon, near the upper forest limit, in a dead, dry, charred, rotten stem.

NAME DERIVATION. The species is named in honour of my friend J. Marek, who collected the type series.

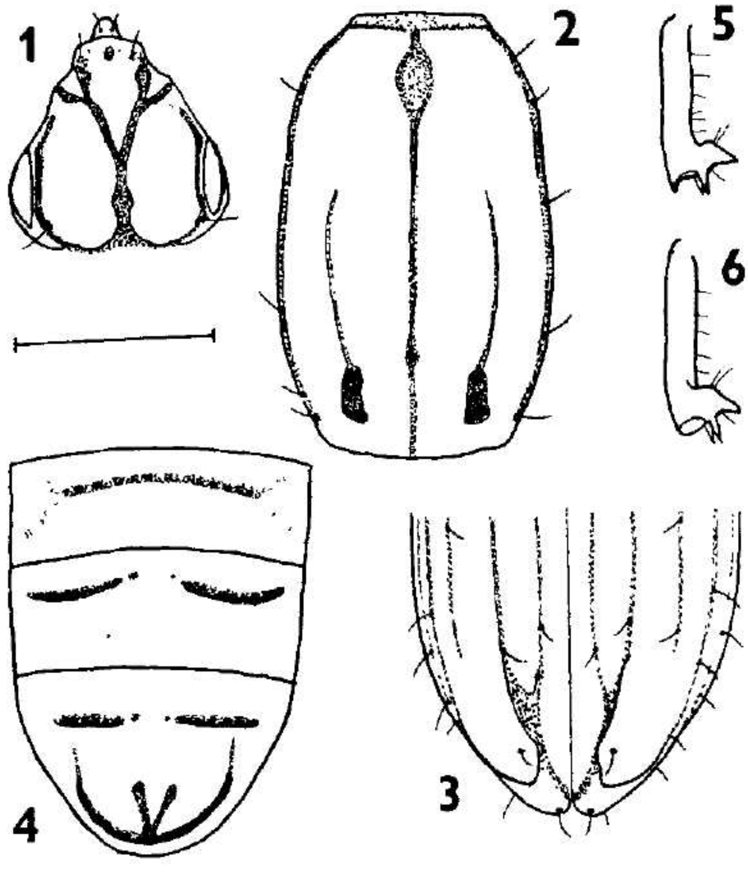
To include the new species in the key of Bell & Bell (1985, p. 94), the couplet 9 must be changed as follows:

9 (8) Median and antennal lobes connected, parasutural stria without setae, median tubercle in sternite VI of female absent .... *C. insigne* Grouvelle

9' Median and antennal lobes not connected; parasutural stria with at least one seta; sternite VI of female with median tubercle 9b

9b Temporal setae are three, head longer than wide; parasutural and intercalary striae with 9–10 setae each. Sternite VI with 4 setae .... *C. howdenorum* Bell & Bell

9b' Only one temporal seta, head as long as wide; parasutural stria with one seta, intercalary stria with 4–5 setae. Sternite VI with 2 setae .... *C. mareki* sp. n.



Figs 1–6. *Clinidium mareki* sp. n. 1 – head, dorsal view, 2 – pronotum, 3 – elytral apex, 4 – sternites IV – VI, female, 5 – mesotibia, male, 6 – metatibia, male. Scale bar 1.0 mm

Acknowledgements

I wish to thank Jaroslav Marek (Prague, Czech Republic) for providing me with the material of Carabidae from the Neotropic region and Ross T. Bell (The University of Vermont, USA) for sending me the literature and some unpublished data about morphology of species mentioned in the present paper.

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New data on taxonomy and distribution of Palaearctic, Oriental and Neotropical Ischnopsyllidae (Siphonaptera), Nycteribiidae and Streblidae (Diptera)

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Abstract *Phthiridium szechuanum turkestanicum* subsp n. is described, *Basilia* (*Paracyclopodia*) *burmensis* Theodor, 1954 is characterized in the male sex Additional morphological, taxonomic and/or faunistic data are given for 11 species of Ischnopsyllidae, 20 species of Nycteribiidae and *Brachytarsina amboinensis* Rondani, 1878 (Streblidae) The distributional area of mentioned species is stated.

Taxonomy, distribution, Ischnopsyllidae, Nycteribiidae, Streblidae, *Hormopsylla trux*, *Phthiridium szechuanum turkestanicum* subsp. n., *Basilia* (*Paracyclopodia*) *burmensis*, Neotropical region, Oriental region, Palaearctic region

Results of the elaboration of samples of bat-fleas and bat-flies from the Czech Republic, Slovenia, Bulgaria, Middle Asia (S Kazakhstan, Uzbekistan, Kyrgyzstan), the Baikal Lake, NW India, Laos, Cambodia and Cuba are given. I am much obliged to Z. Frühbauer (sample from Cambodia), I. Horáček and S. N. Rybin (sample from S Kyrgyzstan), A. Reiter (sample from the Baikal Lake), J. Roháček (sample from Slovenia), T. Scholz (sample from central Laos) and Jorge de la Cruz (sample from Cuba), who provided part of the material studied. The material is deposited in coll. Hůrka, Department of Zoology, Charles University, Praha and in the Silesian Museum, Opava (sample from Slovenia).

Ischnopsyllidae

Ischnopsyllus (*Ischnopsyllus*) *intermedius* (Rothschild, 1898)

CZECH REPUBLIC. Bohemia mer., distr Jindřichův Hradec, Kolence, gamekeeper's lodge Čertova šlápota (6954), *Eptesicus serotinus* (Schreber), 25. vii 1984, 1 F, K. Hůrka leg.

I revised the identification of one female specimen from SE Kazakhstan (Grodikovo near Dzhambul), published as *I. intermedius* by Hůrka (1984a). The specimen belongs in reality to *I. plumatus*. The easternmost localities of *I. intermedius* represent the Caucasus and the Ural Mts.

Ischnopsyllus (*Ischnopsyllus*) *plumatus* Ioff, 1946

KYRGYZSTAN Kurshab, distr. Osh, nursing colony of *Eptesicus serotinus turcomanus* (Eversmann), 17. iv 1985, 24 M, 43 F (from 32 female bats), S. N Rybin leg.

The numerous material enables to determine the most positive distinguishable characters in females of *I. plumatus* (a) and *I. intermedius* (b).

a: 22–32 (mostly 23–28) bristles in double row on sternum VII; intercalary setae in the major rows on abdominal tergites 2–3 times shorter than long main bristles; both head and appendix of spermatheca more slender (Hůrka 1976: fig. 17); dilated part of the duct of spermatheca more slender (Hůrka 1976: fig. 15).
b: 11–21 (mostly 13–17) bristles in irregular row, sometimes partly doubled, on sternum VII, intercalary setae in the major rows of abdominal tergites 5–8 times shorter than long main bristles; both head and appendix of spermatheca robuster (Hůrka 1976: fig. 16); dilated part of the duct of spermatheca broader (Hůrka 1976: fig. 14).
DISTRIBUTION. Turkmenistan, S Kazakhstan, Kyrgyzstan.

Ischnopsyllus (*Ischnopsyllus*) *octactenus* (Kolenati, 1856)

KYRGYZSTAN. Osh, cave No 30, *Pipistrellus pipistrellus aladdin* Thomas, 20. iii. 1985, 1 F, S. N. Rybin leg.

DISTRIBUTION. West Palaearctic species, ranging from Morocco, Spain and Great Britain to Middle Asia and Afghanistan.

Ischnopsyllus (*Ischnopsyllus*) *variabilis* (Wagner, 1898)

CZECH REPUBLIC. Moravia mer., Lednice, pond Prostřední rybník (7266), netting, 24. iv. 1983, *Pipistrellus nathusii* (Keyserling & Blasius) 1 M, 1 F (from 2 female bats), *Myotis daubentoni* (Kuhl), 1 F (from 5 female bats), T. Scholz leg.

DISTRIBUTION. Continental Europe eastward to the Ural and Volga rivers, Turkey, Ciscaucasia, N Caucasus, Transcaucasia.

Ischnopsyllus (*Hexactenopsylla*) *hexactenus* (Kolenati, 1856)

RUSSIA. Siberia, Lake Baikal, Svjatoj Nos peninsula and isthmus, Burtuj, *Eptesicus nilssoni* (Keyserling & Blasius), 1.–6. vii. 1992, 2 M, 3 F (from 5 female bats), A. Reiter leg.

DISTRIBUTION. Europe, northern parts of Asia eastward to Transbaikalia.

Ischnopsyllus (*Hexactenopsylla*) *petropolitanus* (Wagner, 1898)

KYRGYZSTAN. Alaj Mts., Kara-Goj, 3000 m, *Plecotus austriacus wardi* Thomas, 14. viii. 1984, 1 M, 1 F (from 2 bats), I. Horáček leg., Kurshab, distr. Osh, nursing colony of *Eptesicus serotinus turcomanus* (Eversmann), 17. iv. 1985, 1 F (from 30 bats), S. N. Rybin leg.

DISTRIBUTION. Sankt Peterburg, Kazakhstan, Uzbekistan, Tadzhikistan, Kyrgyzstan.

Myodopsylla trisellis Jordan, 1929

RUSSIA. Siberia, Lake Baikal, Svjatoj Nos peninsula and isthmus, Burtuj, *Myotis daubentoni* (Kuhl), 1.–6. vii. 1992, 1 M, 1 F (from 5 bats), 10. ix. 1993, 1 M (from 1 bat), A. Reiter leg.; Kordon, 7.–9. vii. 1992, *Eptesicus nilssoni* (Keyserling & Blasius), 1 M, 1 F (from 2 bats), *Myotis brandti* (Eversmann), 1 M, 2 F (from 4 bats), *Myotis ikonnikovi* Ognev, 1 M (from 2 bats), A. Reiter leg.

DISTRIBUTION. Finland, Russia (eastward to Lake Baikal), E Kazakhstan, N Mongolia, NE China, NE Korea.

Rhinolophopsylla unipectinata unipectinata (Taschenberg, 1880)

BULGARIA. Kamen Brjag, Black Sea shore, *Rhinolophus mehelyi* Matschie, 11. vii. 1986, 1 F (from 1 male bat), K. Hůrka leg.

DISTRIBUTION. West, S and SE Europe, Asia Minor, Crimea, Caucasus, Middle East, Turkmenistan, SW Afghanistan.

Rhinolophopsylla unipectinata turcestanica Ioff, 1953

KYRGYZSTAN. Sasyk-Ungur cave, Aravan, Osh distr., *Tadarida teniotis* Rafinesque, 24. viii. 1984, 1 M, I. Horáček leg.; Adzhidaar-Ungur cave, Osh distr., *Myotis blythi* (Tomes), 5. viii. 1984, 1 M, 1 F, I. Horáček leg.; Barytovaya cave, Osh distr., *Myotis blythi* (Tomes), 13. viii. 1988, 1 F, N. S. Rybin leg.

DISTRIBUTION. S Kazakhstan, Uzbekistan, S Kyrgyzstan, Tadzhikistan, NE Afghanistan.

Nycteridopsylla pentactena (Kolenati, 1856)

CZECH REPUBLIC. Praha, castle: Mikulka tower (5952), *Eptesicus serotinus* (Schreber), 12. ii. 1980, 5 M, 4 F (from 5 male bats), K. Hůrka leg.

DISTRIBUTION. West, central and eastern Europe.

Hormopsylla trux Jordan, 1950

CUBA. Prov. Oriente, Santiago de Cuba, *Tadarida (Nyctinomops) macrotis* Gray, 1 M, Jorge de la Cruz leg.

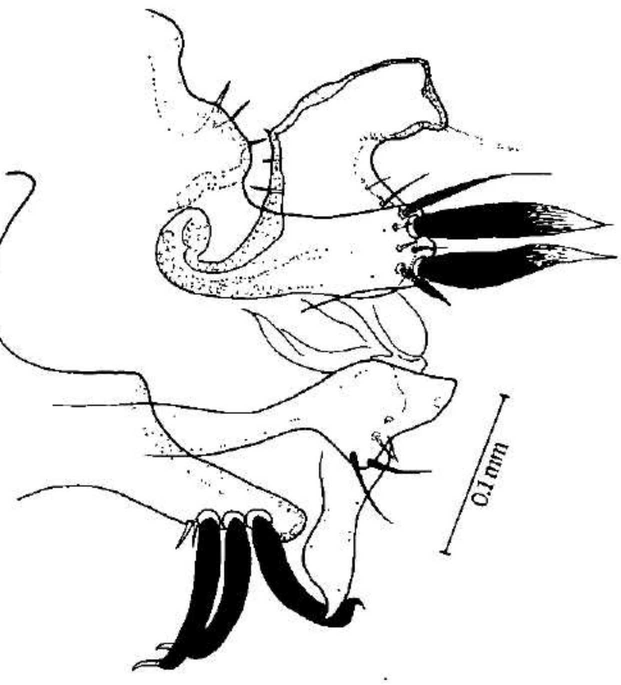


Fig. 1 – *Hormopsylla trux* Jordan, male genitalia.

A poorly known species described from Peru (male holotype and female allotype) from unidentified bat. The found male agree with the description and illustration of this species by Hopkins & Rothschild (1956: 214–215, figs 364, 366). Thoracic and abdominal combs with 32, 13, 23, 16, 16 and 15 spines; clasper bears 2 large bristles, both laterally flattened, for details in male terminalia see Fig. 1 (apical bristle of the anterior lobe of movable process broken).

Nycteribiidae

Nycteribia (Nycteribia) allotopa Speiser, 1901

LAOS Keo-Outem distr., Ban Thinkeo, 8 viii 1989, ? host (Vespertilionidae), 2 F, T Scholz leg.

The shape of the dorsal genital plate in both females (Fig. 2) is intermediary between those in populations from Sumatra (Maa 1967: fig. 66) or Philippines (Theodor 1967: fig. 66) and those of populations from Japan (Maa 1967: fig. 67), Formosa (Theodor 1967: fig. 67) or Afghanistan (Hůrka & Povolný 1968: fig. 2 e). One specimen has the surface of tergite 2 almost bare, the second specimen has most of the surface covered with short setae. Laos represents the new finding place of *N. allotopa* Speiser.
DISTRIBUTION. The species, originally described from the West Sumatra, is recorded from a large distributional area, ranging from E Afghanistan in the west to Japan (Honshu) in the east, and Indonesia and Australia in the south, occurring in the southeastern part of the Palaearctic region, and widely distributed in the Oriental and Australian regions. Several local forms were reported from this wast area, some of which described as subspecies, differing mainly in details of genitalia of both sexes. The entirely complex is much in need of a revision.

Nycteribia (Nycteribia) dentata Theodor, 1967

INDIA Jammu & Kashmir, Poonch valley, *Myotis blythi* (Thomes), 2 M, 1 F (from 2 bats)

DISTRIBUTION. E Afghanistan, NW India (Jammu & Kashmir). The type locality of this species represents the Bumbroo cave, Matan, Pahlgam Road in Kashmir.

Nycteribia (Nycteribia) kolenatii Theodor & Moscona, 1954

CZECH REPUBLIC Moravia mer., Lednice, pond Prostřední rybník (7266), netting, *Myotis daubentoni* (Kuhl), 24. iv 1983, 12 M, 12 F (from 5 female bats), T Scholz leg
SLOVENIA Jama u Dvora (Krka River), *Myotis daubentoni* (Kuhl), 5. viii 1993, 30 M, 41 F (from 20 bat specimens), Kobilna jama (Kolpa River), *Myotis daubentoni*, (Kuhl), 7 viii 1993, 5 M, 2 F (from 5 bat specimens); Kochevje-Rdechi kamen, *Myotis daubentoni* (Kuhl), 2 viii 1993, 3 M (from 1 female bat); Lukuja, *Myotis daubentoni* (Kuhl), 5 ix 1996, 5 M, 4 F (from 3 male bats), all Z Řehák leg., J Roháček det

DISTRIBUTION. European species distributed from S Scottland and S Scandinavia to N Portugal, N Italy, Macedonia and Romania; eastern limit presently 28–29° E.

Nycteribia (Nycteribia) latreillii (Leach, 1817)

BULGARIA Kamen Brjag, Black Sea shore, *Myotis blythi* (Tomes), 11. vii. 1986, 2 M, 4 F (from 2 bats), K Hůrka leg ; NE Rodopi Mts., Mechkovets Mts , *Myotis blythi* (Tomes), 14 vii. 1986, 1 F (from 3 bats), K. Hůrka leg ; Knizhovnik (30 km S Khaskovo), *Myotis myotis* (Borkh), 21 vii 1986, 1 M, 2 F (from 1 bat), K. Hůrka leg.
KYRGYZSTAN Osh distr , Adzhidaar-Ungur cave, *Myotis blythi* (Tomes), 5 viii. 1984, 6 M, 8 F (from 16 bats), I Horáček leg , Sito cave, *Myotis blythi* (Tomes), 28 vi 1988, 3 M, 4 F (from 9 bats), N S. Rybin leg , Kyzyl Kijak cave, *Myotis blythi* (Tomes), 28 vi 1988, 1 M, 3 F (from 3 bats), N. S Rybin leg., Sasyk-Ungur cave, *Myotis blythi* (Tomes), 12 vii 1988, 2 M

(from 4 bats), N S Rybin leg ; Barytovaya cave, *Myotis blythi* (Tomes), 13. viii. 1988, 2 M, 6 F (from 5 bats), N S Rybin leg , Davachan-Ungur cave *Myotis blythi* (Tomes), 15 viii 1988, 2 M, 1 F (from 5 bats), N S Rybin leg

DISTRIBUTION. Continental Europe (northward to 51–52° N), N Africa, SW and Middle Asia eastward to E Kazakhstan.

Nycteribia (Nycteribia) parvula Speiser, 1901

LAOS Keo-Outem distr , Ban Thinkeo, 8 viii 1989, ? host (Vespertilionidae), 2 M, 2 F, T. Scholz leg.

Similarly as *N. allotopa* Speiser, also *N. parvula* occurs on their large distributional area in local forms, differing mainly in details of genitalia of both sexes. The specimens examined agree in main characters (Figs 3–5) with those described by Theodor (1967) from Formosa. Laos was not yet reported as a finding place of this species.

DISTRIBUTION. E Afghanistan, W Pakistan, W India (Maharashtra), Sri Lanka, Burma, Laos, Taiwan, Japan (Honshu), Philippines (Luzon, Tablas, Mindanao), Malaysia, Indonesia (Sumatra, Java, Ambon).

Nycteribia (Nycteribia) pedicularia Latreille, 1796

SLOVENIA Kobilna jama (Kolpa River), *Myotis capaccinii* (Bonaparte), 7. viii. 1993, 1 F (from 1 female bat), Z Řehák leg , J Roháček det

BULGARIA NE Rodopi Mts , Mechkovets Mts., *Myotis capaccinii* (Bonaparte), 14 vii. 1986, 2 M, 10 F (from 1 bat), K Hůrka leg

DISTRIBUTION. A Mediterranean species distributed in southern parts of Europe (northward to the Alps and to the S Carpathians), NW Africa and SW Asia (eastward to Iran).

Nycteribia (Nycteribia) quasiocellata Theodor, 1966

RUSSIA Siberia, Lake Baikal, Svjatoj Nos peninsula and isthmus, Kordon, *Myotis daubentoni* (Kuhl), 22 -29 vi 1992, 3 M, 4 F (from 4 bats), A Reiter leg , Burtuj, 1 -6 vii 1992, *Myotis daubentoni* (Kuhl), 11 M, 11 F (from 5 bats), *Myotis ikonnikovi* Ognev, 1 M (from 2 bats), A Reiter leg.

DISTRIBUTION. The species was till now reported from western (Theodor 1966; Minář & Hůrka 1980) and middle (Krištofík & Kiefer 1983) Mongolia, northern China (Hůrka 1970) and eastern Kazakhstan (Hůrka 1969). Svjatoj Nos peninsula and isthmus represents the first locality in Russia. *Myotis daubentoni* is without doubt the main host of this fly.

Nycteribia (Acrocholidia) lindbergi Aellen, 1959

KYRGYZSTAN Osh distr , *Myotis blythi* (Tomes), N S Rybin leg . Sasyk-Ungur caves, 12 vii 1988, 6 F (from 4 bats); Dangi, 14 vii 1988, 1 M, 1 F (from 1 bat), Barytovaya cave, 13. viii. 1988, 3 M, 6 F (from 5 bats), Davachan-Ungur cave, 15 viii 1988, 1 M, 3 F (from 5 bats). Adzhidaar-Ungur cave, *Myotis blythi* (Tomes), 5 viii. 1984, 13 F (from 16 bats), I. Horáček leg.

UZBEKISTAN. Samarkand env., Amankutan, *Myotis blythi* (Tomes), 9. vi. 1989, 1 F (from 4 bats), K Hůrka leg

DISTRIBUTION. Species of Middle and Central Asia found in SW Uzbekistan, S Kyrgyzstan, E Kazakhstan, Tadzhikistan, Afghanistan and N India (NW Himalaya; Darjeeling).

Nycteribia (*Acrocholidia*) *vexata* Westwood, 1835

SLOVENIA Kochevje-Rdechi kamen, *Myotis bechsteini* (Kuhl), 2 viii 1993, 1 F (from 4 male bats), Z Řehak leg, J Rohaček det

BULGARIA NE Rodopi Mts, Mechkovets Mts, *Myotis blythi* (Tomes), 14 vii 1986, 2 M, 2 F (from 3 bats), Knizhovnik (30 km S Khaskovo), *Myotis myotis* (Borkh), 21 vii 1986, 4 M (from 1 bat), Kamen Brjag, Black Sea shore, *Myotis blythi* (Tomes), 11 vii 1986, 2 M, 1 F (from 2 bats), all K Hůrka leg

DISTRIBUTION Continental Europe (northward to 52–53° N), N Africa and SW Asia eastward to Iran (Elburz Mts) and Turkmenistan (Bakhardenskaya cave).

Phthiridium biarticulatum Hermann, 1804

KYRGYZSTAN Osh distr, Aravan, cave No 12, *Rhinolophus ferrumequinum irani* Cheesman, 23 iii 1983, 1 M (from 1 bat) N S Rybin leg, Kalcitovaya cave, *Rhinolophus ferrumequinum irani* Cheesman, 19 iii 1985, 1 F (from 1 bat), N S Rybin leg, Tuya Muyun, *Rhinolophus ferrumequinum irani* Cheesman, 17 ix 1987, 1 F (from 1 bat), 21 iv 1988, 2 M, 2 F (from 3 bats), 14 vii 1988, 1 M (from 1 bat), 14 VIII 1988, 2 M, 3 F (from 3 bats), N S Rybin leg, Kristalnaya cave, *Rhinolophus bocharicus* Kastschenko & Akimov, 18 iv 1987, 2 M (from 1 bat), N S Rybin leg, Kanigut cave, *Rhinolophus bocharicus* Kastschenko & Akimov, 3 vii 1988, 1 M (from 1 bat), N S Rybin leg

DISTRIBUTION A West Palaearctic species, distributed in southern half of Europe, N Africa and SW Asia, eastward to Kyrgyzstan, Tadzhikistan and Afghanistan In Middle Asia this fly prefers *Rhinolophus ferrumequinum* (and perhaps also *R bocharicus*) as a host

Phthiridium simile Hůrka, 1984

KYRGYZSTAN Osh distr, Kyzyl-Kijak cave (170 km SW Osh), 1 vii 1988, *Rhinolophus* aff *hipposideros* (Bechstein), 1 M (from 1 bat), N S Rybin leg

DISTRIBUTION The species was described from N Tadzhikistan and found also in S Kyrgyzstan (Okhna cave near Kadamdzhay, 120 km SW Osh).

Phthiridium szechuanum turkestanicum subsp. n.

Length 1 8–2 2 mm Colour light brown

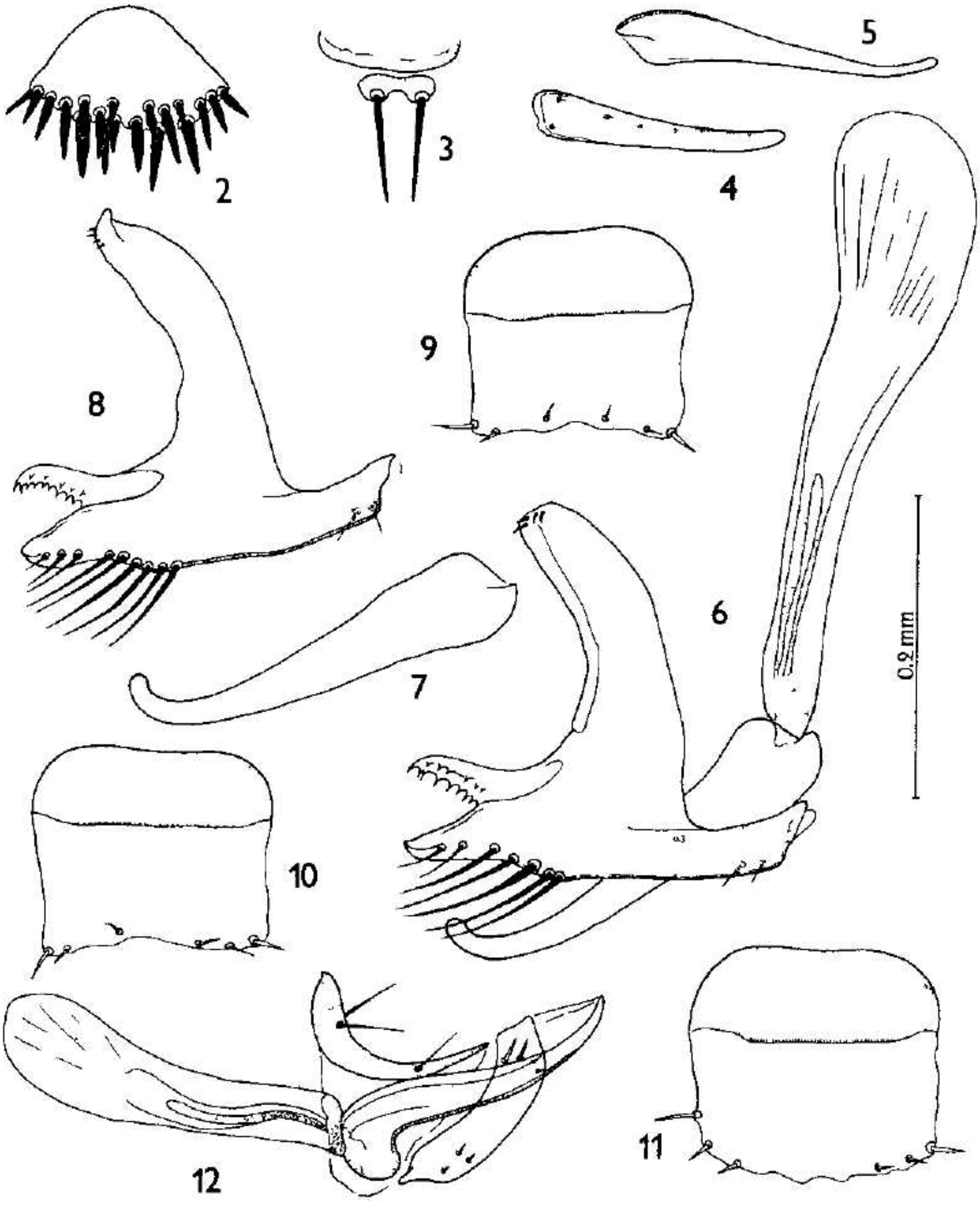
Head with 4 setae at the dorsal anterior margin 7–12 notopleural setae, usually a gap between 2 (1, 3) anterior and the following setae Postspiracular sclerite with 4–6 setae

Male abdomen as in *P szechuanum* Theodor, but surface of tergite 6 with 1–2 short setae Abdominal ctenidium with 35–40 spines Sternite 5 with a group of 25–31 spines, median spines in 3 rows, those in the second and third row about twice as long as those in the first row Genitalia in general as in *P szechuanum* but apices of surstyli (claspers) slenderer, aedeagus not bent in the basal part and with more curved, not bifide apex (Figs 6, 7), parameres (praegonites) with less curved apical process and with more shallow sinuation of its ventral margin, 2 setae on the inner side of the ventral basal corner (Figs 6, 8)

Female abdomen in general as in *P szechuanum* Abdominal ctenidium with 36–41 spines (45 in *P szechuanum*) Setae on the surface of sternites 5 and 6 more numerous (4–6, 1–2 in *P szechuanum*) Genital plate as in Figs 9, 10, 11

DIFFERENTIAL DIAGNOSIS *P szechuanum turkestanicum* subsp n differs from *P szechuanum* Theodor in the shape of aedeagus and parameres and in some characters in chaetotaxy

ETYMOLOGY The name of the subspecies is derivate from its occurrence in the late Turkestan



Figs 2–12 2 – *Nycteribia allotopa* Speiser, dorsal genital plate, 3 – *N parvula* Speiser, ventral and dorsal genital plates, 4,5 – *N parvula*, paramere, aedeagus 6–8 – *Phthiridium szechuanum turkestanicum* subsp n, male genitalia (6,7 – Tuya-Muyun, 8 – Amankutan) 9–11 – *P szechuanum turkestanicum* subsp n, dorsal genital plates (9, 10 – Tuya-Muyun, 11 Amankutan), 12 – *Basilia burmensis* Theodor, male genitalia

HOLOTYPE (male) Kyrgyzstan, Osh distr , Dangi, Tuya-Muyun, *Rhinolophus* aff *hipposideros* (Bechstein), 1 viii 1984, I Horaček leg
PARATYPES 4 males, 6 females, same data as in the holotype, 1 female, Osh distr , Kyzyl-Ungur, *Rhinolophus* aff *hipposideros* (Bechstein) 7 iv 1963, N S Rybin leg (given by Hůrka 1969 as *Stylidia szechuana* Theodor), 1 male, Uzbekistan, Samarkand env , Amankutan, *Rhinolophus* aff *hipposideros* (Bechstein), 9 vi 1989, K Hůrka leg Holotype and paratypes in coll Hůrka, Department of Zoology, Charles University, Praha
OTHER MATERIAL Kyrgyzstan, Osh distr , Dangi, Tuya-Muyun, *Rhinolophus* aff *hipposideros* (Bechstein), 1 viii 1984, 15 M, 15 F, I Horaček leg , 21 iv 1988, 4 M, 5 F, 13 viii 1988, 1 M, N S Rybin leg

NOTE *Phthiridium szechuanum* (Theodor, 1954) was described, based on male holotype and one female paratype, from Kwan Yen Chiao, Szechuan, China No additional material is known

Basilia (*Basilia*) *blainvillii amiculata* (Speiser, 1907)

CAMBODIA Takeo, *Taphozous longimanus* Hardwicke, 10 ix 1984, 1 F, 19 xii 1984, 1 F, Z Fruhbauer leg

DISTRIBUTION. The species inhabits tropics of the Old World, Oriental subspecies is known from India (West Bengal, Maharashtra, Rajastan, Gujarat), Sri Lanka, Burma, Cambodia, Malaysia (Labuan) and Indonesia (Sumatra, Java) From Cambodia given by Klein (1970) from the Phnom-Penh region (Prek-Phnan), host *Taphozous longimanus longimanus* Hardwicke.

Basilia (*Basilia*) *italica* Theodor, 1954

SLOVENIA Kochevje - Luzha, *Myotis mystacinus* (Kuhl), 2 viii 1993, 1M, 1F (from 1 female bat), Z Řehak leg

Both specimens agree in the morphological characters with the descriptions of this rare species, only apical part of aedeagus of studied male is slightly narrower than figured by Aellen (1955) and Theodor (1967)
DISTRIBUTION The species has been found in France, Switzerland, Italy, Slovenia (new locality), Slovakia and Poland

Basilia (*Basilia*) *nana* Theodor & Moscona, 1954

SLOVENIA Kochevje-Rdechi kamen, *Myotis bechsteini* (Kuhl), 2 and 3 viii 1993, 4 M 8 F (from 5 male bats), Kochevje Luzha, *Myotis bechsteini* (Kuhl) 4 viii 1993, 4 M, 1 F (from 2 male bats), *Nyctalus leisleri* (Kuhl), 2 viii 1993, 1 F (from 1 male bat), *Plecotus auritus* (Linnaeus), 2 viii 1993, 1 M (from 1 male bat), Z Řehák leg

DISTRIBUTION Europe (from SE Great Britain and S Sweden to N and E Spain, Switzerland, Slovenia and Bulgaria), Israel, Jordan (Amr & Qumsiyeh 1993), Azerbaidzhan

Basilia (*Basilia*) *nattereri* (Kolenati, 1857)

CZECH REPUBLIC Moravia mer , distr Znojmo, Božice, gamekeeper's lodge (7163), nursing colony of *Myotis nattereri* (Kuhl), 30 vii 1996, 2 M, 1 F (from 1 female bat), A Reiter leg

DISTRIBUTION Kolenati based his description of this species probably on the Moravian sample The recent finding confirms the occurrence of *B nattereri* in southern Moravia, on its evidently main host The species has been found in Spain, France, Switzerland, ?Germany, Czech Republic, Romania and Crimea till now

Basilia (Basilia) rybini rybini Hůrka, 1969

RUSSIA. Siberia, Lake Baikal, Svjatoj Nos peninsula and isthmus, Kordon, *Myotis daubentoni* (Kuhl), 22.–29. vi. 1992, 2 M, 1 F (from 4 bats), A. Reiter leg.; Burtuj, *Myotis daubentoni* (Kuhl), 1.–6. vii. 1992, 1 M, 5 F (from 5 bats), *Myotis ikonnikovi* Ognev or/and *Myotis brandti* (Eversmann), 27.–29. viii. 1992, 2 F, A. Reiter leg.

DISTRIBUTION. The nominotypical subspecies was described from eastern Kazakhstan; east border of the Lake Baikal represents further finding place, the first in Russia. *Basilia rybini japonica* Theodor is known from Japan (Hokkaido).

Basilia (Paracyclopodia) burmensis Theodor, 1954

LAOS. Keo-Outem distr., Ban Thinkeo, *Scotophilus heathi* (Horsfield), 9. viii. 1989, 1 M, 1 F (from 1 female bat), T. Scholz leg.; Nam Ngum Dam, *Scotophilus heathi* (Horsfield), 10. viii. 1989, 4 M, 2 F (from 1 female bat), T. Scholz leg.

Theodor (1954) described *Paracyclopodia roylii burmensis*, based on female specimens from Burma, and included also specimens from Java to this subspecies. In 1967 Theodor repeated the characteristic female features of this taxon, given as *Basilia (Paracyclopodia) roylii burmensis*. Maa (1977) considered *B. (P.) burmensis* Theodor and *B. (P.) roylii* (Westwood) for species propriae, as well as *B. (P.) chlamydophora* (Speiser), considered by Theodor (1967) for synonymic with *B. (P.) roylii roylii*.

Three female specimens from Laos agree in all distinguishing chaetotactic features given by Theodor (1954, 1967) for the taxon „*burmensis*". Short setae on the surface of tergal plate 1 extend to the posterior margin; lateral parts of tergal plate 2 covered with setae; ctenidium consists of 39–43 spines, additional 7–8 setae at each side of ctenidium; posterior margin of sternite 5 bears 17–18 setae; each plate of sternite 7 with (1)–2 setae; (11–13 notopleural setae, anal sclerite with 6–7 short and 2 longer setae). Size 2.45–2.70 mm.

In five males following features have been found: 11–14 notopleural setae; tergites 2 and 3 in all specimens with distinct setae on the surface (tergite 2: 14–23, tergite 3: 7–17), in two specimens also tergite 4 with few setae on the surface, tergites 5–7 only with 2–4 short lateral setae; postspiracular sclerite finger-like, with 1–2 setae; ctenidium consists of 36–45 spines, 2–3 additional setae at each side of ctenidium; sclerite 5 with a double row of 13–15 short spines at the posterior margin. Size 2.45–2.70 mm. Genitalia as in Fig. 12, aedeagal guide (phalobase) with additional strong seta in apical third of dorsal margin.

B. (P.) burmensis Theodor differs from *B. (P.) roylii* (Westwood) in the male sex mainly by setose surface of tergites 2, 3, (4), and by the chaetotaxy of aedeagal guide.

DISTRIBUTION.. According to Maa (1977) the species has been found in Burma, Thailand, Vietnam and Indonesia (Sulawesi, Java). Laos represents a new finding place of this fly.

Penicillidia (Penicillidia) dufourii dufourii (Westwood, 1835)

SLOVAKIA. Tisovecko-Muraňský Kras, Martincova cave (7385), *Myotis blythi* (Tomes), 5. ii. 1988, 1 M, K. Hůrka leg.

BULGARIA. Kamen Brjag, Black Sea shore, 11. vii. 1986, *Myotis blythi* (Tomes), 1 M (from 2 bats), *Miniopterus schreibersi* (Natterer), 1 M (from 1 bat), K. Hůrka leg.; NE Rodopi Mts., Mechkovets Mts., 14. vii. 1986, *Myotis blythi* (Tomes), 1 M, 2 F (from 3 bats), *Myotis capaccinii* (Bonaparte), 3 M (from 1 bat), K. Hůrka leg.

KYRGYZSTAN. Osh distr., Adzhidaar-Ungur cave, 5. viii. 1984, *Myotis blythi* (Tomes), 20 M, 24 F (from 16 bats), I. Horáček leg., Sito cave, 28. vi. 1988, *Myotis blythi* (Tomes), 8 M, 10 F (from 9 bats), N. S. Rybin leg.; Kyzyl-Kijak cave, 1. vii. 1988, *Myotis blythi* (Tomes), 3 M, 6 F (from 3 bats), N. S. Rybin leg.; Barytovaya cave, 13. viii. 1988, *Myotis blythi* (Tomes), 7 M, 8 F (from 5 bats), N. S. Rybin leg.; Davachan-Ungur cave, 15. viii. 1988, *Myotis blythi* (Tomes), 3 M, 2 F (from 5 bats), N. S. Rybin leg.

INDIA. Jammu & Kashmir, Poonch valley, *Myotis blythi* (Tomes), 2 M, 2 F (from 2 bats).

The specimens from Jammu & Kashmir agree in chaetotactic characters with specimens from Middle Asia (number of notopleural setae 8–9, number of setae at posterior margin of the dorsal genital plate 7–8).
DISTRIBUTION. Continental Europe, N Africa, West and Middle Asia, West Himalaya (India: Jammu & Kashmir, Uttar Pradesh).

Penicillidia monoceros Speiser, 1900

RUSSIA Siberia, Lake Baikal, Svjatoj Nos peninsula and isthmus, Burtuj, *Myotis daubentoni* (Kuhl), 1–6 vii 1992, 1 F (from 5 bats), *Myotis ikonnikovi* Ognev, or/and *Myotis brandti* (Eversmann), 27.–29 viii. 1992, 1 M, 2 F, A Reiter leg.

DISTRIBUTION. A north Palaearctic species found in Scandinavia, Denmark, N Germany, Czech Republic, Russia (Kaliningrad, Sankt Peterburg distr., Ural Mts., Lake Baikal), NE Kazakhstan, C Mongolia and N Japan.

Streblidae

Brachytarsina (Brachytarsina) amboinensis amboinensis Rondani, 1878

LAOS Keo-Outem distr , Ban Thinkeo, 8 viii. 1989, ? host (Vespertilionidae), 1 M, 1 F, T Scholz leg

This variable species was described from Amboina (Ambon, Moluccas, Indonesia). It is widespread in the Oriental and the Australian regions, but not yet known from Laos.
DISTRIBUTION. W India (Maharashra), Sri Lanka, Nicobar Islands, Burma, Thailand, Laos, Taiwan, Okinawa Islands, Ryukyu Islands, Philippines (Luzon, Tablas, Mindanao), Malaysia (Pahang, Selangor), Indonesia (Java, Timor, Ambon). Several endemic subspecies were recognized in the Australian Region (New Guinea, Solomon Islands, New Caledonia, New Hebrides, Australia).

The fly occurs mainly on several species of the bat genus *Miniopterus*.

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BOOK REVIEW

ROLLINGHOFF M. & ROMMEL M. (eds.): **Immunologische und molekulare Parasitologie.** Jena, Stuttgart: Gustav Fischer Verlag, 1994. 240 pp. Format 154×229 mm. Hardcover, price DM 88.– ISBN 3-334-60506-X.

Both editors are professors – at University in Erlangen-Nurnberg, and at Veterinary College in Hannover (Germany). The list of contributors contains 21 acknowledged experts affiliated with institutes for microbiology, parasitology and tropical medicine in western federal states of Germany. As the editors emphasize in the preface, in the last decade molecular biology has undergone dramatic development. However, in the field of major parasitic diseases many factors remain to be elucidated. Research of molecular immunology and molecular and cellular biology makes an interdisciplinary approach inevitable. Only application of modern techniques of immunology and molecular biology brings essentially new contribution to specialized knowledge of parasite biology and genetics. Many new specific parasitic antigens have been defined. Moreover, recombinant antigens improve essentially laboratory diagnosis and constitute promising candidates for preparation of anti-parasite vaccines. Mechanisms of parasite evasion and suppression of the host immune response such as sequestration and molecular mimicry have been elucidated. The volume is composed of 12 chapters offering information on major parasitic diseases of man and livestock animals. Stressed here are molecular definitions of antigens and the host immune response. Cytokines and other factors acting in host-parasite systems are also listed here.

Chapter 1 is devoted to African trypanosomes – their morphology and life cycles, genome organization and transcription, antigenic variation and invariant surface antigens, and diagnostic and therapeutic procedures. A chance for effective vaccine preparation against African trypanosomes is rather poor with respect to variable surface glycoproteins. However, the causative agents of African sleeping sickness continue to be subjects of most intense research.

Chapter 2 examines the biology and immunology of host-parasite interactions in causative agents of cutaneous and visceral leishmanioses: *Leishmania mexicana* complex, *L. braziliensis* complex, *L. major*, *L. tropica* and four other *Leishmania* species. Characterized here is the genome organization in leishmaniae and their immunological properties. The technique of genetic manipulations enables studies on pathogenicity of procyclic and metacyclic promastigotes. Homologous recombination enables development of attenuated parasite strains and preparation of a more effective vaccine.

Chapter 3 provides new information on entamoebiasis. The purpose of this chapter is to explain differences between *Entamoeba dispar* and *E. histolytica*, furthermore the identification of IgA antibody in saliva and the preparation of effective vaccine.

Chapter 4 is concerned with eimerioses. Among about 900 eimerian species, eimeriae of domestic poultry and preparation of effective vaccine are the subjects of most intensive research at present.

Chapter 5 deals with toxoplasmosis which represents one of most extensively distributed parasitic zoonoses on the global scale. Besides general information, genome organization is outlined here. Particular cellular structures and organelles such as membranes, granules, microtubules, rhoptries and mitochondria have their corresponding genes and physiological functions. Listed here are complex factors connected with immune processes and invasion and evasion mechanisms.

Chapter 6 surveys the highly complex subject of immune reactions involved in malaria when discussing a variety of recently discovered parasitic proteins and antibodies against sporozoites and merozoites.

Chapter 7 on babesioses follows, namely on their biology, genome organization, immunity, evasion mechanisms and new diagnostic techniques.

Following **chapters 8–13** move into the area of helminthoses of importance for human and veterinary medicine, namely schistosomoses, taeniases, echonococcoses, dictyocaulosis and filarioses. Covered here are the genome of particular helminth genera and species, immune interactions in hosts and intermediary hosts, evasion mechanisms, antigenic structure and new diagnostic procedures as the polymerase chain reaction.

Each chapter is concluded with an extensive list of original scientific reports. Illustations consist of 23 microphotographs and schematic line drawings featuring life cycles of various protozoan parasites and helminths, biological and chemical structures, electrophoreograms, genetic processes and graphs. In 10 summary-type tables included are schemes of life cycles, overviews of specific names of pathogenic agents, molecular biology analyses of genes and their products, and names of commercially available vaccines. This volume is a representative of otherwise not very numerous monographs of this type offering a concise information on explosive advances and progressively forthcoming trends in modern parasitology.

Jindřich Jíra

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Afroisometrus gen. n. from Zimbabwe (Scorpiones: Buthidae)

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Abstract. *Afroisometrus* gen. n with the type species *Lychas minshullae* Fitzpatrick, 1994 is described The new genus is related to the genus *Isometrus* Hemprich & Ehrenberg, 1828, from which it differs by the absence of a subaculear tubercle and the presence of three keels on the dorsal surface of the mesosoma It differs from the genus *Lychas* C L Koch, 1845 in the absence of tibial spurs on the third and fourth legs

Taxonomy, description, new genus, new combination, Scorpiones, Buthidae, *Afroisometrus* gen. n., *Lychas minshullae*, Afrotropical region

Afroisometrus gen. n.
(Figs 1–3, Table 1)

TYPE SPECIES *Lychas minshullae* Fitzpatrick, 1994.

ETYMOLOGY. Denotes affinity to the genus *Isometrus* and the geographic distribution.
DESCRIPTION. A combination of characters differentiates this genus from all other genera of the family Buthidae. The basic trichobothrial pattern is beta (Fitzpatrick 1994: 25, fig. 6 and Sissom 1990: 70, fig. 3.3), the third and fourth legs are without tibial spurs (Sissom 1990: 74, fig. 3.8A), the sternum is subtriangular (Fitzpatrick 1994: 24, fig. 2), and tibia and tarsomeres of the first through third legs bear setae which are not arranged into a bristlecomb.

This complex of characters is exhibited by the genus *Isometrus* Hemprich & Ehrenberg, 1828, but *Afroisometrus* gen. n. has three keels on the dorsal surface of the third through sixth mesosomal segments, lacks a subaculear tooth, and has12 pectinal teeth.

The first and second metasomal segments bear 10 keels, the third and fourth segments bear 8 keels, and the fifth segment lacks keels. Other characters are given in the description of *Afroisometrus minshullae* (Fitzpatrick, 1994) below.
AFFINITIES. Differentiation from the genus *Isometrus* and inclusion in the Sissom's (1990: 96) key of genera of the family Buthidae is as follows:

Tibia and tarsomeres of legs I – III with setae not arranged into a bristlecomb.

– Subaculear tooth present, mesosoma with one keel .... *Isometrus*
– Subaculear tooth absent, mesosoma with three keels. .... *Afroisometrus* gen n

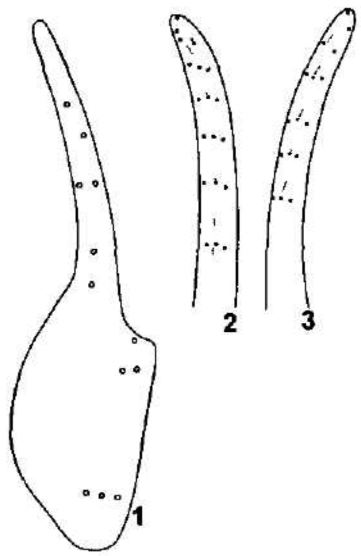
Afroisometrus minshullae (Fitzpatrick, 1994) comb. n.
(Figs 1–3, Table 1)

Lychas minshullae Fitzpatrick, 1994 24–25

MATERIAL Holotype – a female preserved in alcohol, labelled. Zimbabwe, Doddieburn Headquarters, Doddieburn Ranch (Z129A4), 18.XII.1985, leg. J. Minshull, deposited in the Natural History Museum, Bulawayo, Zimbabwe, No. NMZ/86/48.

Table 1 Measurements in millimeters of holotype of *Afroisometrus minshullae* (Fitzpatrick) comb n Line denoted „pectinal teeth" contains numbers of both left and right teeth separated by a colon

		Afroisometrus minshullae (Fitzpatrick, 1994) comb n holotype
Total length		27 3
Carapace	length	2 8
	width	2 6
Metasoma	length	15 1
segment I	length	1 6
	width	1 5
segment II	length	2 1
	width	1 4
segment III	length	2 2
	width	1 3
segment IV	length	2 7
	width	1 3
segment V	length	3 2
	width	1 3
telson	length	3 0
Pedipalp		
femur	length	2 4
	width	0 9
patella	length	3 0
	width	1 2
tibia	length	5 0
manus	width	1 1
movable finger length		3 0
Pectinal teeth		12 12



Figs 1–3 *Afroisometrus minshullae* (Fitzpatrick) comb n , holotype Fig 1 tibia of pedipalp, Fig 2 movable finger, Fig 3 fixed finger

DESCRIPTION. The length of the holotype is 27.3 mm. Measurements of the carapace, telson, segments of the metasoma and of the pedipalps, and numbers of pectinal teeth are given in Tab. 1. For the position and distribution of trichobothria on the pedipalps see Fig. 1 and Fitzpatrick 1994: 25, figs 4–8. Cutting edges of movable and fixed fingers are shown in Figs 2–3. Other characters are given in the diagnosis of *Afroisometrus* gen. n. and the description of *Afroisometrus minshullae* (Fitzpatrick 1994: 23–28) above.

DISCUSSION

Fitzpatrick placed *Afroisometrus minshullae* in the genus *Lychas* but noted certain differences. He stated that *Lychas minshullae* has tibial spurs on the third and fourth legs, but the female holotype examined by me lacks any such spurs. This important character indicates a relationship closer to *Isometrus* than to *Lychas*. However, the differences between *Afroisometrus minshullae* and *Isometrus* are profound enough to warrant erection of *Afroisometrus* gen. n..

Acknowledgements

I would like to thank M. J. Fitzpatrick of the Natural History Museum in Bulawayo, Zimbabwe, for the loan of holotype of *Lychas minshullae*, and Jiří Zídek (New Mexico Tech, Socorro, USA) for help with the language.

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BOOK REVIEW

HARTWICH G **II. Strongylida.: Strongyloidea und Ancylostomatoidea. Die Tierwelt Deutschlands. 68. Teil.** Jena-Stuttgart Gustav Fischer Verlag, 1994 157 pp Format 170×240 mm Softcover, price DM 98 – ISBN 3–334–60814–X

The author is an acknowledged authority in the field of helminthology affiliated with the Museum of Zoology in Berlin The previously (1975) published companion volume No 62 covered the nematode orders Rhabditida and Ascaridida In this volume the author presented second monograph on nematode helminths of vertebrates published in the series **Die Tierwelt Deutschlands** (founded by Friedrich Dahl in 1925) dealing with superfamilies Strongyloidea and Ancylostomatoidea, bursate phasmidians belonging to the order Strongylida (other sources introduce the order or suborder Strongylata) Strongyles and hookworms cause diseases to domestic and wild animals as well as to humans, some of them having extreme importance for hygiene and economy Thus the investigation devoted to exact determination of particular nematode species is essential for knowledge of development and spreading of these parasites as well as for prevention and control of helminthiases caused by them

The volume is well-illustrated by 27 figures composed of 170 line drawings 62 nematode species are listed here in total They have been often described under different names, introduced as synonyms Descriptions of nematode species featured in this volume base upon collections of the Museum of Zoology in Berlin and other research institutions in Beltsville, St Albans, Lyons Budweis and Budapest

The special part centers attention upon descriptions of particular taxonomical groups superfamilies, families, subfamilies, genera, subgenera and species The superfamily Strongyloidea includes the families Strongylidae, Chabertiidae and Syngamidae The superfamily Ancylostomatoidea includes the family Ancylostomatidae, commonly known as hookworms Chapters on particular taxonomical groups are concerned with detailed morphological characteristics Moreover, keys for determination of superfamilies, families, subfamilies, genera, subgenera and species are given For example the genus *Strongylus* has been divided into three subgenera *Strongylus* (*Alfortia*), *Strongylus* (*Delafondia*) and *Strongylus* (*Strongylus*), the genus *Oesophagostomum* includes four subgenera *Oesophagostomum* (*Hysteracrum*), *Oesophagostomum* (*Bosicola*) *Oesophagostomum* (*Proteracrum*) and *Oesophagostomum* (*Oesophagostomum*), etc The genus *Ancylostoma* has been divided into four subgenera, only the nominotypical taxon is looked at Besides in-depth descriptions of morphology including measurements of particular organs, outlined here are type names, occurence and localization in hosts, life cycles and geographical distribution The line drawings illustrate anterior ends with mouth parts, the buccal capsule, respectively typical of the order Strongylata, and posterior parts of females and males with characteristic expanded copulatory bursa composed of lobes, rays and the genital cone The volume is concluded with a list of host species together with their parasites and with a comprehensive list of references

As stated above, strongyles and hookworms represent an important group of causative agents of diseases in humans and animals In this volume only species occuring in Germany and adjacent areas are listed Beyond the scope of this publication it may be stressed that human hookworms afflict 20 per cent of the world population and represent major pathogens in countries with warm and moist climates since prehistorical times (for review see Helminthologia,29,1992,p 58) The canine hookworm *Ancylostoma caninum* and some members of the genera *Uncinaria* and *Bunostomum* have been diagnosed causing creeping eruption (cutaneous larva migrans) in people vacating in tropics and subtropics The gapeworms (*Syngamus*) that live in the upper air passages of various species of poultry, game birds and ruminants may cause sporadic respiratory disorders (syngamosis or mammomonogamosis) in humans Various species of nodular worms (*Oesophagostomum*) are common parasites of mammals *O bifurcum* has been reported recently as causative agent of serious intestinal disorders with high incidence rate in some African countries

Designed for researchers in biological, medical and veterinary sciences, this comprehensive and practically oriented monograph supplements classic textbooks of medical and veterinary helminthology or parasitology

Jindřich Jíra

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Results of the Czech Biological Expedition to Iran. Part 2. Arachnida: Scorpiones, with descriptions of *Iranobuthus krali* gen. n. et sp. n. and *Hottentotta zagrosensis* sp. n. (Buthidae)

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Abstract Distribution data are presented for *Androctonus amoreuxi baluchicus* (Pocock, 1900), *Compsobuthus matthiesseni* (Birula, 1905), *Hottentotta saulcyi* (Simon, 1880), *Hottentotta schach* (Birula, 1905), *Mesobuthus eupeus* (C. L. Koch, 1839), *Odontobuthus doriae* (Thorell, 1876), *Odontobuthus odonturus* Pocock, 1897, *Orthochirus* sp. n. ?, *Paraorthochirus glabrifrons* (Kraepelin, 1903), *Paraorthochirus goyffoni* Lourenço & Vachon, 1995, and *Hemiscorpius lepturus* Peters, 1862, all collected by members of the Czech Biological Expedition Iran 1996. *Iranobuthus* gen. n. with the type species *I. krali* sp. n. is described. The new genus is related to the genera *Androctonus* Hemprich & Ehrenberg, 1828, *Buthus* Leach, 1815, *Hottentotta* Birula, 1908, and *Mesobuthus* Vachon, 1950 by the presence of central medial and posterior medial carinae on the carapace that merge and form a continuous linear series of granules at the posterior margin. It differs from genera possessing similar characters, such as *Compsobuthus* Vachon, 1949 and *Darchenia* Vachon, 1977, in size (total length of 82 mm) and in having dorsal granulated keels only on the second through fourth metasomal segments. *Hottentotta zagrosensis* sp. n. is described. Its black coloration differentiates it from all other species of *Hottentotta* Birula, 1908 known from Iran. A list of all 32 species known and believed to occur in Iran is given.

Taxonomy, descriptions, new genus, new species, distribution, Scorpiones, Buthidae, *Iranobuthus* gen. n., *Hottentotta*, Palaearctic region

INTRODUCTION

Thanks to organizational efforts of Mrs Zdena Hodková of Prague, the Czech Biological Expedition Iran 1996 took place between 20.IV. and 20.V.1996 (for details see Frynta et al. 1997). Members of the expedition collected 153 scorpions belonging to 13 species, 9 genera, and two families. The last comprehensive study of Iranian scorpions (Farzanpay 1988) lists 23 species, 17 genera (of which, however four are nomina nuda), and two families. For the map includes all localities that produced insects and arachnids see Frynta et al. 1997.

Explanatory notes: M = male, F = female, A = specimens preserved in 75% alcohol, E = dry-mounted specimens. Unless noted otherwise, the material is deposited in the author's collection.

RESULTS

Androctonus amoreuxi baluchicus (Pocock, 1900)

MATERIAL. Iran, Esfahan prov., alt. ca 800 m, SEE of Kashan, Jafar Abad vill. env., 33° 55' N 51° 53' E, Loc. No. 2, 26.–27.IV.1996, 1 immature MA, leg. M. Kaftan

COMMENTS. This subspecies was described from Pakistan, northern Baluchistan (Pocock 1900: 16), and was subseguently found in Afghanistan (Vachon 1959: 125, Kovařík 1993: 201) and

Iran (Vachon 1959: 125, Vachon 1966: 209, Habibi 1971: 42). Farzanpay (1988: 35) doubted the presence of *A. amoreuxi* (Audouin, 1825) in Iran and thought that specimens identified by Habibi as *A. amoreuxi* are only a local form of *A. crassicauda*. Therefore, he did not include *A. amoreuxi* among the Iranian taxa.

The immature male examined is 58 mm long and has 28 and 30 pectinal teeth.

Vachon and Habibi (Vachon 1966: 209, Habibi 1971: 42) listed also the subspecies *A. amoreuxi finitimus* (Pocock, 1897) from Iran. However, I concur with Farzanpay (1988) in that this subspecies most likely does not occur in Iran, and therefore it is not included in the checklist below.

Compsobuthus matthiesseni (Birula, 1905)

MATERIAL. Iran, Fars prov., alt. ca 1700 m, 10 km E of Sivand vill., 30° 05' N 52° 55' E, Loc. No. 10, 29.–30. IV. 1996, 1FA, leg. M. Kaftan, 1FA, leg. D. Král, 3FA, leg. J. Pitulová, alt. ca 1000 m, Zagros Mts., Abshar vill. env., 30° 23' N 51° 30' E, Loc. No. 14, 2.–3. V. 1996, 1FA 1FE, leg. M. Kaftan; Lorestan prov., alt. ca 1000 m, Zagros Mts., 30 km W of Khorram Abad, Gholaman vill. env., 33° 25' N 48° 12' E, Loc. No. 22, 6.–7. V. 1996, 2M 6FA, leg. D. Král; Hamadan prov., ca 2000 m, 35 km SE of Hamadan, Gonbad vill. env., 34° 40' N 48° 45' E, Loc. No. 23, 7.–8. V. 1996, 1M 3FA, leg. M. Kaftan, 8M 17FA 1ME, leg. V. Šejna.

COMMENTS. *Compsobuthus matthiesseni* was described by Birula (Birula 1905: 142) as a subspecies of *C. acutecarinatus*. The species is well characterized by the pronounced difference in length of the metasoma between males and females, which is present also in immature specimens. This character unequivocally differentiates *C. matthiesseni* from *C. acutecarinatus*. In the latter the metasoma is of approximately the same length in both sexes. In contrast to *C. rugosulus*, in *C. matthiesseni* the cutting edges on movable fingers of the pedipalps lack external granules.

C. matthiesseni occurs in Iraq and Iran (Vachon 1966: 211), and in Turkey (Kovařík 1996: 53).

Hottentotta saulcyi (Simon, 1880)

MATERIAL. Iran, Lorestan prov., alt. ca 1000 m, Zagros Mts., 30 km W of Khorram Abad, Gholaman vill. env., 33° 25' N 48° 12' E, Loc. No. 22, 6.–7. V. 1996, 1FA, leg. I. Hrdý, Hamadan prov., ca 2000 m, 35 km SE of Hamadan, Gonbad vill. env., 34° 40' N 48° 45' E, Loc. No. 23, 7.–8. V. 1996, 1FE 2juvs A, leg. M. Kaftan.

COMMENTS. *Hottentotta saulcyi* was described by Simon (1880: 378) as *Buthus saulcyi*. Simon gave total length of 93 mm and 29–33 pectinal teeth. The females I have examined are 75 and 93 mm long and have 24–27 pectinal teeth. The two immatures are 32 mm long and have 28–32 pectinal teeth.

This species has been so far known from Iraq and Iran (Kovařík 1992: 183), but there is also one male from Afghanistan (labelled as from: „Djebel us Saraj“) in my collection.

Hottentotta schach (Birula, 1905)

MATERIAL. Iran, Fars prov., alt. ca 1700 m, 10 km E of Sivand vill., 30° 05' N 52° 55' E, Loc. No. 10, 29.–30. IV. 1996, 1FA, leg. M. Kaftan, 1ME, leg. V. Šejna.

COMMENTS. *Hottentotta schach* was described by Birula (Birula 1905: 134) as *Buthus schach*. Birula gave total length of 130 mm and 29 pectinal teeth for the female and 101 mm and 34–35 pectinal teeth for the male. The female examined is 120 mm long and has 26 and 27 pectinal teeth, whereas the male is 110 mm long and has 33 and 34 pectinal teeth.

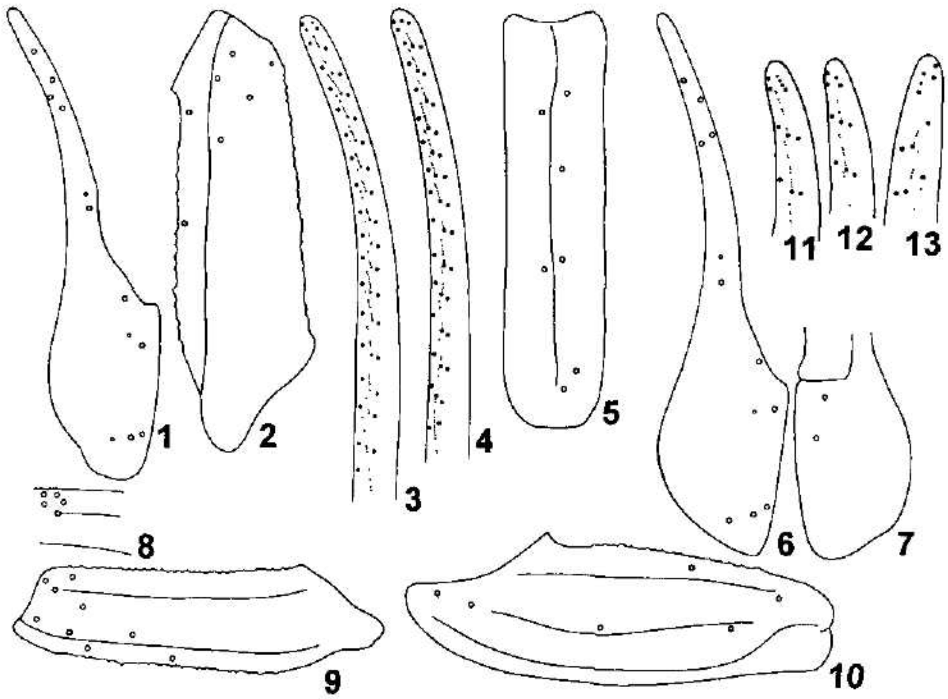
This species is known only from Iraq and Iran.

Hottentotta zagrosensis sp. n.
(Figs 1–3, 14, Table 1)

TYPE MATERIAL. Holotype – male, allotype and paratypes Nos 1–4 labelled: Iran, Fars prov., alt. ca 1000 m, Zagros Mts., Abshar vill. env., 30° 23' N 51° 30' E, Loc. No. 14, 2.–3.V.1996; holotype and paratype No 1 leg. J. Pitulová, allotype and paratypes No 2 and No. 3 leg V. Šejna, paratype No. 4 leg. D. Král. Paratype No. 1 and its ecdysis mounted dry, other type specimens preserved in 75 % alcohol. Type specimens currently housed in the author's collection, will be deposited in the Department of Invertebrate Zoology, National Museum (Natural History), Prague.

TYPE LOCALITY. Iran, Fars prov., alt. ca 1000 m, Zagros Mts., Abshar vill. env., 30° 23' N 51° 30' E. Specimens were collected in a dry river bed with rocky banks, fields, and scattered oaks cf. *Quercus brantii*.

ETYMOLOGY. Named after the Zagros Mts., to which the species appears to be restricted.
DESCRIPTION. The total length is 102 mm in the male holotype, 103 mm in the female allotype, and 83 mm in the immature male paratype No. 1, whose ecdysis measures 63 mm. Paratypes Nos 2–4 measure 62, 66, and 50 mm, respectively. The habitus is shown in Fig. 14. Measure-



Figs 1–13. Figs 1–3. *Hottentotta zagrosensis* sp. n. (holotype). Fig. 1. Tibia external, Fig. 2. Femur dorsal, Fig. 3. Movable finger. Figs 4–10. *Iranobuthus krali* gen. n. et sp. n. (holotype) Fig. 4. Movable finger, Fig. 5. Patella external, Fig. 6. Tibia external, Fig. 7. Tibia ventral, Fig. 8. Femur internal, Fig. 9. Femur dorsal, Fig. 10, Patella dorsal. Fig. 11. *Odontobuthus doriae* (male from Iran). Movable finger. Figs 12–13. *Odontobuthus odonturus* (female from Iran). Fig. 12. Right movable finger, Fig. 13. Left movable finger. Designation and description of trichobothria according to Vachon (1974).

ments of the carapace, telson, segments of the metasoma and of the pedipalps, and numbers of pectinal teeth in the holotype and allotype are given in Table 1. The male has 34 and 35 pectinal teeth, the female (allotype) has 31 and 33 pectinal teeth, and immature specimens (paratypes Nos 1–4) have 27–36 pectinal teeth. For the position and distribution of trichobothria on the pedipalps see Figs 1–2. The position of the trichobothrium Esb on the manus of the tibia (Fig. 1) is variable. Fig. 1 shows its position in the holotype. The allotype and paratypes have this trichobothrium situated in the same plane as trichobothrium Est or closer to trichobothrium Eb. Trichobothria Eb3, Esb, esb of tibia (Fig. 1), and d2 of femur (Fig. 2) are smaller than others.

Nearly the entire animal is hirsute. Pedipalps, the dorsal surface of the mesosoma, legs, lateral and ventral surfaces of metasomal segments, and the vesicle are densely hirsute, whereas the ventral surface of the mesosoma is hirsute only sparsely and the dorsal surface of the metasoma, ventral surface of femur and patella of pedipalps, and aculeus of telson lack hair cover. The male has longer and narrower metasomal segments than the female (Tab. 1).

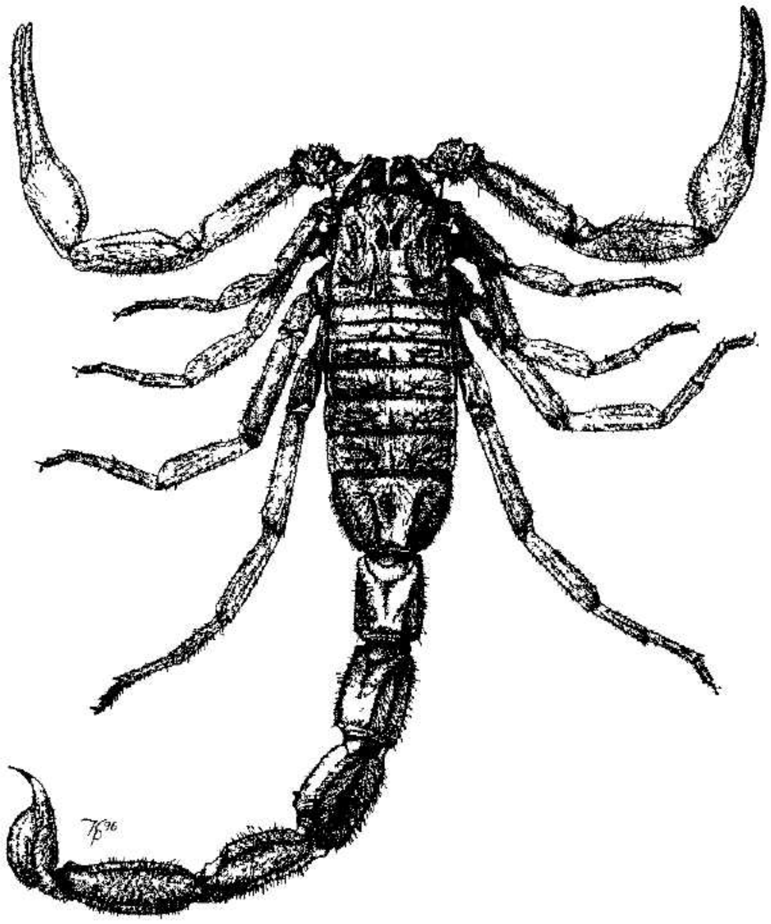


Fig. 14. *Hottentotta zagrosensis* sp. n. (holotype). Dorsal aspect

Color is black except reddish brown tibia of pedipalps. Sometimes yellow ends of the first and second tarsomeres, marbled coxa and trochanter on the ventral side of mesosoma, and yellowish-brown pecten.

The chelicera has dorsal protuberances which are less conspicuous in immature specimens. The posterodorsal part of the chelicera is smooth and black, but in immature specimens it is reticulated.

The femur of pedipalps has five keels and a row of granules in the middle part of the internal surface. The ventral surfaces of femur and patella are smooth to glossy. The patella has eight keels. The tibia lacks keels. The movable fingers of the pedipalps have 16 cutting edges (Fig. 3).

The mesosoma has three keels on the dorsal surface and two keels on the ventral surface with the exception of the seventh segment, whose ventral surface bears four well marked keels.

The first and second segments of metasoma bear 10 keels, the third segment bears 8 or 10 keels, the fourth segment bears 8 keels, and the fifth segment bears only 5 keels. The dorsal surface is smooth and glossy, with the fifth segment bearing two short, inconspicuous keels. A subaculear tooth is absent, but the ventral surface of the aculeus bears five rows of granules.

AFFINITIES. The described features distinguish *Hottentotta zagrosensis* sp. n. from all other species of the genus. The uniformly black color differentiates *Hottentotta zagrosensis* sp. n. from all other Iranian *Hottentotta* Birula, 1908 and most other species of the genus. The same coloration is present only in *H. franzwerneri gentili* (Pallary, 1924) from Morocco and *H. judaicus* (Simon, 1872) from Israel, the Jordan and Syria.

H. judaicus is easily distinguished from *Hottentotta zagrosensis* sp. n. by its sparse hair cover, by having only 13–14 cutting edges on the pedipalps (Levy & Amitai 1980: 57), and by the number of pectinal teeth that in *H. judaicus* number 22–27 in the female and 27–32 in the male (Levy & Amitai 1980: 55). Another difference is in the dorsolateral keels of the first through fourth metasomal segments, which in *Hottentotta zagrosensis* sp. n. consist of minute, low, and always apically rounded granules of even size. In *H. judaicus* as well as *H. f. gentili* these keels consist of taller granules that increase in size posteriorly, with the second through fourth granules tall and pointed.

Of these black species of *Hottentotta*, the new species *H. zagrosensis* sp. n. is most similar to *H. f. gentili*, namely in the hair cover. However, *H. f. gentili* is less hirsute on the aculeus of telson and on the dorsal surface of the mesosoma. In *H. f. gentili* the movable fingers of the pedipalps have 14–15 cutting edges, and there are 26–31 pectinal teeth in females and 32–38 in males (Vachon 1952: 236).

Iranobuthus gen. n.

(Figs 4–10, 15, Table 1)

TYPE SPECIES. *Iranobuthus krali* sp. n.

ETYMOLOGY. The generic name combines relationship to the genera of the *Buthus* type and the geographic distribution and it is a masculinum in gender.

DESCRIPTION. A combination of characters differentiates this genus from all other genera of the family Buthidae. The basic trichobothrial pattern is beta (Fig. 9 and Sissom 1990: 70, fig. 3.3). The third and fourth legs bear tibial spurs (Sissom 1990: 74, fig. 3.8). The pectines bear fulcra (Sissom 1990: 93, fig. 3.17 D). The movable fingers of pedipalps have cutting edges and four proximal to terminal granules (Fig. 4). The fixed finger of the chelicera has two ventral denticles. The dorsal surface of mesosomal segments bears three keels (Fig. 15). The carapace has distinct carinae (Fig. 15). The trichobothrium eb in situated on the fixed finger of pedipalps and

Tab. 1. Measurements in millimeters of ***Iranobuthus krali*** gen. et sp. n. and ***Hottentotta zagrosensis*** sp. n. Line denoted „pectinal teeth" contains numbers of both left and right teeth separated by a colon

		Iranobuthus krali gen. n. et sp. n. holotype	*Hottentotta zagrosensis* sp. n. holotype, male	*Hottentotta zagrosensis* sp. n. allotype, female
Total	length	82.0	102.0	103.0
Carapace	length	8.5	10.9	10.7
	width	9.0	11.7	12.0
Metasoma	length	50	64	58
segment I	length	7.1	7.6	6.6
	width	4.8	6.5	6.9
segment II	length	7.4	8.7	8.0
	width	4.4	6.4	6.8
segment III	length	7.6	10.0	8.6
	width	4.4	6.4	6.8
segment IV	length	8.4	11.3	10.1
	width	4.2	6.0	6.4
segment V	length	9.6	12.9	12.0
	width	4.0	5.6	5.6
telson	length	8.7	12.0	12.0
Pedipalp				
femur	length	9.4	11.5	10.3
	width	2.2	2.6	3.0
patella	length	10.0	13.0	12.0
	width	3.2	3.7	4.0
tibia	length	16.2	20.0	20.0
manus	width	3.3	4.5	4.5
movable finger	length	11.1	14.4	14.1
Pectinal teeth		31:31	35:34	33:31

does not reach on the manus as in genus *Kraepelinia* Vachon, 1974 (Fig. 6 and Vachon 1974: 950, fig. 238). The ventral surface of the metasoma lacks protuberances characteristic of the genus *Odontobuthus* Vachon, 1950 (Pocock 1900: 17, fig. 8b). The central medial and posterior medial carinae on the carapace join to form a continuous linear series of granules at the posterior margin. The carapace lacks posterior lateral keels (Fig. 15 and Sissom 1990: 92, figs 3.17a–c).

Iranobuthus gen. n. is further characterized by the number and distribution of trichobothria on the pedipalps (Figs 5–10), size (total length of 82 mm), the presence of only dorsal granulated keels on the second through fourth metasomal segments, and other features included in the description of *Iranobuthus krali* sp. n. below.

AFFINITIES. *Iranobuthus* gen. n. is easily distinguished from *Compsobuthus* Vachon, 1949 and *Darchenia* Vachon, 1977 by its size. The holotype of *Iranobuthus krali* sp. n. is 82 mm long, whereas *Darchenia* from Africa (Lourenço 1995: 197) is only 20.5 mm long (Vachon 1977: 289) and *Compsobuthus* species range between 20 and 50 mm. Moreover, *Darchenia* has the trichobothrium db of pedipalps situated between trichobothria et and est (Vachon 1977: 289), whereas *Iranobuthus* gen. n. has this trichobothrium situated between trichobothria est and esb (Fig. 6). *Compsobuthus* has trichobothrium db in a position similar to *Iranobuthus* gen. n., but farther away from trichobothrium est. In *Compsobuthus* the cutting edges on movable fingers of the pedipalps range from 9 to 12 and pectinal teeth range from 12 to 29, but most species have less than 20 *Iranobuthus* gen n has 14 cutting edges (Fig 4) and 31 pectinal teeth Marked differences can be discerned also in the habitus

The genera *Androctonus* Hemprich & Ehremberg, 1828, *Buthus* Leach, 1815, *Hottentotta* and *Mesobuthus* Vachon, 1950 are of similar size, but *Iranobuthus* gen n differs from them in that the central medial and posterior medial carinae on the carapace join and form a continuous linear series of granules at the posterior margin, and the carapace lacks posterior lateral keels (Fig 15 and Sissom 1990 92, figs 3 17 a–c)

Iranobuthus krali sp. n.

(Figs 4–10, 15, Table 1)

TYPE MATERIAL Holotype male preserved in 75% alcohol, labelled Iran, Fars prov , alt ca 1700 m 10 km E of Sivand vill 30° 05' N 52° 55' E, Loc No 10, 29 – 30 IV 1996 leg D Král It is currently in the author's collection, but will be deposited in the Department of Invertebrate Zoology, National Museum, Prague

TYPE LOCALITY The holotype was found under stone on a limestone hillside covered with xerophytic vegetation

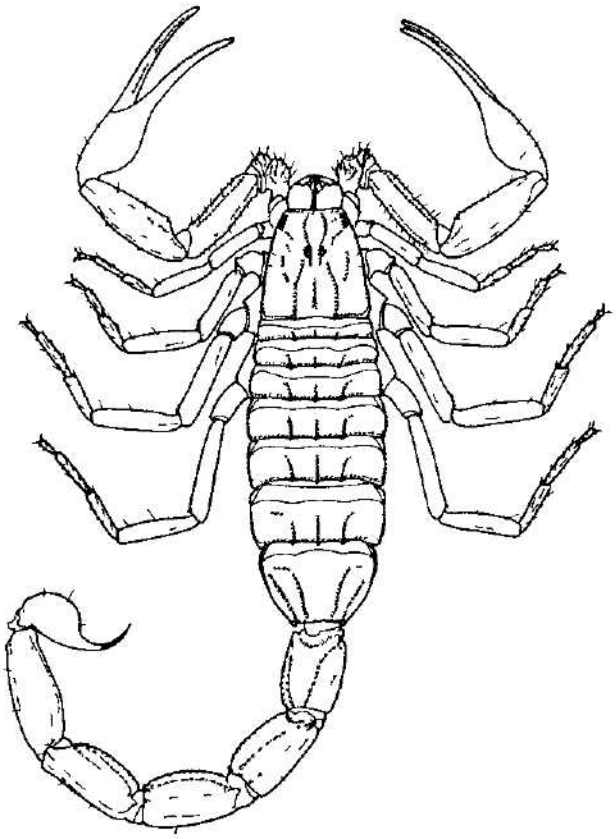


Fig 15 *Iranobuthus krali* gen et sp n , (holotype) Dorsal aspect

ETYMOLOGY. Named after the collector.

DESCRIPTION. The holotype is 82 mm long and has 31 pectinal teeth. The habitus is shown in Fig. 15. Measurements of the carapace, telson, segments of the metasoma and of pedipalps, and numbers of pectinal teeth are given in Table 1. For the position and distribution of trichobothria on the pedipalps see Figs 1–2.

The base color is yellow, with only the vicinity of the medial and posterior eyes and the aculeus being black.

The carapace has keels and several solitary granules. Three pairs of lateral eyes are situated in a row distant from the carapace margin.

The third and fourth legs possess tibial and pedal spurs. The entire first and second tarsomeres are covered with long, dense hair, whereas the tibia is hirsute only on the inner surface, and the trochanter and femur bear only several scattered hairs.

The mesosoma has three median keels. The keels of individual tergites each terminate in a larger granule that overlaps the hind margin of the tergite. In addition, the hind margin bears a transverse row of granules.

The metasoma bears several scattered hairs. The first and second metasomal segments possess 10 keels each, of which four keels on the first segment and six keels on the second segment are smooth and blunt. Only four dorsal keels on the second segment and four dorsal and two lateral keels on the first segment are covered with blunt granules which do not merge. The last granule is slightly larger and pointed. The third and fourth metasomal segments bear eight keels, of which the two dorsal ones are covered with minute, non-merging granules. The ventral surface of the fifth metasomal segment has one keel composed of minute granules and several scattered granules. The telson is smooth, without a subaculear tubercle and with several scattered hairs.

AFFINITIES. Differential diagnosis of the new species is included in the generic diagnosis.

Mesobuthus eupeus (C. L. Koch, 1839)

MATERIAL. Iran, Esfahan prov., alt. ca 2000–2200 m, Zagros Mts., Qamishlu vill. env., 32° 02' N 51° 29' E, Loc. No. 5, 27.–28 IV 1996, 4F 2juvsA, leg. M. Kaftan, 1MA, leg. D. Král, 1FA, leg. J. Pitulová; Fars prov., alt. ca 1700 m, 10 km E of Sivand vill., 30° 05' N 52° 55' E, Loc. No. 10, 29 – 30 IV 1996, 1FA, leg. M. Kaftan, alt. ca 2200 m, Zagros Mts., road Dasht-e-Arzhan - Tang-Abolhayat, 30 IV –1 V.1996, 1juv. A, leg. V. Šejna, alt. ca 1000 m, Zagros Mts., Abshar vill. env., 30° 23 N' 51° 30' E, Loc. No. 14, 2 –3 V.1996, 1FA, leg. J. Pitulová; Boyerahmad-va-Kuhgiluyeh prov., alt. ca 1800–2300 m, Zagros Mts., Kuh-e-Dinar Ridge, 10 km NE of Yasuj, by road, 30° 39' N 51° 36' E, Loc. No. 13, 1 –2 V 1996, 1juv. A, leg. V. Šejna, 1FA, leg. J. Pitulová; prov. Bushehr, alt. ca 50 m, 15 km NW of Bandar-e-Gonaveh, Chahak vill. env., 29° 40' N 50° 25' E, Loc. No. 19, 3 –5.V 1996, 3MA, leg. M. Kaftan, 1M 1juv. A, leg. V. Šejna; Khuzestan prov., alt. ca 100 m, Choqa-Zanbil (zikkurat) env., 32° 00' N 48° 31' E, Loc. No. 20, 5 –6 V.1996, 1MA, leg. M. Kaftan, 3M 1F 1juv. A, leg. D. Král, Hamadan prov., ca 2000 m, 35 km SE of Hamadan, Gonbad vill. env., 34° 40' N 48° 45' E, Loc. No. 23, 7–8 V 1996, 1juv. A, leg. D. Král; Mazandaran prov., alt. ca 1800–2500 m, Alborz Mts. N slopes, Vali Abad vill. env., 36° 14' N 51° 18' E, Loc. No. 25, 8 –10.V 1996, 3M 6F 5juvsA, leg. D. Král, 4F 1juv. A, leg. V. Šejna, Azarbayejan-e-Gharbi prov., alt. ca 1000 m, 8 km N of Ev Oghli, Markan vill. env., 13.V.1996, 1juv. A, leg. V. Šejna.

COMMENTS. *Mesobuthus eupeus* is widely distributed from Turkey (e. g. Kovařík 1996: 54) to Mongolia (e. g. Stahnke 1967: 61) and forms many subspecies, nine in Iran alone (Farzanpay 1988: 38, 1986: 333–335). Some of the subspecies are controversial and a revision of the entire species is needed (Farzanpay 1988: 38). The hitherto published criteria are at the most part inadequate for precise determination below the species level. For this reason I have not attempted such determination, although the material includes at last two subspecies (*M. e.* cf. *eupeus* from most of the localities and *M. eupeus* subsp. ? from Chahak and Choqa-Zanbil).

Odontobuthus doriae (Thorell, 1876)

(Fig 11)

MATERIAL Iran, Esfahan prov , alt ca 800 m, SEE of Kashan, Jafar Abad vill env , 33° 55' N 51° 53' E, Loc No 2, 26 – 27 IV 1996, 1MA, leg M Kaftan

COMMENTS *Odontobuthus doriae* was described as *Buthus doriae* (Thorell 1876 107) and later became the type species of the genus *Odontobuthus* Vachon, 1950 This genus has only two species *O doriae* and *O odonturus*

Thorell (1876) stated that *O doriae* has a total length of 74 mm and 20–22 pectinal teeth The male from Iran is immature, with a total length of 53 mm and 31–32 pectinal teeth

O doriae is known from Iran, Iraq (Birula 1917 239), and Pakistan (Minnocci 1974 28)

Odontobuthus odonturus Pocock, 1897

(Figs 12–13)

MATERIAL Iran, Bushehr prov , alt ca 50m, 15 km NW of Bandar e-Gonaveh, Chahak vill env , 29° 40' N 50° 25 E Loc No 19, 3 –5 V 1996, 1ME 1FA, leg M Kaftan, 1FA, leg D Kral

COMMENTS *Odontobuthus odonturus* was described as *Buthus odonturus* (Pocock 1897 104) based on a male from India with a total length of 58 mm and 28–29 pectinal teeth Pocock (1897) distinguished it from *O doriae* on three lobes laterally terminating the fifth metasomal segment *O doriae* has only two such lobes

The genus *Odontobuthus* is well characterized by protuberances on the ventral side of the metasomal segments (Pocock 1900 17, fig 8b), but it is often characterized also by a short row of five to seven smaller granules on the tips of movable fingers of the pedipalps (Fig 11) – e g in Sissom's (1990 98) key of the family Buthidae However, the number of granules is intraspecifically variable An examined male of *O odonturus* from Iran has three such granules, whereas a female (leg D Král) has three granules on the left movable finger (Fig 13) but only two external basal granules on the right movable finger (Fig 12), like species of the genus *Mesobuthus* Vachon, 1950 Another female has four terminal granules on the right movable finger, but on the left finger no such granules precede the first granular row

The females are 82 and 86 mm long and have 25–28 pectinal teeth, the male is 73 mm long and has 32 pectinal teeth Apart from India and Iran, the species is known also from Pakistan (Birula, 1917 239)

Orthochirus sp. n. ?

MATERIAL Iran, Esfahan prov , alt ca 2000–2200 m, Zagros Mts , Qamishlu vill env , 32° 02' N 51° 29' E, Loc No 5, 27 28 IV 1996, 1MA, leg M Kaftan, Boyerahmad-va-Kuhgiluyeh prov , alt ca 1800–2300 m, Zagros Mts Kuh-e Dinar Ridge, 10 km NE of Yasuj, by road, 30° 39' N 51° 36' E, Loc No 13, 1 –2 V 1996, 1MA, leg J Pitulova, Bushehr prov , alt ca 50 m, 15 km NW of Bandar-e Gonaveh, Chahak vill env , 29° 40' N 50° 25' E, Loc No 19, 3 –5 V 1996 1M 1FA leg M Kaftan 1FA, leg D Kral, Khuzestan prov , alt ca 100 m , Choqa-Zanbil (zikkurat) env , 32° 00' N 48° 31' E, Loc No 20, 5 –6 V 1996, 1MA, leg M Kaftan

COMMENTS *O scrobiculosus* differs from these Iranian specimens in the absence of external granules on the movable fingers of the pedipalps *Orthochirus* sp n ? has eight cutting edges with seven external granules on the movable fingers and differs in coloration as well It is almost entirely black, with only the tibia of pedipalps and metatarsi of legs yellow and fingers of the pedipalps yellow to yellowish brown The specimens are up to 40 mm long and have 18–20 pectinal teeth

I surmise that this is a new species but defer formally describing and naming it until criteria for differentiating among the species and subspecies of *Orthochirus* become less equivocal A revision of the genus *Orthochirus* has been repeatedly advocated (Levy & Amitai 1980 94, Fet 1988 116, Kovařík 1993 203, Kovařík 1996 181) Although Tikader & Bastawade presented a key to the species of *Orthochirus* from India (Tikader & Bastawade 1983 113), they used variable characters and included *Orthochirus melanurus* (Kessler, 1874) whose status is dubious

Paraorthochirus glabrifrons **(Kraepelin, 1903)**

MATERIAL Iran Hamadan prov , ca 2000 m, 35 km SE of Hamadan, Gonbad vill env , 34° 40 N 48° 45' E, Loc No 23, 7 8 V 1996, 1M 1F 1juv A leg V Šejna

COMMENTS *Paraorthochirus glabrifrons* was described as *Butheolus glabrifrons* (Kraepelin 1903 564), later placed in the genus *Orthochirus* Karsch, 1891, and in turn transferred to the genus *Paraorthochirus* Lourenço & Vachon, 1995 (= *Pseudoorthochirus* [sic] Lourenço & Vachon 1995 304) based on the presence of trichobothrium d2 on the dorsal surface of the femur

Kraepelin gave the type locality at „Mascat" (Kraepelin 1903 565), but Lourenço & Vachon (1995 298) list it as „sud de la Perse" In my opinion, this species occurs only in Iran

According to Kraepelin (1903 564), *Paraorthochirus glabrifrons* has 19–21 pectinal teeth whereas Lourenço & Vachon (1995) found 18–20 pectinal teeth in the female and 21–24 in the male The adult male examined in this study has a total length of 38 mm and 24 pectinal teeth, the female has a total length of 41 mm and 20 pectinal teeth, and an immature male has a total length of 17 mm and 21 pectinal teeth

Paraorthochirus goyffoni **Lourenço & Vachon, 1995**

MATERIAL Iran, Fars prov , alt ca 1000 m, Zagros Mts , Abshar vill env , 30° 23 N' 51° 30' E, Loc No 14, 2 –3 V 1996 2juvsA, leg V Šejna

COMMENTS *Paraorthochirus goyffoni* was described from Bandar-Langeh, Iran (Lourenço & Vachon 1995 301) The occurrence of two specimens at Abshar vill env shows that the species occupies a larger area

The two examined juveniles are 23 5 mm (male) and 17 mm (female) long and have 22 and 20 pectinal teeth, respectively

Hemiscorpius lepturus **Peters, 1862**

MATERIAL Iran, Fars prov , alt ca 1700 m, 10 km E of Sivand vill , 30° 05' N 52° 55' E, Loc No 10, 29 – 30 IV 1996, 3M 1F 1juv A, leg M Kaftan, 1M 3F 4juvsA, leg D Kral, 2F 2juvsA, leg J Pitulova, 1M 1F1juv A leg V Šejna, alt ca 1000 m Zagros Mts Abshar vill env , 30° 23' N 51° 30' E, Loc No 14, 2 –3 V 1996 2FA, leg M Kaftan, 1F 1juv A, leg D Kral 1M 1FA 2juvsA leg J Pitulova, 1juv A, leg V Šejna, Boyerahmad-va-Kuhgiluyeh prov , alt ca 1800–2300 m Zagros Mts , Kuh e Dinar Ridge, 10 km NE of Yasuj, by road, 30° 39' N 51° 36' E, Loc No 13, 1 –2 V 1996, 1F 1juv A, leg J Pitulova Lorestan prov alt ca 1000 m, Zagros Mts , 30 km W of Khorram Abad Gholaman vill env , 33° 25' N 48° 12' E Loc No 22, 6 –7 V 1996, 1F 1MA, leg D Kral, Hamadan prov , ca 2000 m, 35 km SE of Hamadan, Gonbad vill env , 34° 40 N 48° 45' E, Loc No 23, 7 – 8 V 1996, 2FA, leg M Kaftan

COMMENTS *Hemiscorpius lepturus* was described from Baghdad, Iraq (Peters 1862 426) From *H maindroni* Kraepelin, 1901, which appears to have been incorrectly listed from Iran, *H lepturus* differs in overall length and the number of pectinal teeth According to Kraepelin (1901 16), the male of *H maindroni* reaches 38 mm and has 12–13 pectinal teeth, and the female reaches 33 mm and has 9–10 pectinal teeth. Kraepelin (1899: 142) gave a total length of up to 66 mm and 15–16 pectinal teeth for the male and up to 45 mm and nine pectinal teeth for the female of *H. lepturus*. The newly collected males of *H. lepturus* from Iran reach 64 mm and have 14–16 pectinal teeth, whereas the females reach 57 mm and have 7–16 pectinal teeth (most freguently 9–11, twice 8, and once 7, 13 and 16, respectively).

CHECKLIST OF SCORPIONS FROM IRAN

(compiled from Pocock (1889) – 1, Pocock (1900) – 2, Birula (1900) – 3, Birula (1903) – 4, Birula (1904) – 5, Birula (1905) – 6, Birula (1911) – 7, Birula (1917) – 8, Birula (1918) – 9, Vachon (1958) – 10, Vachon (1959) – 11, Bucherl (1959) – 12, Vachon (1966) – 13, Vachon & Stockmann (1968) – 14, Habibi (1971) – 15, Whittick (1971) – 16, Farzanpay & Pretzmann (1974) – 17, Minnocci (1974) – 18, Vachon (1974) – 19, Francke (1980) – 20, Farzanpay (1986) – 21, Fet (1988) – 22, Farzanpay (1988) – 23, Dehghani (1989) – 24, Fet (1994) – 25, Kovařík (1992) – 26, Lourenço & Vachon (1995) – 27, Lourenço (1996) – 28, and author's collection – 29)

Buthidae Simon, 1879

Androctonus amoreuxi baluchicus (Pocock, 1900)	(11, 13, 15, 29)
Androctonus crassicauda crassicauda (Olivier, 1807)	(12, 13, 15, 16, 17, 22, 23, 26)
Apistobuthus pterygocercus Finnegan, 1932	(23)
Buthacus leptochelys leptochelys (Hemprich & Ehrenberg, 1829)	(13, 15, 18, 23)
Buthacus tadmorensis (Simon, 1892)	(13, 15, 18)
Compsobuthus acutecarinatus (Simon, 1882)	(17, 18, 29)
Compsobuthus matthiesseni (Birula, 1905)	(13, 15, 18, 23, 29)
Compsobuthus rugosulus (Pocock, 1900)	(13, 15, 18, 23)
? *Hottentotta alticola* (Pocock, 1895)	(23)
? *Hottentotta jayakari* (Pocock, 1895)	(23)
Hottentotta saulcyi (Simon, 1880)	(13, 15, 23, 26, 29)
Hottentotta schach (Birula, 1905)	(11, 13, 14, 15, 17, 18, 23, 29)
Hottentotta zagrosensis **sp. n.**	(29)
Iranobuthus krali **gen. n. et sp. n.**	(29)
Kraepelinia palpator (Birula, 1903)	(4, 8, 13, 15, 18, 22, 23, 25)
Liobuthus kessleri Birula, 1898	(10, 13, 15, 22, 23)
Mesobuthus caucasicus caucasicus (Nordmann, 1840)	(13, 15, 22, 25)
Mesobuthus caucasicus intermedius (Birula, 1897)	(13, 15, 22, 25)
Mesobuthus caucasicus parthorum (Pocock, 1889)	(11, 13, 15, 22, 25)
Mesobuthus eupeus afghanus (Pocock, 1889)	(8, 11, 13, 15, 22, 23, 25)
Mesobuthus eupeus eupeus (C. L. Koch, 1839)	(5, 13, 15, 22, 23, 25, ? 29)
Mesobuthus eupeus iranus (Birula, 1917)	(8, 18, 22, 25)
Mesobuthus eupeus kirmanensis (Birula, 1900)	(3, 6, 11, 13, 15, 18, 22, 23, 25)
? *Mesobuthus eupeus macmahoni* (Pocock, 1900)	(15)
Mesobuthus eupeus pachysoma (Birula, 1900)	(3, 13, 15, 18, 22, 25)
Mesobuthus eupeus persicus (Pocock, 1899)	(11, 13, 15, 18, 22, 25)
Mesobuthus eupeus phillippovitschi (Birula, 1905)	(6, 7, 8, 9, 11, 13, 15, 18, 22, 23, 25)
Mesobuthus eupeus phillipsii (Pocock, 1889)	(1, 11, 13, 15, 18, 22, 23, 25)
Mesobuthus eupeus thersites (C. L. Koch, 1839)	(13, 15, 18, 21, 22, 25)
Mesobuthus zarudnyi zarudnyi (Birula, 1900)	(8, 11, 13, 15)
Mesobuthus zarudnyi gracilis (Birula, 1900)	(13, 15, 18, 23)
Mesobuthus zarudnyi sarghadensis (Birula, 1903)	(13, 15, 23)
Neohemibuthus kinzelbachi Lourenço, 1996	(28)
Odontobuthus doriae (Thorell, 1876)	(13, 15, 18, 23, 24, 29)
Odontobuthus odonturus (Pocock, 1897)	(13, 15, 23, 24, 29)
? *Orthochirus scrobiculosus dentatus* (Birula, 1900)	(3, 18, 25)
? *Orthochirus scrobiculosus melanurus* (Kessler, 1874)	(13)
? *Orthochirus scrobiculosus persa* (Birula, 1900)	(3, 13, 15, 25)
? *Orthochirus srobiculosus scrobiculosus* (Grube, 1873)	(? 15)
Orthochirus sp. n. ?	(29)

Paraorthochirus glabrifrons (Kraepelin, 1903)	(18, 29)
Paraorthochirus goyffoni Lourenço & Vachon, 1995	(27, 29)
Paraorthochirus stockwelli Lourenço & Vachon, 1995	(27)

Scorpionidae Peters, 1862

Habibiella gaillardi Vachon, 1974	(19, 23)
Habibiella persica (Birula, 1903)	(13, 15, 17, 18, 23)
Hemiscorpius lepturus Peters, 1862	(13, 15, 17, 18, 23, 29)
Scorpio maurus kruglovi Birula, 1910	(15)
Scorpio maurus townsendi (Pocock, 1900)	(2, 13, 15, 18, 23)

Diplocentridae Pocock, 1893

Nebo henjamicus Francke, 1980	(20)

DISCUSSION

Also described from Iran is *Androctonus crassicauda orientalis* (Vachon 1966: 210, Habibi 1971: 43), however I concur with Fet (1988: 79) in that this subspecies is a synonym of *A. c. crassicauda*.

Hottentotta alticola and *H. jayakari* are questionable, because they are listed for Iran only by Farzanpay (1988: 37) without localities to ascertain their occurrences.

Farzanpay (1988: 38) questioned the occurrences of subspecies *Mesobuthus eupeus macmahoni, M. e. pachysoma, M. e. persicus, M. e. iranus,* and *M. e. thersites* in Iran. However, with the exception of *M. e. macmahoni* these subspecies have been found in Iran by Fet (1988: 86).

The above list does include *Orthochirus scrobiculosus melanurus* (Kessler, 1874), although Fet (1994: 529–530) regards this subspecies as questionable. Also equivocal is the status of subspecies *O. s. dentatus* and *O. s. persa* (see *Orthochirus* sp. n. ? above and Fet 1988: 116).

Minnocci (1974: 36) listed from Iran also *Hemiscorpius maindroni* Kraepelin, 1901. This species is excluded from the above list because I am not aware of any specific occurrence in Iran and the type locality is Muscat in Oman.

In addition, Farzanpay (1988: 41) lists for Iran „*Simonoides farzanpay*", a „gen. and sp. n. to be described by Vachon". However, Vachon never described this genus and species, which thus is a nomen nudum similarly to the genera *Olivierus*, *Razianus*, and *Sassanidotus* also listed by Farzanpay (1986: 334, 1988: 39, 40, 41).

Vachon (1966) lists for Iran 15 species, 9 genera, and two families. Habibi (1971) lists 37 subspecies, 24 species, 11 genera, and two families. Farzanpay (1988) lists 23 species, 17 genera (of which, however, four are nomina nuda), and two families. In this paper I list 49 subspecies, 32 species, 18 genera, and three families. However, the occurrence of two species and five subspecies is uncertain.

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A review of Chinese *Aphodius* species (Coleoptera: Scarabaeidae). Part 3 description of two new *Agolius* species with a key to Chinese and Himalayan species of this subgenus

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Abstract. Two new species, *Aphodius* (*Agolius*) ***hengduanensis*** sp n from Yunnan and *A* (*A*) *zangbo* sp n from Tibet, are described Epipharyngeal structures and external male genitalia of all *Agolius* Mulsant et Rey, 1869 species so far known from China, the Himalayas and Middle Asia (excl *A* (*A*) *montisjuldi* Pittino, 1988) are figured Taxonomic position of *Neagolius* W Koshantschikov, 1912 is briefly discussed Lectotypes for *Aphodius* (*Agolius*) *falcispinis* W Koshantschikov, 1912, *A* (*A*) ***haroldi*** D Koshantschikov, 1894, and *A* (*A*) *ornus* W Koshantschikov, 1912 (all housed at Zoological Institute, Russian Academy of Sciences, St Petersburg) are designated A previously published key to *Agolius* species known from China and the Himalayas is modified to include new species described here and species known from Middle Asia

Taxonomy, new species, lectotype designation, key, distribution, Coleoptera, Scarabaeidae, *Aphodius*, *Agolius*, Palaearctic region

INTRODUCTION

The present part of the series of reviews concerning the Chinese *Aphodius* Illiger, 1798 specie is a supplementum to the first part (Král 1995) dealing with Chinese and Himalayan representa tives of the subgenus *Agolius* Mulsant et Rey, 1869 Since the first part (Kral 1995) I hav possibility to study further recently collected material from the regions under study resulting tw new *Agolius* species described here Study of the material deposited in the collections of th Zoological Museum of the Russian Academy of Sciences in St Petersburg makes me possible t design lectotypes and paralectotypes for some *Agolius* species described by Dmitrij or Wassil D Koshantschikov (Koshantschikov 1894, 1912) The paper includes also a modified key for a the *Agolius* species known so far from China, the Himalayas and Middle Asia

MATERIAL AND METHODS

Terminology concerning epipharyngeal structures was adopted from Dellacasa (1983)

The following codens (after Arnett et al 1993) identify the collections housing the material examined

DKCP – Czech Republic, Praha, David Kral collection,
MHNG – Suisse, Geneve, Museum d'Histoire naturelle (I Lobl),
ZMAS – Russia, St Petersburg, Zoological Museum, Academy of Sciences (B M Kataev, M G Volkovich)

Specimens of the newly described species are provided with one red printed label "[Name of a taxon] sp n HOLOTY PUS, ALLOTYPUS or PARATYPUS with No, ♂, David Kral det 1997" In the case of lectotype and/or paralectotype designation, each specimen bears a red printed label "[Name of a taxon], LECTOTYPUS or PARALECTOTYPUS with

No ♂, David Kral design 1997" Exact label data are cited for the types only, separate labels are indicated by slashes (/ Author's remarks and complementations are found in square brackets, [p] – preceding data within quotation are printed, [h – the same but handwritten, MS – manuscript, HT – holotypus, PT – paratypus

SYSTEMATIC PART

Aphodius (*Agolius*) *hengduanensis* sp. n.
(Figs 1, 13, 14)

TYPE MATERIAL Holotype and paratypes Nos 1, 2 – all males, labelled "YUNNAN, 28 vi [1]996, 28°20'N 98°59'E, 4400-4500 m Hengduan mts – part BAIMA" Deposited in DKCP

DESCRIPTION Male Body length 3 5–3 7 mm, HT – 3 6 mm Body subparallel, moderately convex, moderately shiny, with microreticulation Colour reddish brown, disc of head, antennal club, pronotum except for anterior and lateral parts, and elytral suture darkened Dorsal surface entirely bare

Head almost semicircular, anterior clypeal margin broadly sinuate at middle, anterior angles widely rounded, almost indistinctly upturned, sides regularly broadly rounded, notched before genae Genae rounded, lateral margin almost straight, distinctly exceeding eyes outwards, with several light, long setae Clypeal surface moderately depressed near anterior angles, medial frontal hump only slightly pronounced, with microreticulation, frontal suture not visible Punctures simple, coarse, moderately irregularly spaced, separated by more or less their diameter posteriorly in occiput becoming rather finer and sparser

Epipharynx (Fig 1) Epitorma and pternotormae slightly sclerotized Epitorma broad, nearly square-shaped, with transversal group of numerous sensillae basally Helus bare Corypha with 2 very long and thick medial setae and 3–4 relatively shorter and thick lateral setae Chaetoparia with 2–3 irregular rows of thick short setae gradually decreasing in size posteriorly Chaetopedium and acroparia with numerous long setae

Pronotum moderately convex, wide subparallel, scarcelly narrowed anteriorly, anterior angles rounded, slightly projecting anteriorly, sides weakly diverging over anterior third, then almost straight, subparallel, posterior angles broadly rounded Anterior margin and base without margin lines, lateral margin distinctly bordered, marginal line extending basally along posterior angle, reaching elytral stria 5 Surface with microreticulation, punctation simple, consisting of coarse, rather irregularly spaced punctures, separated by once to about twice their diameter, discally intermixed with several fine ones

Scutellum triangular, longer than wide, impunctate

Elytra only very slightly dilatate posteriorly, widest just behind middle, humerus not denticulate Striae distinctly impressed, strial punctures only very slightly crenating intervals margins regularly spaced, separated by about once their diameter Intervals flat, microreticulate, with fine punctures arranged in two irregular longitudinal rows, narrow interval 1 only slightly angustate apically

Macropterous, wings functional

Protibia with three wide, distinctly protruding external teeth and group of four external denticles basally, ventromedial edge with row of small denticles equal in size, terminal spur stout, long, acute apically, bent anteroventrally, inserted approximately against middle tooth, reaching about 0 3 of protarsomere 2 Apical margin and two well expressed transversal carinae of meso- and metatibia fimbriate with strongly unequal setae Basimesotarsomere distinctly shorter than upper terminal spur, lower terminal spur simply pointed Basimetatarsomere hardly shorter than upper terminal spur and subequal to to next three metatarsomeres combined

Aedeagus See Figs 13, 14

Female unknown

DIFFERENTIAL DIAGNOSIS *A* (*A*) *hengduanensis* sp n is closely related to *A* (*A*) *takin* Král, 1995 (see Discussion) and is distinguished from it by having the following diagnostical characteres relatively smaller (body length 3 5–3 7 mm) and paler species, head convexity, pronotum a elytra with microreticulation and only moderately shiny, basimeso- and basimetatarsomere shor than upper terminal spur, different shape of parameres (Figs 13, 14), and different epiphary geal structures (Fig. 1) In comparison *A* (*A*) *takin* exerts the following characters relativ larger (body length 5 8–6 4 mm) and dark colour, dorsal surface without microreticulati entirely shiny, basimeso- and basimetatarsomere equal in length to upper terminal spur, dif rent shape of parameres (Figs 15, 16) and different epipharyngeal structures (Fig 3) For differentiation from other Chinese and Himalayan species see the key below

COLLECTION CIRCUMSTANCES All the three specimens were collected in alpine zone from un stones on northern extremely steep slope ca 2–5 m from snow fields together with *Carab wagae* Fairmaire, 1882 and *Nebria* sp (Carabidae)

NAME DERIVATION The new species is named in reference to the area of its origin, the Hengdu shan mountains

Aphodius (*Agolius*) *takin* Král, 1995

(Figs 3, 15, 16)

Aphodius (*Agolius*) *takin* Kral, 1995 102, 105–107, figs 1–4 (fig 4 – erroneously figured epipharynx of *A* (*Paracr sulus*) *impressiusculus* Fairmaire, 1888)

TYPE LOCALITY China, Sichuan, 50 km NEE Songpan (Král 1995)

EPIPHARYNX (Fig 3) Epitorma and pternotormae only very slightly sclerotized Epitorma broa not dostinctly separated laterally from chaetopedium, and with transversal group of numero sensillae basally Helus with 8–9 short and thick setae Corypha with 4–5 long and thick seta Chaetoparia with 2–3 irregular rows of long and thin setae gradually decreasing in size post riorly Chaetopedium and acroparia covered with numerous long and fine microtrichiae Aca thoparia with 1–3 long and thin setae

Aphodius (*Agolius*) *zangbo* sp. n.

(Figs 2, 8, 11, 12)

TYPE MATERIAL Holotype and paratype – both males, labelled China, E-Tibet [= Xizang], 19 –28 6 '96 [1996], mts N Nyingchi, 29° 36'–45'N 94° 28'–37' E, 3900–4600 m Deposited in DKCP

DESCRIPTION Male Body length 3 8 mm (HT) and 4 0 (PT) Body subparallel, strongly conve shiny, without microreticulation Colour blackish, anterior margin of clypeus and anterolater area of pronotum, and scutellum brownish Elytron with pale discal area, interval 1, humer area, area along lateral margin reddish brown, and the following dark, almost black pattern (short oblong basal spot in interval 5 reaching completely base, (ii) oblique discal spot reachi completely base in interval 4 basally, and approximately 0 75 of elytral length in interval apically, (iii) oblique lateral spot in intervals 5–8, extending to humeral umbone basally and same distance as discal one, apically (Fig 8)

Head almost semicircular, anterior clypeal margin broadly, shallowly sinuate at middl anterior angles widely rounded, almost indistinctly upturned, sides regularly broadly rounde notched before genae Genae rounded, distinctly exceeding eyes externally Clypeal surfa moderately depressed near anterior angles, medial convexity only slightly pronounced, front suture indicated by short medial line Punctation consisting of coarse, dense, irregularly distr buted, rather fused punctures, punctures posteriorly of frontal suture finer, not fused, separate by approximately their diameter.

Epipharynx (Fig. 2). Epitorma and pternotormae slightly sclerotized. Epitorma broad, nearly quadrate-shaped, with transversal group of numerous sensillae basally. Helus with numerous short and thick setae. Corypha with 4 very short and thick setae. Chaetoparia with longitudinal group of short and thick setae in anterior half, with 2–3 irregular rows of very short and thick setae posteriorly, and with several long and thin setae along lateral margin. Chaetopedium with numerous long microtrichiae. Acroparia and acanthoparia with numerous long and fine setae. Ipophoba with 4–5 short and thin setae.

Pronotum strongly convex, almost parallel-sided; anterior angles rounded, almost not projecting anteriorly; sides broadly rounded up to broadly rounded posterior angles. Anterior margin and base without marginal lines, lateral margin distinctly bordered, marginal line extended basally along posterior angle, reaching elytral stria 5. Punctation simple, consisting of coarse, deep, moderately irregularly distributed punctures, mostly separated by approximately their diameter; basally and laterally punctation becoming rather sparser, finer and more irregularly spaced.

Scutellum triangular, longer than wide, with several coarse punctures.

Elytra convex, only very slightly dilatate posteriorly, widest just behind middle, humerus finely denticulate. Striae distinctly impressed, strial punctures distinctly crenating intervals margins, regularly distributed, separated by about their diameter, punctures becoming denser apically. Intervals almost flat, with fine punctures arranged in two irregular longitudinal rows; narrow interval 1 convex and only slightly angustate apically.

Macropterous, wings functional.

Protibia with three wide, distinctly protruding external teeth and group of 4–5 external denticles basally; ventromedial edge with only 2–3 subobsolete denticles; terminal spur stout, long, acute apically, bent moderately anteroventrally, inserting approximately against medial external tooth, reaching hardly 0.3 of protarsomere 2. Apical margin and both well pronounced transversal carinae of meso- and metatibiae fimbriate with strongly unequal setae. Basimesotarsomere equal to upper terminal spur, lower terminal spur simply pointed. Basimetatarsomere hardly longer than upper terminal spur and subequal to next three tarsomeres combined.

Aedeagus. See Figs 11, 12.

Female unknown.

Differential diagnosis. The new species is similar to *A.* (*A.*) *takin* and *A.* (*A.*) *hengduanensis* sp. n. (see Discussion). It differs from these two species in the following diagnostical characters: body strongly convex, elytra bicoloured with blackish pattern (Fig. 10), punctation of pronotum simple and coarse, different shape of parameres (Figs 11, 12) and epipharyngeal structures (Fig. 2) (in the two compared species body only moderately convex, elytra unicoloured without blackish pattern, punctation of pronotum double, coarse intermixed with fine, different shape of parameres (Figs 13–16) and epipharyngeal structures (Fig. 1 and 3)). For the differentiation from other species known from China and the Himalayas see the key below.

Collection circumstances. Both type specimens were collected from dung (probably of yak) on an open alpine pasture at elevation of approximately 4200 m.

Name derivation. "Zangbo" is the Tibetan name for the Brahmaputra river running through the area of the type locality; noun in apposition.

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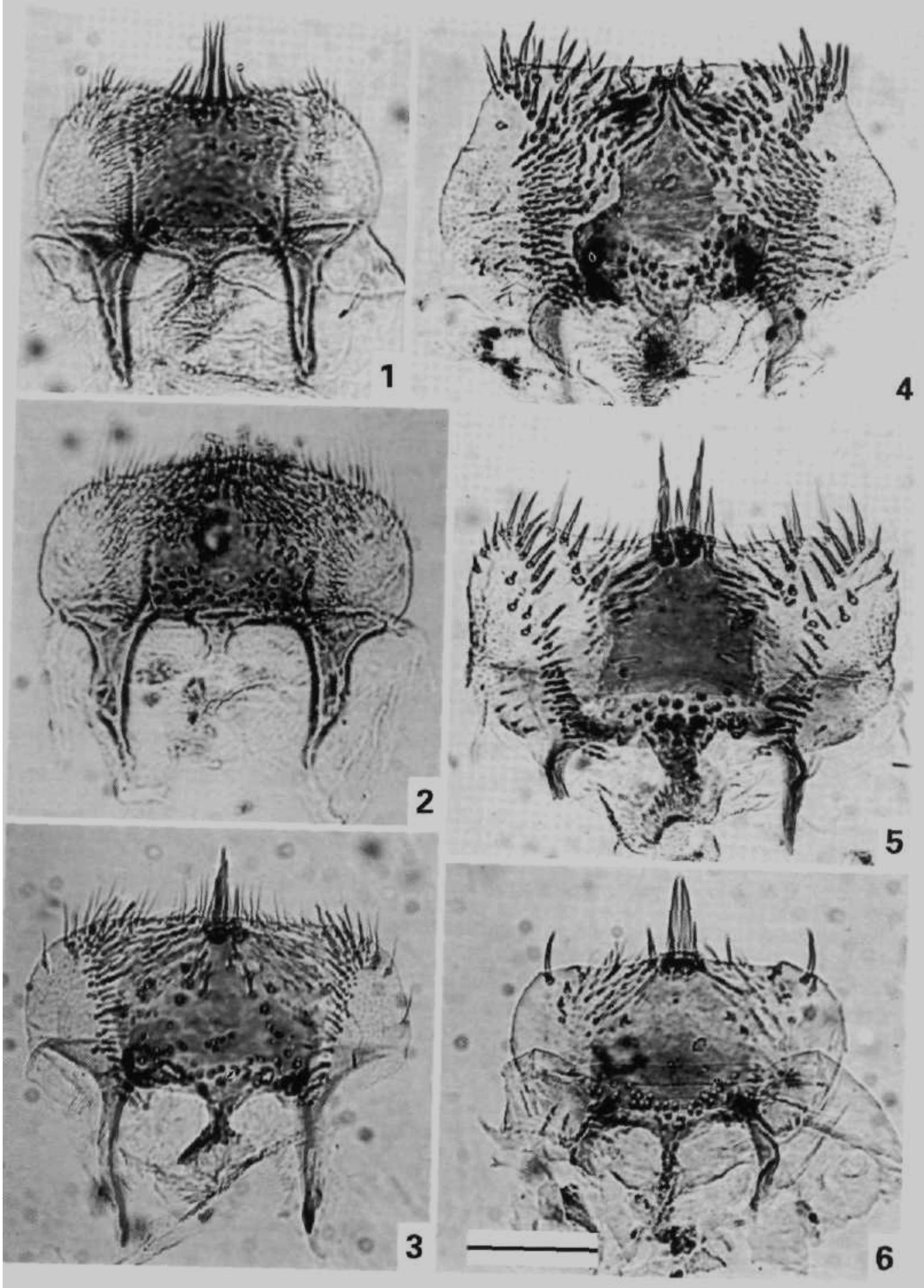
Figs 1–6. Epipharynx. *Aphodius* (*Agolius*) *hengduanensis* sp. n. – PT No. 1 (1), *A.* (*A.*) *zangbo* sp. n. PT (2), *A.* (*A.*) *takin* Král PT No. 5 (3), *A.* (*A.*) *haroldi* D. Koshantschikov – Kyrgyzstan, Oy-Tal (4), *A.* (*A.*) *orinus* W. Koshantschikov – NW India (5), *A.* (*A.*) *interstitialis* D. Koshantschikov – Tadzhikistan, Ganishou (6). Scale: 0.2 mm.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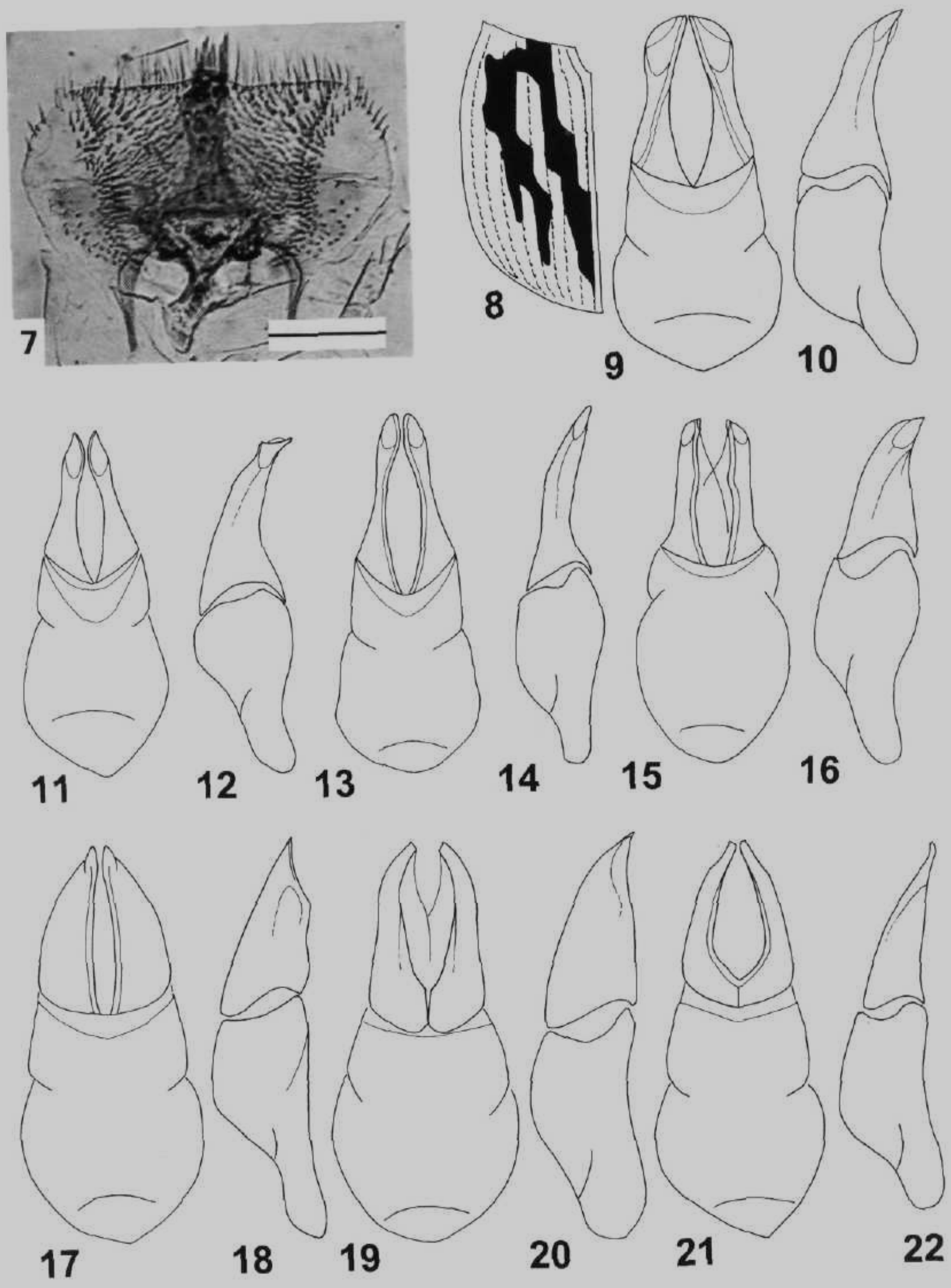
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Aphodius (Agolius) falcispinis W. Koshantschikov, 1912
(Figs 7, 9, 10)

Aphodius (Neagolius) falcispinis W Koshantschikov, 1912 517, fig 3; Schmidt, 1922 218, Boucomont, 1929 779, G Dellacasa, 1983 324–325, figs 728–732, M Dellacasa, 1988 386
Aphodius (Melinopterus) pallidicinctus Reitter, 1892 237, nec Waterhouse, 1875 85
Aphodius (Agolius) falcispinis Balthasar, 1964 150, Mariani, 1979 84, Nikolaev & Puntsagdulam, 1984 145, fig 31 Kral, 1995 102

RESTRICTED TYPE LOCALITY "In den Bergen des Chinesischen Turkestan" (Dellacasa 1983)

TYPE MATERIAL EXAMINED Lectotype and 3 paralectotypes, all males, by present designation "Polu Grombcz[ewski] 20 IV [18]90 [h] / Neag[olius] falcispinis♂ m [W Koshantschikov's MS] det W Koshantschikov [p]" All specimens in ZMAS
OTHER MATERIAL EXAMINED **China** Amdo 1884 Przewalsky, 3 males, Amdo 1884 Przewalsky / Mont Przewalskianae II/IV 29/5 7500–8000', 2 males, Amdo 1886 G Potanin, 3 males, Central Asia Amdo, 1 male All specimens in ZMAS

EPIHARYNX (Fig 7) Epitorma and pternotormae only very slightly sclerotized Epitorma not distinctly separated laterally from chaetopedium Helus with several sensillae Corypha with 6 short and thick setae Chaetoparia with internal row of long and thin setae gradually decreasing in size toward crepis, and two more or less irregular rows of shorter and thinner setae Chaetopedium in addition to numerous microtrichiae with 6–7 thick setae Acroparia with long, thin setae Acanthoparia with thin and relatively shorter setae Ipophoba with group of very short and fine setae.

For further material examined see Král (1995)

Aphodius (Agolius) haroldi D. Koshantschikov, 1894
(Figs 4, 17, 18)

Aphodius (Agolius) haroldi D Koshantschikov, 1894 98, Schmidt, 1922 107–108, 111, Balthasar, 1964 146–147, Mariani, 1979 83 figs 46, 47, Kral, 1995 103
Aphodius (Neagolius) haroldi Nikolaev, 1987 113, M Dellacasa, 1988 386, Pittino, 1988 115

TYPE LOCALITY. Ketmen – Gebirge (Koshantschikov 1894)

TYPE MATERIAL EXAMINED Lectotype, male, by present designation "Ketmen Geb[irge] Issyk-kul 13 VI [18]92 / Haroldi D Kosh [probably D Koshantschikov's MS] / A Haroldi♂ D Kosh [W Koshantschikov's MS] det W Koshantschikov [p]" In ZMAS
OTHER MATERIAL EXAMINED **Kazakhstan** Issyk-kul Ketmen Geb[irge] , 5 males, 1 female in ZMAS

EPIPHARYNX (Fig 4) Epitorma and pternotormae slightly sclerotized Epitorma broad with distinctly concave lateral margins, and with group of numerous fine sensillae basally Helus with group of numerous long microtrichiae Corypha only with 2–3 short and thick setae Chaetoparia in anterior third with row of 7–8 short and thick setae, gradually decreasing in size posteriorly, and with large group of numerous fine and thin setae medially and posteriorly Chaetopedium anteriorly with 4–5 long and thick setae, posterioly with longitudinal group of numerous

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Figs 7–22 Epipharynx (7), left elytron (8), aedeagus (9–22 odd numerals – dorsal aspect, even numerals – lateral aspect) *Aphodius (Agolius) falcispinis* W Koshantschikov – Mongolia, Ulanbaatar (7, 9, 10), *A (A) zangbo* sp n – HT (8, 11, 12), *A (A) hengduanensis* sp n – HT (13, 14), *A (A) takin* Kral – HT (15, 16), *A (A) haroldi* D Koshantschikov Kazakstan, Ketmen (17, 18), *A (A) orinus* W Koshantschikov – NW India, Rohtang pass (19, 20), *A (A) interstitialis* D Koshantschikov – Tadzhikistan, Cherekty (21, 22) Scale for 7 0 1 mm

short and thick setae. Acanthoparia with 2–3 long and thick setae. Ipophoba with group of microtrichiae.

For further material examined see Král (1995).

Aphodius (*Agolius*) *interstitialis* D. Koshantschikov, 1894
(Figs 6, 21, 22)

Aphodius (*Volinus*) *interstitialis* D Koshantschikov, 1894 215; Schmidt, 1922· 168, 182; Balthasar, 1964: 219, 239–240
Aphodius (*Neagolius*) *interstitialis*: Nikolaev, 1980. 65; 1987· 113,
Aphodius (*Agolius*) *roniticus* Stebnicka, 1975. 186–188, figs 3–5 (syn by Nikolaev 1980: 65).

TYPE LOCALITY. Varsaut, Jagnob (Koshantschikov 1894).

TYPE MATERIAL EXAMINED. **Tadjikistan** [p] / Gissarski chreb. [mts.] Ronit [correctly Romit] – 1200 m 21.V [19]72 leg. J Pawlowski [h] / paratypus [h, yellow label] / Aphodius (Agolius) roniticus sp n det. Z. Stebnicka [p], 3 females in MHNG
FURTHER MATERIAL EXAMINED **Tadzhikistan** Pamir, Cherekty, 29 08 1971, leg V Mikhailov [label written in Cyrillic script], 1 male in DKCP; khr. Petra I [mts], Ganishou, 15.06 1969, leg. V. Chikatunov [label written in Cyrillic script], 3 males in ZMAS.

EPIPHARYNX (Fig. 6). Epitorma and pternotormae only very sligthtly sclerotized. Epitorma broad not distinctly separated laterally from chaetopedium, and with transversal group of numerous sensillae basally. Helus bare. Corypha with two very long and thick medial setae and two relatively shorter and finer lateral setae.Chaetoparia only with row of 4–5 very short, but relatively thick setae in anterior half. Chaetopedium and acroparia with numerous long microtrichiae. Acanthoparia with one long and thick seta. Ipophoba with 2–3 fine short setae.

Aphodius (*Agolius*) *orinus* W. Koshantschikov, 1912
(Figs 5, 19, 20)

Aphodius (*Agolius*) *haroldi* var *orinus* W. Koshantschikov, 1912 516–517; Schmidt, 1922. 112; Balthasar, 1964· 146, Mariani, 1979. 43, Stebnicka, 1989: 19.
Aphodius (*Neagolius*) *haroldi* ab. *orinus*: M. Dellacasa, 1988: 386.
Aphodius (*Agolius*) *orinus*: Král, 1995: 104–105, figs 5, 6 (stat n)

TYPE LOCALITY. Himalaya Gebiet, Rotang Pass (Koshantschikov 1912).

TYPE MATERIAL EXAMINED Lectotype and paralectotype No 1, males, by present designation· "Rotang Pass [h] / Ag Haroldi var orinus ♂ m [W Koshantschikov's MS] det W Koshantschikov [p]"; paralectotype No 2, male, by present designation "Kashmir Rost [legit] 1905 [h, yellow label] / Ag Haroldi v orinus ♂ m [W Koshantschikov's MS] det W Koshantschikov [p]" All in ZMAS.
OTHER MATERIAL EXAMINED **India** NW-India, Himachal Pradesh (ca 40 km N of Manali), btw. Marhi / Rohtang pass, alp meadow, 3000–3800 m, 18 VI 1996, K & B Březina [legit], 1 male in DKCP.

EPIPHARYNX (Fig. 5). Epitorma and pternotormae slightly sclerotized. Epitorma broad, about pentagonal-shaped, with transversal group of numerous sensillae basally. Helus bare. Corypha with 5–6 long and thick setae. Chaetoparia with row of 6–8 thick setae in anterior half and longitudinal group of numerous microtrichiae posteriorly of proplegmatium. Chaetopedium with 5–6 thick setae gradually decreasing in size posteriorly, and numerous relatively long microtrichiae. Apophoba with 2–4 very short and stout setae. Acanthoparia with 3–4 setae gradually decreasing in size laterally.

For detailed redescription and further material examined see Král (1995).

Key to *Agolius* species known from China, the Himalayas and Middle Asia

1(2) Pronotal base completely bordered. Terminal spur of protibia in male falciform, strongly bent ventromedially. China: Gansu, Qinghai, Xinjiang; Kazakhstan, Mongolia and southern parts of Siberia . . . . *A.* (*A.*) *falcispinis* W. Koshantschikov, 1912

2(1) Basal border of pronotum at middle broadly interrupted. Terminal spur of protibiae in male simply acute, only slightly bent ventrally

3 (8) Anterior clypeal margin distinctly sinuate medially. Genae markedly protruding externally, distinctly separated by sinuation from clypeus. Females unknown

4 (5) Head convexity, pronotum and elytra with microreticulation, only moderately shiny. Basimeso- and basimetatarsomere shorter than upper terminal spur of meso- and metatibia, resp. China: Yunnan. . . . . *A.* (*A.*) ***hengduanensis*** **sp. n.**

5 (4) Dorsal surface without microreticulation, comparatively more shiny. Basimeso- and basimetatarsomere equal to or hardly longer than upper terminal spur of metatibia

6 (7) Body moderately convex, elytra unicoloured without blackish pattern. Punctation of pronotum double coarse intermixed with fine. China: Sichuan. . . . . *A.* (*A.*) *takin* Král, 1995

7 (6) Body strongly convex, elytra bicoloured with blackish pattern (Fig. 10). Punctation of pronotum simple and coarse. China: E Xizang . . . . *A.* (*A.*) *zangbo* sp. n.

8 (3) Anterior clypeal margin subtruncate, not or very slightly subsinuate. Genae not so markedly protruding externally, not separated by sinuation from clypeus

9 (10) Elytra with microreticulation, almost alutaceous. Himalayas (Uttar Pradesh). . . . . *A.* (*A.*) *orinus* W. Koshantschikov, 1912

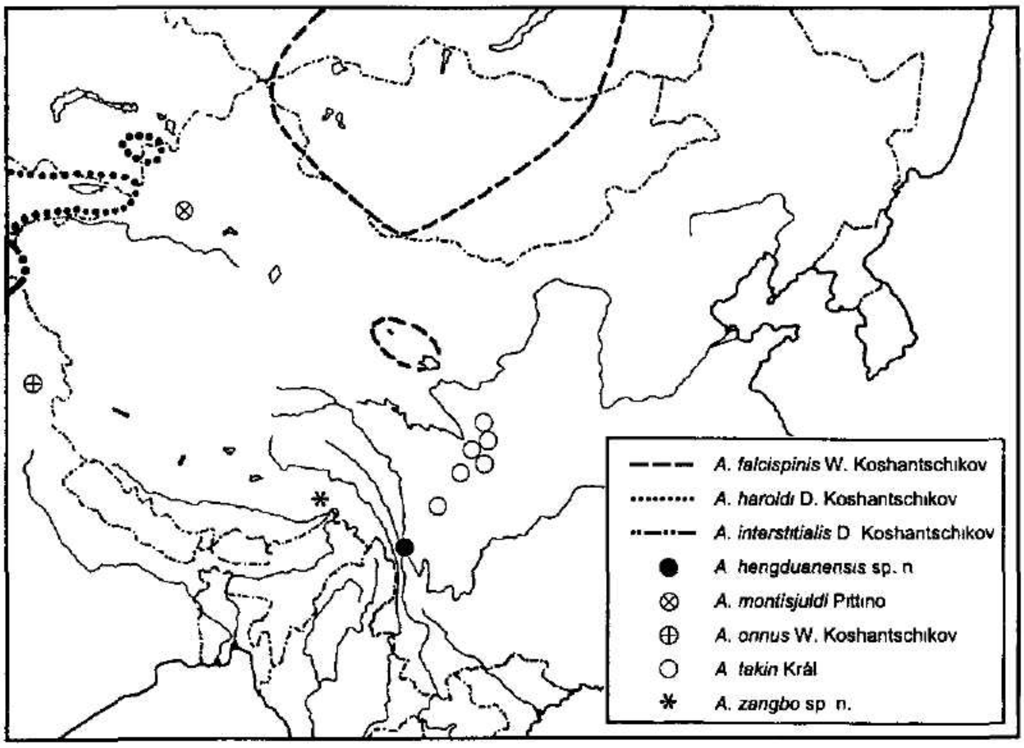

Fig. 23. Map with known distribution of the subgenus *Agolius* Mulsant et Rey in China, the Himalayas and adjacent areas

10(11) Elytra without microreticulation, distinctly shiny.

11(12) Basimetatarsomere equal in length to upper terminal spur of metatibia. Body dark brown to black. Shape of parameres different from the following two species (Figs 17, 18). China: Xinjiang, Kazakhstan, Kyrgyzstan ... *A.* (*A.*) *haroldi* D. Koshantschikov, 1894

12(11) Basimetatarsomere shorter than upper terminal spur of metatibia. Body colour paler, or elytra with blackish pattern

13(14) Parameres with outstanding apical membraneous appendices – figs 7, 8 in Pittino (1988). Female unknown. China: Xinjiang (Juldus Mts) ... *A.* (*A.*) *montisjuldi* Pittino, 1988

14(13) Parameres without apical membraneous appendices (Figs 21, 22). Middle Asia (Tadzhikistan) ... *A.* (*A.*) *interstitialis* D. Koshantschikov, 1894

DISCUSSION

The subgenus *Agolius* contains presently, including two new species described here, 31 taxa (23 species and 8 subspecies), all confined to the Alpine areas of the Palaearctic region (Dellacasa 1988, Král 1995, Pittino & Ballerio 1994, 1996). *A.* (*A.*) *falcispinis* is the only hitherto known species preferring other biotopes such as lowlands pastures of Central Asia.

Seven species are presently known from China, the Himalayas, and Central and Middle Asia. *These species can be divided from morphologiacal point of view in the following three groups* also approximately corresponding to the zoogeographical aspect (see the map in Fig. 23):

group 1 (*A. hengduanensis* sp. n., *A. takin*, *A. zangbo* sp. n.)
- clypeus rounded, distinctly emarginate anteriorly
- genae separated by sinuation from clypeus
- pronotum without basal margin line
- terminal spur in male protibia simply acute
- eastern and southeastrn part of the Tibetan plateau (Sichuan, Yunnan)

group 2 (*A. falcispinis*)
- clypeus rounded, not emarginate anteriorly
- genae not separated by sinuation from clypeus
- pronotal base completely bordered
- terminal spur in male protibia falciform
- Central Asia (Mongolia and adjacent regions, southernmost to NE Xizang)

group 3 (*A. haroldi*, *A. interstitialis*, *A. montisjuldi*, *A. orinus*)
- clypeus subtruncate, not emarginate anteriorly
- genae not separated by sinuation from clypeus
- pronotum without basal margin line
- terminal spur in male protibia simply acute
- Middle Asia (Pamiro-Alai and Tian Shan mountain system), western Himalayas

All the three groups possess relatively uniform epipharyngeal structures (see Figs 1–7) and shape of aedeagus (see Figs 9–22). Parameres are simply built, straight, anteriorly more or less bent anteroventrally, apex simply pointed. The only exception is manifested in *A.* (*A.*) *montisjuldi* Pittino 1988 having parameres with outstanding apical membraneous appendices (Pittino 1988: figs 7, 8). Species inhabiting rest of the areal (mountainous areas of Europe, the Caucasus, and northeastern Turkey) seem to be mostly related to group 3, representatives of which display most of the characteristic features (mentioned in group 3) to be the same. However, shape of parameres is very complicated in several species and some of them possess terminal spur of protibia of different shape or anterior clypeal margin subsinuate (see Dellacasa 1983: 131–138, 317–341; figs 183–207, 728–796).

In 1912, the subgenus *Neagolius* was erected by W. Koshantschikov for single species *Aphodius falcispinis* W. Koshantschikov, 1912 based on completely bordered basal margin of pronotum and terminal protibial spur in male being falciform. This concept is also accepted in the monograph by Schmidt (1922). Balthasar (1964) and Mariani (1979) consider for mentioned species only the subgenus *Agolius* (= *Neagolius*). On the other hand, Dellacasa (1983, 1988) and authors of some further papers not concerning the species spectrum from the whole distribution areal distinguish the subgenus *Agolius* (with *A. abdominalis* Bonelli, 1812 and *A. bonvouloiri* Harold, 1860 with terminal protibial spur in male short, not robust – reaching not to base of protarsomere 2, and with marginal line of pronotal base reaching to elytral humerus) and the subgenus *Neagolius* (rest of species spectrum sharing terminal protibial spur in male long and robust – reaching to middle of protarsomere 2, and marginal line of pronotal base reaching approximately to elytral stria 5). Representatives of above groups 1 and 3 have terminal protibial spur in male of transitional nature being simply acute and relatively short (reaching mostly to 0.3 of protarsomere 2). The shape of parameres and epipharyngeal structures of individual species also display no distinct dividing line justifying the existence of two separate subgenera. *A. falcispinis*, the type species of the subgenus *Neagolius*, is the only relatively more different species with completely bordered pronotal base (not expressed in any other known species of the group) and with falciform terminal protibial spur. In addition this species is not known to inhabit habitats at high elevation.

Based on the current knowledge of morphology of the species discussed the group can be appreciated (perhaps except for *A. falcispinis*) as homogeneous and therefore it is treated as one subgenus *Agolius* (= *Neagolius*) in the present paper. In addition it must be said, that the area of China and the Himalayas is, with regard to current inadequate knowledge in alpha-taxonomy, much richer in species than it is seen from enumeration of so far described species (22 : 7 for species inhabiting Europe, the Caucasus and Turkey). An adequate interpretation of phylogenetical relations would be satisfactorily resolved only after discovery of further *Agolius* species inhabiting these areas of high mountains.

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Metazoan parasites of fishes from the section of the Vltava River supposed to be affected by the operation of the Temelín nuclear electric power-station, Czech Republic

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Abstract. Between 1986 and 1988, a total of 357 fishes of 15 species collected from the Vltava River near the site of the planned discharge of heated effluent water from the Temelín nuclear power-station (South Bohemia, Czech Republic), were examined for the presence of metazoan parasites. A total of 88 species of metazoan parasites were recorded. The most numerous were monogeneans represented by 58 species of 6 genera (*Dactylogyrus*, *Gyrodactylus*, *Ancyrocephalus*, *Tetraonchus*, *Diplozoon*, *Paradiplozoon*). Other recorded ectoparasites were the leech *Piscicola geometra*, the crustaceans *Ergasilus sieboldi* and *Argulus foliaceus* and occasionally glochidia larvae of clams. The endohelminth fauna comprised 10 species of adult cestodes from 6 genera (*Caryophyllaeus*, *Caryophyllaeides*, *Khawia*, *Triaenophorus*, *Bothriocephalus*, *Proteocephalus*), 6 species of adult and larval trematodes belonging to 5 genera (*Rhipidocotyle*, *Phyllodistomum*, *Bunodera*, *Diplostomum*, *Cotylurus*), 7 species of adult nematodes of 5 genera (*Pseudocapillaria*, *Raphidascaris*, *Philometra*, *Camallanus*, *Rhabdochona*), and 3 acanthocephalan species of the genera *Acanthocephalus* and *Neoechinorhynchus*. *Dactylogyrus achmerowi*, *Dactylogyrus* cf. *caballeroi*, *Gyrodactylus kherulensis* and *Paradiplozoon alburni* were recorded from the Czech Republic for the first time, *Dactylogyrus falcatus* and *Philometra kotlani* were not previously known from the Elbe River drainage system in the Czech Republic. The relatively poor parasite fauna of fish, particularly the trematode fauna, reflected the influence of considerable pollution and eutrophication in the section of river under investigation. These unfavourable conditions probably resulted in a substantial elimination of the mollusc intermediate hosts of trematodes. Qualitative and quantitative changes in the composition of the parasite fauna of fish in this river section can be expected, due to ecological changes caused by the operation of the nuclear power-station.

Metazoan parasites, fish, water pollution, nuclear power-station, Temelín, Czech Republic

INTRODUCTION

In view of the high density of settlement and considerable agricultural activity in the Czech Republic, the industrial application of nuclear power requires detailed environmental impact assessment during the construction and operation of power-stations. Since these problems are of a priority social interest, considerable attention has been paid to them. In connection with the construction of the nuclear power-station Temelín in southern Bohemia, the Institute of Parasitology of the then Czechoslovak Academy of Sciences participated in coordinated broad investigations within the framework of the agreement between the then Czechoslovak Commission for Atomic Energy and the Czechoslovak Academy of Sciences. One research project was designed to study the influence of temperature pollution and eutrophication of water on qualitative and quantitative changes in the composition of the parasite fauna of fish.

The influence of heated waters on the parasite fauna of fish has been reported previously in connection with the construction of large electric power-stations. Numerous papers have appeared in recent years, mainly dealing with the presence of the parasite fauna in fish cultured in heated freshwater or brackish-water reservoirs and the influence of this environment on the seasonal cycles of the occurrence and maturation of fish parasites. Such publications have originated, for example, in Poland (Grabda-Kazubska 1974, Pojmańska et al. 1980, Pojmańska 1984a,b,c, 1985a,b, Pojmańska & Dzika 1987), Russia (Strizhak 1972, Golovin 1977), Sweden (Thulin 1980, Höglund & Thulin 1989), USA (Eure 1976) or Brazil (Kohn & Fernandes 1988, Kohn et al. 1988). Influence of water pollution on the parasite fauna of fish and the use of fish parasites as bioindicators of water quality are dealt with, for example, in the papers by Möller (1987), Khan & Thulin (1991), Koskivaara et al. (1991), Kuperman (1992), Poulin (1992), Bucke (1993), Gelnar et al. (1994) and MacKenzie et al. (1995).

Temelín nuclear power-station will be supplied by cooling water from the newly built reservoir Hněvkovice. The outlet waters, the temperature of which should be up to 33 °C during summer, will be released into the Vltava River near the village of Neznašov. During a maximum release, the water temperature in this section of the Vltava has been forecast to increase by 2.2 °C in the summer and 5.5 °C in the winter, however, because of poor mixing, there is expected to be an accumulation of warm water on the surface and, consequently, a greater increase in temperature in the upper layers of the water.

In addition to an increase in water temperature, there is another factor that will apply in the connection with the construction and operation of the power-station, which may influence both its ichthyofauna and the fauna of other aquatic organisms. At the time of this investigation, the Vltava River in the region of České Budějovice was highly polluted, mainly by outlet waters of the paper mill at Větřní, so that the water quality in the river was not adequate for use by the power-station. A new waste-water treatment plant has been built recently at Větřní, which has improved considerably the water quality of the Vltava. Probably, this will reflect in the presence of more species of both fish parasites and their hosts.

In view of these facts, it was decided to study changes in the parasite fauna of fishes in this locality at three stages. 1. recording the state of the parasite fauna of fishes in the Vltava River section under investigation before construction of the waste-water purifying plant; 2. recording changes in the parasite fauna following launch of the purification plant; and 3. study of the composition of the parasite fauna following putting out the Temelín nuclear electric power-station into operation.

In 1986, work on the first stage was initiated by two research teams of the Institute of Parasitology of the then Czechoslovak Academy of Sciences. Ichthyoparasitological investigations were carried out over an approximately five-kilometre long section of the Vltava River near the village of Neznašov, where the electric power-station effluent will be released into the river. Both protozoan and metazoan parasites were studied (protozoans were investigated by the research team headed by Jiří Lom). Since little attention has been paid to the parasite fauna of fishes in the Vltava River, especially in the region of South Bohemia, and because the existing data are often based on occasional findings, it was necessary to obtain new, original data for the evaluation of the current state of the occurrence of fish parasites. The present paper reports the results relating to fish metazoan parasites. Details of this work can be found in the unpublished project report by Moravec et al. (1988).

MATERIAL AND METHODS

Fishes for parasitological examinations were obtained from an approximately 5 km long section of the Vltava River near the village of Neznašov (Fig. 1), mostly by electrofishing, less often by angling. Fish samples were taken monthly throughout the year. The most numerous fish in the samples was bream, *Abramis brama* (the most frequent fish species in the locality), in which we tried to follow possible seasonal changes in the populations of its parasites, in addition to recording the qualitative composition of its parasite fauna From 1986–1988, a total of 365 fish specimens belonging to 15 species of 4 families were examined from this locality The numbers of individual fish species sampled varied with locality The numbers of fishes examined for the presence of endohelminths and ectoparasitic metazoans differ, because time constraints meant that not all of the fishes examined for endoparasites could also be examined for ectoparasites and vice versa

Immediately after the catch fish were transported in barrels in the original river water to the Institute of Parasitology in České Budějovice, where they were killed, then examined within 2 days for the presence of metazoan parasites by standard ichthyoparasitological methods

The following 15 species of fishes were examined (the first figure gives the number of fish specimens examined for endohelminths, the second one those examined for metazoan ectoparasites) Cyprinidae *Abramis brama* (L) – 151/120, *Blicca bjoerkna* (L) – 10/3, *Alburnus alburnus* (L) – 30/27, *Aspius aspius* (L) – 3/4, *Leuciscus cephalus* (L) – 40/41, *Leuciscus leuciscus* (L) – 3/5, *Rutilus rutilus* (L) – 48/40, *Scardinius erythrophthalmus* (L) – 2/2, *Carassius carassius* (L) – 1/1 *Cyprinus carpio* L – 8/10, *Gobio gobio* (L) – 2/2, Esocidae *Esox lucius* L – 7/5, Anguillidae *Anguilla anguilla* (L) – 3/3, Percidae *Perca fluviatilis* L – 39/32, *Stizostedion lucioperca* (L) – 10/11 A total of 357/306 fish specimens were examined from this locality

Parasites of individual groups were fixed and further processed using current helminthological methods The parasite material is deposited in the helminthological collection of the Institute of Parasitology, Academy of Sciences of the Czech Republic, in České Budějovice

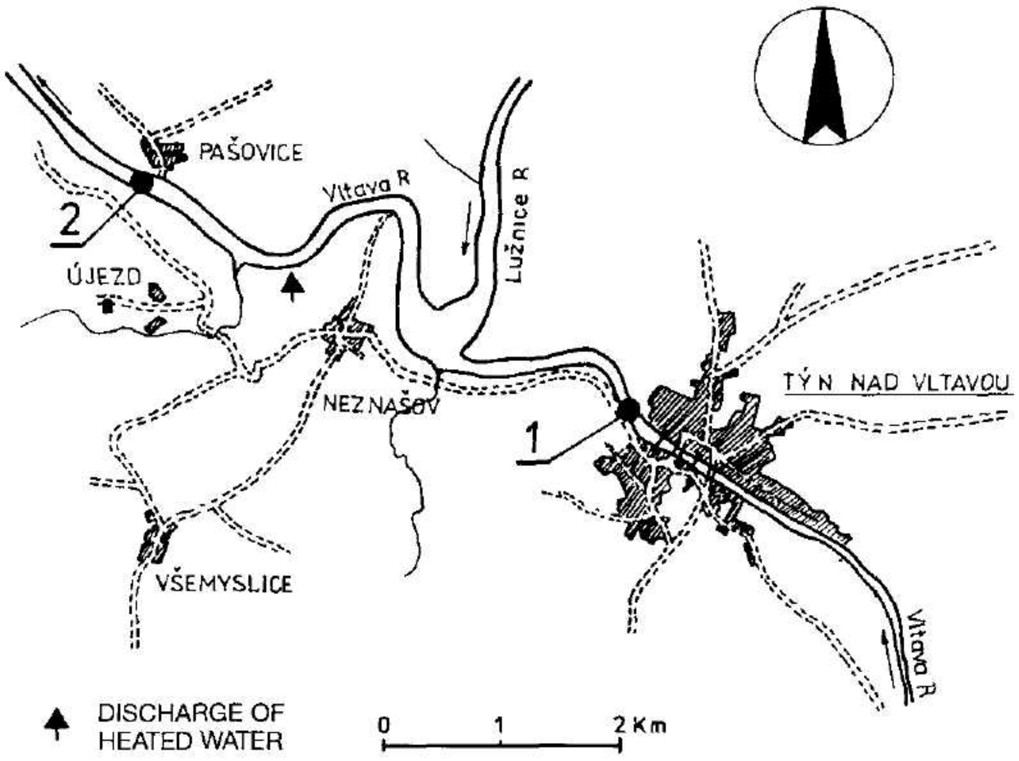

Fig 1 Map of the Vltava River section under study Figures 1 and 2 show sites of catching fishes

RESULTS

A total of the following 88 species of metazoan parasites were found in fishes of the Vltava River section under investigation in 1986–1988:

Monogenea

1. *Dactylogyrus achmerowi* Gussev, 1955
Host. *Cyprinus carpio*, localization: gills; prevalence. 10% (1 fish infected/10 fishes examined); intensity. 13 specimens. In September.

2. *Dactylogyrus auriculatus* Nordmann, 1832
Host. *Abramis brama*, localization. gills, prevalence. 29% (35/120); intensity. 1–48. From March to August.

3. *Dactylogyrus cordus* Nybelin, 1936
Host: *Leuciscus leuciscus*, localization gills; prevalence: 40% (2/5); intensity: 2–5. In October

4. *Dactylogyrus crucifer* Wagener, 1857
Host *Rutilus rutilus*, localization gills; prevalence: 50% (20/40); intensity 2–20. From March to November

5. *Dactylogyrus difformis* Wagener, 1857
Host. *Scardinius erythrophthalmus*, localization gills; prevalence: 50% (1/2); intensity 4. In September

6. *Dactylogyrus distinguendus* Nybelin, 1937
Host: *Abramis brama*; localization: gills; prevalence: 1% (1/120); intensity: 1. In August

7. *Dactylogyrus extensus* Mueller et Van Cleave, 1932
Host *Cyprinus carpio*; localization gills, prevalence. 70% (7/10); intensity. 4–137 Throughout the year.

8. *Dactylogyrus falcatus* (Wedl, 1857)
Hosts: *Abramis brama*, localization gills; prevalence: 18% (22/120); intensity: 1–16. Throughout the year Also in *Rutilus rutilus*, prevalence 3% (1/40), intensity. 1. In September.

9. *Dactylogyrus fallax* Wagener, 1857
Host. *Rutilus rutilus* (L.); localization. gills; prevalence 3% (1/40), intensity: 1 In March

10. *Dactylogyrus folkmanovae* Ergens, 1956
Host *Leuciscus cephalus*; localization. gills; prevalence: 20% (8/41); intensity 1–10 In February, June and September

11. *Dactylogyrus fraternus* Wegener, 1909
Host *Alburnus alburnus*, localization. gills; prevalence: 74% (20/27); intensity: 1–19. Throughout the year.

12. *Dactylogyrus micracanthus* Nybelin, 1937
Hosts: *Leuciscus cephalus*; localization: gills, prevalence 2% (1/41); intensity 1 Also in *Rutilus rutilus*: 3% (1/40), 1 In March and October.

13 *Dactylogyrus minor* Wagener, 1857
Host. *Alburnus alburnus*; localization: gills, prevalence 41% (11/27); intensity 1–5 Throught the year

14. *Dactylogyrus minutus* Kulwiec, 1927
Host: *Cyprinus carpio*; localization. gills, prevalence 10% (1/10); intensity: 10. In September.

15. *Dactylogyrus nanoides* Gussev, 1966
Host: *Leuciscus cephalus*; localization: gills; prevalence: 27% (11/41); intensity: 1–4 Throught the year

16. *Dactylogyrus nanus* Dogiel et Bychowsky, 1934
Host. *Rutilus rutilus*; localization gills; prevalence: 15% (6/40), intensity: 2–7 In spring, summer and autumn.

17. *Dactylogyrus naviculoiodes* Ergens, 1956
Host *Leuciscus cephalus*; localization: gills, prevalence 2% (1/41), intensity. 1 In October.

18. *Dactylogyrus parvus* Wegener, 1909
Host. *Alburnus alburnus*; localization gills; prevalence: 33% (9/27); intensity: 1–4 In April, August and September.

19. *Dactylogyrus prostae* Molnár, 1964
Host: *Leuciscus cephalus*, localization gills, prevalence: 2% (1/41); intensity. 2 In October.

20. *Dactylogyrus rutili* Gläser, 1965
Host *Rutilus rutilus*, localization: gills, prevalence. 8% (3/40); intensity: 1–5. In spring and summer.

21. *Dactylogyrus similis* Wegener, 1909
Host: *Rutilus rutilus*, localization gills; prevalence. 17.5% (7/40); intensity: 2–10. In March, April and September.

22. *Dactylogyrus sphyrna* Linstow, 1878
Hosts: *Blicca bjoerkna*; localization gills; prevalence: 100% (3/3), intensity 1–5 Also in *Rutilus rutilus*; 5% (2/40); 1; and *Abramis brama*; 3% (4/120); 1–4. In May and September

23. *Dactylogyrus suecicus* Nybelin, 1937
Host. *Rutilus rutilus*; localization: gills, prevalence 18% (7/40); intensity 2–10 In March, April and September.

24. *Dactylogyrus tuba* Linstow, 1878
Host *Aspius aspius*; localization: gills; prevalence. 25% (1/4); intensity: 1 In September.

25. *Dactylogyrus vistulae* Prost, 1957
Host *Leuciscus cephalus*, localization gills; prevalence: 22% (9/41); intensity: 1–5 From February to June and from September to October.

26. *Dactylogyrus vranoviensis* Ergens, 1956
Host: *Leuciscus cephalus*; localization. gills, prevalence: 7% (3/41); intensity: 1–2. In June and September.

27. *Dactylogyrus wunderi* Bychowsky, 1931
Host: *Abramis brama*; localization: gills; prevalence 49% (59/120); intensity. 8–32 From March to November

28. *Dactylogyrus zandti* Bychowsky, 1933
Host: *Abramis brama*; localization. gills; prevalence: 34% (41/120); intensity. 1–26. From March to November

29. *Dactylogyrus* cf. *caballeroi* Prost, 1960
Host. *Rutilus rutilus*, localization. gills; prevalence 15% (6/40), intensity: 2–8. From March to April and from July to September.

30. *Tetraonchus monenteron* (Wagener, 1857)
Host *Esox lucius*, localization. gills, prevalence. 100% (5/5); intensity 7–151 From September to November

31. *Ancyrocephalus paradoxus* Creplin, 1839
Host. *Stizostedion lucioperca*; localization: gills; prevalence: 91% (10/11), intensity: 1–38. From February to April and from October to November

32. *Ancyrocephalus percae* Ergens, 1966
Host: *Perca fluviatilis* L.; localization. gills; prevalence: 6% (2/32); intensity: 1. In June and October.

33. *Gyrodactylus carassii* Malmberg, 1957
Hosts *Leuciscus cephalus*, localization: fins and gills; prevalence 7% (3/41); intensity: 1–25 Also in *Alburnus alburnus*; 7% (2/27); 2–4. In April.

34. *Gyrodactylus cyprini* Diarova, 1964
Host *Cyprinus carpio*; localization fins, skin and gills, prevalence: 10% (1/10); intensity: 67. In April.

35. *Gyrodactylus elegans* Nordmann, 1832
Host. *Abramis brama*; localization: gills; prevalence 36% (43/120), intensity: 1–372 From May to September

36. *Gyrodactylus gobii* Shulman, 1953
Host: *Gobio gobio*, localization: fins, prevalence. 50% (1/2); intensity 22 In February

37. *Gyrodactylus gobiensis* Gläser, 1974
Host *Gobio gobio*; localization fins; prevalence: 100% (2/2); intensity· 6–27 In February.

38. *Gyrodactylus gracilihamatus* Malmberg, 1964
Host· *Leuciscus cephalus*; localization: fins; prevalence: 2% (1/41); intensity 4. In April

39. *Gyrodactylus katharineri* Malmberg, 1964
Hosts· *Cyprinus carpio*, localization fins and skin; prevalence· 10% (1/10); intensity: about 1000 Also on *Rutilus rutilus*; localization fins, 3% (1/40), 2 In April.

40. *Gyrodactylus kearni* Ergens, 1989
Host: *Leuciscus cephalus*; localization: fins; prevalence: 3% (1/41); intensity 1. In April.

41. *Gyrodactylus kherulensis* Ergens, 1974
Host *Cyprinus carpio*, localization. fins; prevalence 10% (1/10); intensity 1. In September

42. *Gyrodactylus laevis* Malmberg, 1957
Host. *Leuciscus cephalus*; localization. gills; prevalence: 2% (1/41); intensity. 1. In April

43. *Gyrodactylus leucisci* Žitňan, 1964
Host: *Rutilus rutilus*, localization fins, prevalence: 3% (1/40); intensity: 1. In February

44. *Gyrodactylus lucii* Kulakowskaja, 1951
Host: *Esox lucius*, localization. fins; prevalence 20% (1/5); intensity· 2 In November

45. *Gyrodactylus luciopercae* Gussev, 1962
Hosts *Stizostedion lucioperca*, localization: fins, skin and gills; prevalence 73% (8/11); intensity. from 2 up to several hundreds Also on *Perca fluviatilis*, 16% (5/32), 1–2 In February, April, October and November.

46. *Gyrodactylus markakulensis* Gvosdev, 1950
Host *Gobio gobio*; localization: gills; prevalence 100% (2/2); intensity: 1–3 In February.

47. *Gyrodactylus osoblahensis* Ergens, 1963
Host: *Leuciscus cephalus*; localization. gills, prevalence: 2% (1/41); intensity: 1. In April

48. *Gyrodactylus prostae* Ergens, 1963
Hosts *Leuciscus cephalus*, localization fins and gills; prevalence· 12% (5/41), intensity· 1–16. Also on *Leuciscus leuciscus*; 20% (1/5), 1, and *Rutilus rutilus*, 3% (1/40); 1. In February, April and October.

49. *Gyrodactylus vimbi* Shulman, 1953
Host: *Abramis brama*; localization: gills and fins; prevalence: 10% (12/120); intensity: 1–246. From May to July.

50. *Gyrodactylus* sp. 1
Host. *Gobio gobio*, localization: fins, prevalence: 50% (1/2); intensity: 1 In February.

51. *Gyrodactylus* sp. 2 (belonging to *G. vimbi* complex)
Host: *Perca fluviatilis*; localization. fins, prevalence 3% (1/32), intensity 1 In February

52. *Gyrodactylus* sp. 3 (resembling *G. hronosus* Žitňan, 1964 considered a *species inquirenda*)
Host. *Alburnus alburnus*; localization. gills; prevalence. 4% (1/27), intensity 1 In June.

53. *Paradiplozoon alburni* Khotenovsky, 1982
Host. *Alburnus alburnus*, localization· gills, prevalence· 4% (1/27); intensity: 2. In March.

54. *Paradiplozoon ergensi* (Pejčoch, 1968)
Host. *Leuciscus cephalus*; localization. gills; prevalence: 22% (9/41); intensity: 1–17 From February to April and from September to October.

55. *Paradiplozoon homoion homoion* (Bychowsky et Nagibina, 1959)
Hosts. *Rutilus rutilus*; localization: gills; prevalence· 30% (12/40), intensity 1–5 Also on *Leuciscus cephalus*; 40% (2/5); 1–2; and *Alburnus alburnus*; 48% (13/27), 1–16. From February to April and from July to September.

56. *Paradiplozoon pavlovskii* (Bychowsky et Nagibina, 1959)
Host. *Aspius aspius*, localization gills; prevalence 50% (2/4); intensity· 2–4 In March and September.

57. *Paradiplozoon* sp. (diporpae)
Hosts *Blicca bjoerkna*; localization gills, prevalence: 67% (2/3), intensity 1 Also on *Leuciscus leuciscus*; 20% (1/5), 1 In September

58. *Diplozoon paradoxum* Nordmann, 1832
Host: *Abramis brama*; localization. gills. prevalence 60% (72/120); intensity. 1–16. From March to November

Cestoda

59. *Caryophyllaeus brachycollis* Janiszewska, 1951
Host *Leuciscus cephalus*; localization. intestine; prevalence· 2% (1/48); intensity 1. In May.

60. *Caryophyllaeus fimbriceps* Annenkova-Chlopina, 1919
Host: *Alburnus alburnus*, localization: intestine; prevalence 3% (1/30), intensity 1 In May

61. *Caryophyllaeus laticeps* (Pallas, 1781)
Host *Abramis brama*, localization intestine, prevalence 25% (38/151); intensity 1–43 From March to November.

62. *Caryophyllaeides fennica* (Schneider, 1902)
Hosts. *Rutilus rutilus*; localization intestine; prevalence 13% (6/48); intensity: 1–3 Also in *Leuciscus cephalus*; 6% (3/40), 1–3. In March, October and December.

63. *Khawia sinensis* Hsü, 1935
Host. *Cyprinus carpio*; localization: intestine; prevalence: 50% (4/8), intensity: 1–6 In June and September

64. *Bothriocephalus claviceps* (Goeze, 1782)
Host *Anguilla anguilla*, localization· intestine; prevalence. 33% (1/3), intensity. 5. In September.

65. *Triaenophorus nodulosus* (Pallas, 1781) plerocercoids
Host. *Perca fluviatilis*; localization: liver; prevalence 5% (2/39); intensity: 1 In September.

66. *Proteocephalus torulosus* (Batsch, 1782)
Hosts *Aspius aspius*; localization intestine, prevalence 67% (2/3), intensity; 3–32 Also in *Alburnus alburnus*; 7% (2/30), 1, and *Rutilus rutilus*; 4% (2/48); 1. From March to May

67. *Proteocephalus macrocephalus* (Creplin, 1825)
Host: *Anguilla anguilla*, localization· intestine; prevalence· 33% (1/3); intensity: 6 In September.

68. *Proteocephalus* sp. juv.
Hosts. *Perca fluviatilis*; localization: intestine, prevalence: 3% (1/39), intensity: 1. Also in *Stizostedion lucioperca*; 10% (1/10), 1. In February and May.

Trematoda

69. *Phyllodistomum dogieli* Pigulewsky, 1953
Host *Alburnus alburnus*; localization urinary bladder, prevalence 7% (2/30); intensity: 1. In May and August.

70. *Bunodera luciopercae* (Müller, 1776)
Hosts *Stizostedion lucioperca*, localization intestine and pyloric caeca; prevalence: 40% (4/10); intensity: 10–25 Also in *Perca fluviatilis* L., 5% (2/39), 3–17 In January, February, April and October

71. *Rhipidocotyle illense* (Ziegler, 1883)
Hosts *Perca fluviatilis* L., localization intestine, prevalence 18% (7/39), intensity 1–18 Also in *Stizostedion lucioperca*, 10% (1/10), 10 In January, February and October

72 *Cotylurus pileatus* (Rudolphi, 1802) metacercaria
Host *Abramis brama*, localization abdominal cavity, prevalence 2% (1/151), intensity 1 In September

73. *Cotylurus platycephalus* (Creplin, 1825) metacercaria
Host *Stizostedion lucioperca*, localization abdominal cavity, prevalence 10% (1/10), intensity 1 In February

74 *Diplostomum* sp metacercariae
Hosts *Blicca bjoerkna*, localization lens of eyes, prevalence 100% (10/10), intensity 7–87 *Abramis brama*, 82% (124/151), 1–79 *Leuciscus leuciscus*, 100% (3/3), 1–8 *Leuciscus cephalus*, 50% (24/48), 1–12 *Rutilus rutilus*, 54% (26/48) 1–36 *Cyprinus carpio*, 75% (6/8), 1–9 *Scardinius erythrophthalmus*, 50% (1/2), 1 *Aspius aspius*, 33% (1/3), 3 *Alburnus alburnus*, 3% (1/30), 1 *Anguilla anguilla*, 67% (2/3), 1 *Stizostedion lucioperca*, 40% (4/10), 1–4 Throughout the year

Nematoda

75 *Philometra abdominalis* Nybelin, 1928
Hosts *Leuciscus cephalus*, localization beneath serosa of swimbladder (males and young females) and abdominal cavity (females), prevalence 33% (16/48), intensity 1–69 Also in *Leuciscus leuciscus*, 33% (1/3), 1 From September to April

76 *Philometra kotlani* (Molnár, 1969)
Host *Aspius aspius*, localization beneath serosa of swimbladder (males and young females) and abdominal cavity (females), prevalence 33% (1/3), intensity 1–36 In April and May

77 *Philometra ovata* (Zeder, 1803)
Hosts *Abramis brama*, localization beneath serosa of swimbladder (males and young females) and abdominal cavity (females), prevalence 57% (86/151), intensity 1–28 *Blicca bjoerkna*, 10% (1/10), 1 *Rutilus rutilus*, 2% (1/48), 1 *Leuciscus cephalus*, 2% (1/48), 1 Only males were recorded from the three last named hosts Throughout the year

78 *Camallanus lacustris* (Zoega, 1776)
Hosts *Perca fluviatilis*, localization intestine and pyloric caeca, prevalence 15% (6/39), intensity 1–10 Also in *Stizostedion lucioperca*, 10% (1/10) 7 In June, September, October and December

79 *Rhabdochona denudata* (Dujardin, 1845)
Hosts *Leuciscus cephalus*, localization intestine, prevalence 15% (7/48), intensity 1–4 *Alburnus alburnus*, 10% (3/30), 1 2 *Blicca bjoerkna*, 10% (1/10), 2 In February, April, May and from September to December

80 *Raphidascaris acus* (Bloch, 1779)
Host *Esox lucius*, localization intestine, prevalence 2% (2/7), intensity 1–2 In May and October

80a *Raphidascaris acus* (Bloch, 1779) larvae
Hosts *Abramis brama*, localization abdominal cavity, prevalence 5% (7/151), intensity 1 Also in *Rutilus rutilus*, 2% (1/48), 1 In February, May, June, August and September

81 *Pseudocapillaria tomentosa* (Dujardin, 1843)
Host *Cyprinus carpio*, posterior end of intestine, prevalence 25% (2/8), intensity 25–58 In June and September

Acanthocephala

82 *Acanthocephalus anguillae* (Muller, 1780)
Hosts *Leuciscus cephalus*, localization intestine prevalence 8% (3/40) intensity 1–8 *Blicca bjoerkna*, 10% (1/10), 1 *Abramis brama*, 5% (8/151), 1–4 *Rutilus rutilus*, 4% (2/48), 2–5 *Alburnus alburnus*, 3% (1/30), 1 In January, April, May, July and September

83 *Acanthocephalus lucii* (Muller, 1776)
Hosts *Perca fluviatilis*, localization intestine, prevalence 28% (11/39), intensity 1–9 Also in *Stizostedion lucioperca*, 10% (1/10) 1 In January, February, April, June and October

84 *Neoechinorhynchus rutili* (Muller, 1780)
Hosts *Abramis brama*, localization intestine, prevalence 2% (3/151), intensity 1 Also in ***Esox lucius***, 14% (1/7), 1 In May and November

Hirudinea

85 *Piscicola geometra* (Linnaeus, 1761)
Host *Perca fluviatilis*, localization fins, prevalence 6% (2/32), intensity 1 In January

Mollusca

86 Glochidium sp (larva)
Hosts *Perca fluviatilis*, localization fins and gills, prevalence 19% (6/32), intensity 1–4 *Leuciscus cephalus*, 2% (1/41), 1 *Stizostedion lucioperca*, 27 2% (3/11), 1–7 From January to April

Crustacea

87 *Ergasilus sieboldi* Nordmann, 1832
Hosts *Abramis brama*, localization gills, prevalence 11% (13/120), intensity 1 *Aspius aspius*, 25% (1/4), 58 *Rutilus rutilus* 2 5% (1/40), 6 *Esox lucius*, 20% (1/5), 11 *Stizostedion lucioperca*, 9% (1/11), 6 From March to May and from September to October

88 *Argulus foliaceus* (Linnaeus, 1758)
Hosts *Abramis brama*, localization gills, prevalence 2% (2/120), intensity 1 *Cyprinus carpio*, 20% (2/10), 1–2 *Leuciscus cephalus*, 2% (1/41), 1 In April, May and September

Survey of examined fishes and their parasites

Esox lucius
Tetraonchus monenteron, Gyrodactylus lucii, Raphidascaris acus, Neoechinorhynchus rutili

Anguilla anguilla
Bothriocephalus claviceps, Proteocephalus macrocephalus, Diplostomum sp met

Rutilus rutilus
Dactylogyrus crucifer, D falcatus, D fallax, D micracanthus, D nanus, D rutili, D similis, D sphyrna, D suecicus, Dactylogyrus cf *caballeroi, Gyrodactylus katharineri, G leucisci, G prostae, Paradiplozoon homoion homoion, Caryophyllaeides fennica, Proteocephalus torulosus, Diplostomum* sp met , *Philometra ovata, Raphidascaris acus* larv , *Acanthocephalus anguillae, Ergasilus sieboldi*

Leuciscus cephalus
Dactylogyrus folkmanovae, D micracanthus, D nanoides, D naviculoides, D prostae, D vistulae, D vranoviensis, Gyrodactylus carassii, G gracilihamatus, G kearni, G laevis, G prostae, G osoblahensis, Paradiplozoon ergensi, Caryophyllaeus brachycollis, Caryophyllaeides fennica, Diplostomum sp met , *Philometra abdominalis, P ovata, Rhabdochona denudata, Acanthocephalus anguillae,* Glochidium sp , *Argulus foliaceus*

Leuciscus leuciscus
Dactylogyrus cordus, Gyrodactylus prostae, Paradiplozoon sp juv , *Diplostomum* sp met , *Philometra abdominalis*

Aspius aspius
Dactylogyrus tuba, Paradiplozoon pavlovskii, Proteocephalus torulosus, Diplostomum sp met , *Philometra kotlani, Ergasilus sieboldi*

Scardinius erythrophthalmus
Dactylogyrus difformis, Diplostomum sp met

Alburnus alburnus

Dactylogyrus fraternus, D. minor, D. parvus, Gyrodactylus carassii, Gyrodactylus sp. 3, *Paradiplozoon alburni, P. homoion homoion, Caryophyllaeus fimbriceps, Proteocephalus torulosus, Phyllodistomum dogieli, Diplostomum* sp. met., *Rhabdochona denudata, Acanthocephalus anguillae.*

Gobio gobio

Gyrodactylus gobiensis, G. gobii, G. markakulensis, Gyrodactylus sp. 1.

Blicca bjoerkna

Dactylogyrus sphyrna, Paradiplozoon sp. juv., *Diplostomum* sp. met., *Philometra ovata, Rhabdochona denudata, Acanthocephalus anguillae*

Abramis brama

Dactylogyrus auriculatus, D. distinguendus, D. falcatus, D. sphyrna, D. wunderi, D. zandti, Gyrodactylus elegans, G. vimbi, Diplozoon paradoxum, Caryophyllaeus laticeps, Diplostomum sp. met., *Cotylurus pileatus* met., *Philometra ovata, Raphidascaris acus* larv., *Acanthocephalus anguillae, Neoechinorhynchus rutili, Ergasilus sieboldi, Argulus foliaceus*

Cyprinus carpio

Dactylogyrus achmerowi, D. extensus, D. minutus, Gyrodactylus cyprini, G. katharineri, G. kherulensis, Khawia sinensis, Diplostomum sp. met., *Pseudocapillaria tomentosa, Argulus foliaceus.*

Perca fluviatilis

Ancyrocephalus percae, Gyrodactylus luciopercae, Gyrodactylus sp. 2, *Triaenophorus nodulosus* plcr., *Proteocephalus* sp. juv., *Bunodera luciopercae, Rhipidocotyle illense, Camallanus lacustris, Acanthocephalus lucii, Piscicola geometra,* Glochidium sp.

Stizostedion lucioperca

Ancyrocephalus paradoxus, Gyrodactylus luciopercae, Proteocephalus sp. juv., *Bunodera luciopercae, Rhipidocotyle illense, Diplostomum* sp. met., *Cotylurus platycephalus* met., *Camallanus lacustris, Acanthocephalus lucii, Ergasilus sieboldi,* glochidium sp.

CONCLUSIONS

Examinations of 365 fish specimens of 15 species collected from the Vltava River section near the planned heated effluent from the Temelín nuclear power-station, carried out in 1986–1988, revealed the presence of 88 species of metazoan parasites. The occurrence of several additional parasite species cannot, however, be excluded because only small numbers of some fish species were examined. Nevertheless, even these results give an idea of the general state of the fauna of metazoan parasites of fish in the study section of the Vltava River.

Monogeneans were represented by six genera: *Dactylogyrus* by 29 species, *Gyrodactylus* by 20 species, *Ancyrocephalus* by 2 species, *Tetraonchus* and *Diplozoon* each by one species and *Paradiplozoon* by four species. Most of them are host specific parasites, only some were found on more than one species of host fishes. Some of the present findings are remarkable, supplementing present knowledge about the geographical distribution of species. *Dactylogyrus achmerowi* and *Gyrodactylus kherulensis*, two species found on carp were, for the first time, recorded from the Czech Republic (Gelnar & Lux 1991), as well as *Paradiplozoon alburni* and *Dactylogyrus* cf. *caballeroi* from bleak and roach, respectively. *Dactylogyrus falcatus* is reported for the first time from the Elbe River drainage system.

The cestode fauna was found to be represented by ten species from six genera. *Proteocephalus* sp. juv. from perch-like fishes is probably *P. percae* (Müller, 1780). The life cycles of these cestodes involve either oligochaetes or planktonic crustaceans as intermediate hosts.

In contrast to the cestodes, the trematode fauna appears to be rather species poor, formed of only three species of adult trematodes, *Rhipidocotyle illense, Phyllodistomum dogieli* and *Bun-*

odera luciopercae, of which only the last named is frequent, metacercariae were represented only by three species of bird trematodes (*Diplostomum*, *Cotylurus*) The first intermediate hosts of the above mentioned adult trematodes are clams (Bivalvia), whereas the bird species of trematodes develop through aquatic snails

Acanthocephalans were represented by three species Whereas both *Acanthocephalus* species, developing through the benthic isopod *Asellus aquaticus* L , were rather frequent in fishes, *Neoechinorhynchus rutili*, utilizing ostracods as intermediate hosts, occurred only rarely

Nematodes parasitic in fishes were represented by seven species from five genera *Philometra kotlani*, a specific tissue parasite of *Aspius aspius*, was recorded, for the first time, from the Elbe River basin All *Philometra* and *Camallanus* members develop through planktonic crustaceans (copepods), *Rhabdochona denudata* through ephemeropterans, and *Raphidascaris acus* utilizes mostly small cyprinids as intermediate hosts, the life cycle of *Pseudocapillaria tomentosa* has not yet been elucidated

Metazoan parasites were recorded from all species of fishes examined The highest numbers of species were found in *Leuciscus cephalus* (23), *Rutilus rutilus* (21) and *Abramis brama* (18), these fish species belonged to the most frequently caught fishes in the locality

In view of the numbers of fishes examined in the course of the year, the seasonal cycles in occurrence and maturation could be followed only in a few parasite species, mostly those from *Abramis brama* Pronounced seasonality was recorded, for example, in many ectoparasites of bream, mainly monogeneans Of the endohelminths, the findings of some species, e g cestodes of the genus *Proteocephalus*, trematodes *Bunodera luciopercae* or nematodes of the genus *Philometra* and *Raphidascaris acus*, showed distinct seasonal cycles in maturation, as observed in other localities

It was possible to observe, on comparing with other localities, a certain decrease in the number of parasite species, particularly of endohelminths

Even though a detailed ichthyological study has not been carried out in this locality, the poor fauna of fish parasites might be associated with both a disappearance or a strong reduction of populations of some previously frequent fish species, e g barbel, and with a qualitative and quantitative poorness of the fauna of some groups of aquatic invertebrates serving as obligate intermediate hosts for many parasites, as a result of serious water pollution This is probably the main cause of the conspicuously poor fauna of fish trematodes, the life cycles of which depend on the presence of mollusc intermediate hosts Of course, it is necessary to take into account that, due to migrations, some fishes might acquire infection by parasite species recorded by us outside the Vltava River section under study, for example from the tributary streams or the upper part of the Orlik water reservoir

Nevertheless, it can be expected that the improvement of living conditions for aquatic organisms in this section of the Vltava River after the start of working of the clarification plant at Větřní will result in a more diverse composition of the fish parasite fauna Consequently, the fish parasite fauna might serve, to a certain degree, as an indicator of the water quality

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Development of the female internal reproductive system in *Ilyocoris cimicoides* (Heteroptera: Nepomorpha: Naucoridae)

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Abstract. Oogenesis and gross morphology of ovaries and their ducts were studied in nymphal instars 1–5 and variously aged adult females of *Ilyocoris cimicoides* L., 1758 of Central European populations. Ovarioles of instar 1 and 2 are not differentiated, the ovaries are formed by a homogenous mass of oogonia which is localized in the second abdominal segment. The onset of intensive growth of ovarioles was observed in the late instar 5 although ovarioles differentiated in instar 3 and they contained fully differentiated oocytes and trophic syncytium connected with first egg chambers in instar 4. Growth of ovarioles and oogenesis are fully ceased during the overwintering quiescence (from late November to early March in the populations studied). Mature (chorionated) eggs start to appear from the first decade of April. The rudiments of lateral oviducts are apparent even in the first instar. Two ampular invaginations of the ectodermal part of duct system (common oviduct and vagina & spermatheca) are discernible in nymphs from the instar 3. Spermatheca in its nearly definitive shape appears in the late instar 5. Structure and development of internal reproductive system in *I. cimicoides* is compared to available data on other aquatic bugs and morphological data are correlated with events of mating, oviposition and life cycle.

Development, morphology, histology, ovarioles, efferent ducts, oogenesis, life cycle, overwintering, sexual strategy, nymphs, adults, apomorphies, Heteroptera, Naucoridae

INTRODUCTION

Although the first precise comparative study dealing with the gross morphology and histology of internal reproductive systems of adults in some aquatic bugs was published before 60 years ago (see Larsén 1938), the available informations on the development of nepomorphan gonads and their ducts are yet relatively scare in present time. Only Papáček & Soldán (1987) studied development of this system „step by step" in detail only in the one model species – *Notonecta glauca*. The mentioned authors summarized till published data on this subject as well.

Ilyocoris cimicoides is a very common predaceous water bug of lentic biotopes. It is one of the only two Central European species (*Plea minutissima* (Pleidae) is the second one) having an obligatory diapause. Adults usually overwinter in bottom habitats in completely inactive state (Papáček 1989). Spermatogenesis and development of the male gonads and their ducts has been already described by Papáček & Gelbič (1989). The position and general arrangement of mature ovaries of *I. cimicoides* were studied by Larsén (1938). It is true that Rawat (1939) pointed out some ontogenetic aspects of reproductive organ in this species, but there was no complete information on the development of ovaries and of the effect of obligatory diapause on the reproductive events of this species in general. The present paper helps to fill this gap.

MATERIAL AND METHODS

Specimens of the saucer bug, *Ilyocoris cimicoides*, both nymphs and adults, were collected from March 1994 to November 1996 at seventeen localities in South and West Bohemia including the winter months (regularly at three localities in the vicinity of České Budějovice) Further specimens kept (from eggs to adults) in an outdoor aquarium from 1994 – 1995 were used too. They were fixed with Bouin fixative and dissected under a stereoscopic microscope in 96% ethanol Dissected reproductive organs and their total micropreparations (organs dehydrated in isopropanol and embedded in Euparal) were used for the study of morphology and for measurement of individual parts of the reproductive system The oldest and largest oocytes or eggs respectively, was always measured in all ovarioles of both ovaries in the specimens examined (i e 2×7 = 14 oocytes in specimens measured; cf. Fig 13) Oogenesis and histology of ducts was studied on 4–6 m paraplast sections stained with Harris hematoxylin-eosin (whole abdomens cut in nymphs of instars 1 and 2).

It is not possible to distinguish the true age of specimens during the instars 1–3 As in older nymphs (instars 4–5) preferably specimens immediately before or after ecdysis were studied Their age was estimated according to cuticular changes in specimens of defined age kept in aquarium. Interval for the study of the development of reproductive system in adult females was two weeks or three weeks in the winter months (December – February) respectively.

The terminology used here is derived mainly from Büning (1994) and Larsén (1938)

RESULTS

Development of ovaries

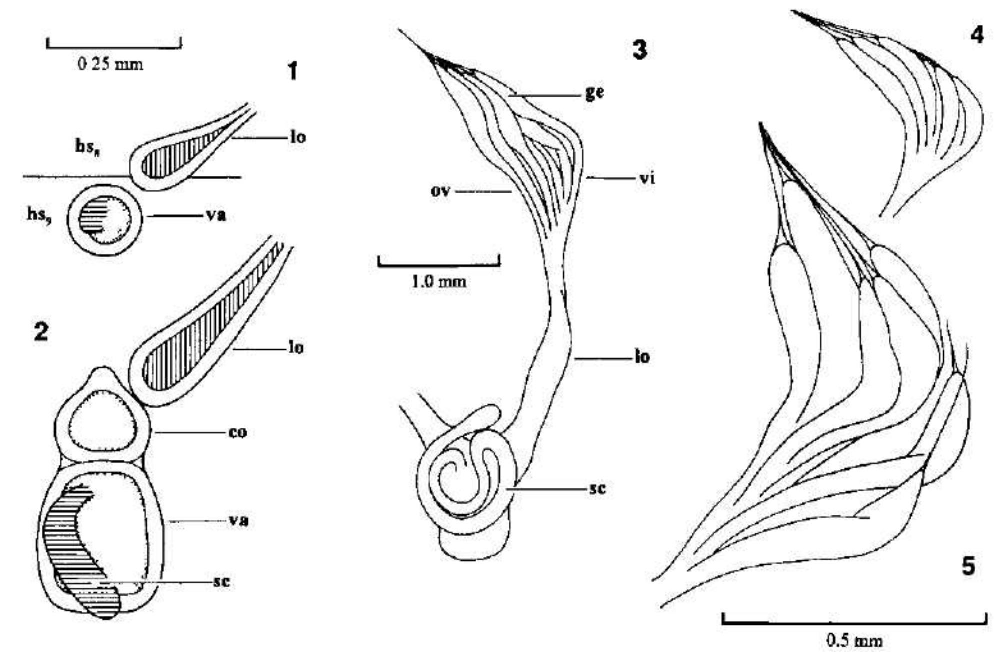
The ovarial rudiments in nymphs of the first and second instars measured about 0.1–0.2 mm. They are situated in the second abdominal segment and surrounded by fat body. Individual ovarioles are still not differentiated. Histologically, these rudiments are seen as a homogenous mass of germ cells showing some mitotic activity. Differentiation of the ovarioles starts in the nymphs of the third instar. Seven ovarioles of not equal length can be distinguished at the end of this instar. The whole ovariole is formed only by germarium (Figs 4, 5). Length growth of ovarioles is apparent during the fourth instar, when trophic syncytium in the germarium starts to be formed as well. A short vitellarium with about 4–6 small, still not linearly arranged pre-vitellogenetic oocytes can be distinguished in nymphs of the fifth instar (Fig. 3)

Ovaries of teneral adult females are very similar to those in last instar nymphs although the ovarioles are now relatively longer. Germ cells are restricted to a narrow band in the distal portion of the germarium at that time. About 4–7 linearly arranged oocytes with clearly visible trophic cords are distinguishable in two to four week-old females, from mid September to mid August. Vitellogenesis evidently starts in one or two of the oldest oocytes although they are still of the same size as the younger ones. Till the beginning of diapause (about mid November) 14–15 egg chambers are gradually formed, the proximal ones being at least twice the length of younger chambers. Yolk granula conceal nuclei in 1–3 oldest oocytes. The young (proximal) egg chambers are connected with the short follicular stalks (sensu Büning 1994) (Plate 1, Fig. B). Both the development of the ovaries (growth of vitellarium) and vitellogenesis completely cease throughout diapause, i. e. from mid November to about mid March. From mid March, an intensive length growth of ovarioles can be observed. Secretion of chorion takes place from the end of March till mid April (Fig. 12) depending on climatic conditions at the individual locality. Oviposition starts from mid April. Mature eggs, when still inside the ovariole, are arranged to utilize space in the most „economic" manner with always the opposite orientation of the chorionic micropilar respiratory plate in the following egg (Fig. 11). The growth of the oldest (distal) oocytes is apparent from Fig. 13. The oldest oocytes of overwintering (= diapausing) females are about 1 mm long,, it is on nearly one half of the length of chorionated definitive eggs. The smaller (37% of length of chorionated eggs) distally localized oocytes were found in females overwintering in one locality under extremely unfavourable conditions in Pacov highland in South Bohemia during the winter of 1995–96 (pool with 0.2–0.4 m high column of water completely iced during December, January and most of February).

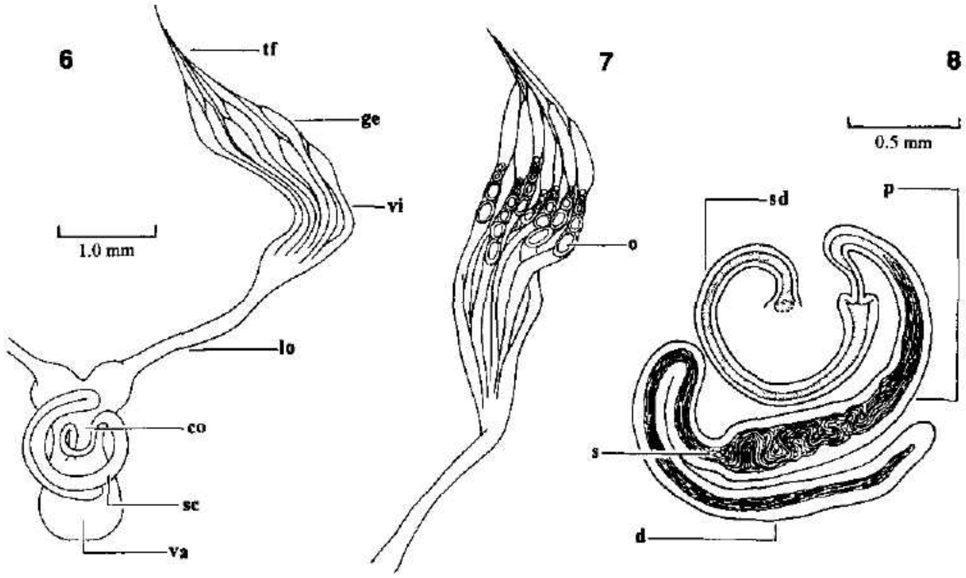
The epithelium of the egg chambers undergoes rapid changes during vitellogenesis, and during secretion of the chorion. The follicular epithelium of the proximal egg chamber (namely in adult females before overwintering) is very high and columnar (Plate 1, Fig. B). Egg chambers of vitellogenic eggs have evidently a cubic follicular epithelium (Plate 1, Fig. C). Epithelial cells shortly before chorional secretion start are more or less cubic and binucleate (Plate 2, Fig D). The last phase in development of the follicular cells is one of postsecretory degeneration (Plate 2, Fig. E).

Development of lateral oviducts and ectodermal efferent ducts

The lateral oviducts of nymphs of the first and second instars are connected with the ovaries and each ends in a blind terminal ampula between the eight and ninth abdominal segments. The rudiments of vagina and spermatheca start to invaginate from ectodermal tissues in the third instar nymph (Fig. 1). In nymphs of the fourth instar, two ectodermal invaginations are apparent. The anterior one of these represents the rudiment of the common oviduct, while the posterior one, corresponding to a single invagination in younger nymphs, represents the ectodermal anlage of vagina and spermatheca. The spermathecal rudiment of the nymphs of fourth instar is



Figs 1–5 Development of the internal reproductive organs in nymphs of *Ilyocoris cimicoides* (dorsal view, semischematic) 1 – terminal part of the anlage of efferent ducts in nymphs of instar 3, left lateral oviduct omitted. Ectodermal invagination (= posterior invagination in nymphs of the instar 4, compare Fig. 2) represents the vaginal and spermathecal anlage 2 – terminal part of the efferent ducts anlage in nymphs of the instar 4, left lateral oviduct omitted 3 – the reproductive system of nymphs of the instar 5, left ovary omitted. 4 – right ovary in nymphs of instar 3 5 – right ovary with unequal length of individual ovarioles in nymphs of instar 4 Cavities or ampulae of mesodermal origin are lined vertically, those of the ectodermal origin are lined horizontally (spermathecal rudiment) or dotted, respectively. co – rudiment of common oviduct, ge – germarium, hs_8, hs_9 – hypodermis of the 8th or 9th abdominal sterna, lo – rudiment of lateral oviduct, ov – ovary, sc – spermatheca or its rudiment, va – vagina, vi – vitellarium.



Figs 6–8. Development of the internal reproductive organs in adult females of *Ilyocoris cimicoides* (dorsal view, semischematic) 6 – *the reproductive system of teneral adults, left ovary omitted. This situation corresponds to that most females* occurring from the end of July to the beginning of August in Central European populations 7 – right ovary and the respective lateral oviduct of a two-week-old female This situation corresponds to that of most females occurring at the second half of August. 8 – spermatheca of females after diapause (mid April)
co – common oviduct, d – distal portion of spermatheca, ge – germarium, lo – lateral oviduct, o – oocyte, p – proximal portion of spermatheca, s – mature spermatozoa, sc – spermatheca, sd – spermathecal duct, tf – terminal filament, vi – vitellarium.

an elongated, sack-like asymmetric formation, apparently longer than the anlage of the vagina (Fig. 2). The cavities of the future efferent ducts remain still unconnected in nymphs of the fifth instar (Fig. 3) although they represent the consistent outflow ways in the outer view. In the same instar, the spermatheca undergoes an intensive growth and is apparently divided into spermathecal duct and spermathecal body (= spermathecal bulbus). The spermathecal body is only a little more voluminous than the duct. Both the lateral and common oviducts possess the usual structure consisting of an outer layer of muscles and an inner epithelial layer. The inner follicular epithelium is conspicuously folded, enabling considerable extension of the walls of these ducts.

Notes on the structure of spermatheca

According to Larsén (1938), three portions of spermatheca can be distinguished: the canal (= ductus), the vesicula (= medial expanded portion, = proximal part of spermathecal bulbus) and the apical gland (= distal portion, = apical part of spermathecal bulbus). The spermathecal ductus is provided with cylindric secretory cells with large light vacuoles well visible even at low power in micropreparations. The distal part of the spermatheca, apart from its secretory function, can also serve as a reservoir for mature spermatozoa after copulation. The spermatozoa are currently found in the spermathecas of females after diapause in April. However, spermathecas of females before overwintering can contain mature spermatozoa as well although very rarely.

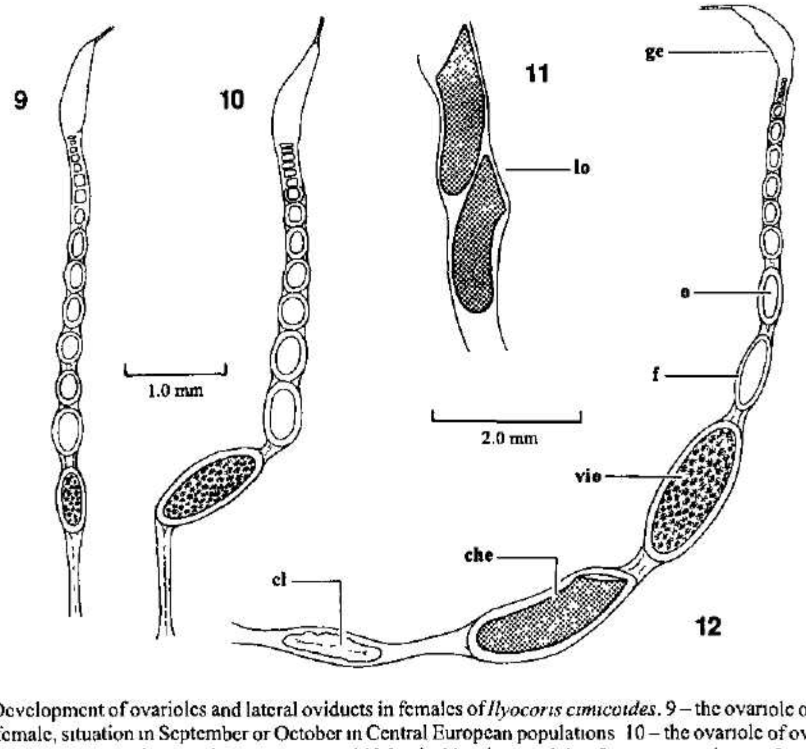
The arrangement of spermatozoa in the spermathecal bulbus is worthy of attention. In its distal part, the spermatozoa are arranged parallelly while showing an irregular arrangement in the proximal part. Small papillae apparent on the inner surface of the proximal spermathecal part probably serve as a comb for the separation of individual spermatozoa (Fig. 8).

DISCUSSION AND CONCLUSIONS

Structures of reproductive system – differentiation and ontogenetic changes

If we compare our present data with the fragmentary pieces of knowledge on the other water bugs (especially with *Notonecta glauca* L., 1758 (Notonectidae) (cf. Papáček & Soldán 1987), *Enithares* Spinola, 1837, *Anisops* Spinola, 1837, (Notonectidae), some Corixidae, *Aphelocheirus aestivalis* (Fabricius, 1803) (Aphelocheiridae), *Plea minutissima* Leach, 1817 (Pleidae) and *Helotrephes semiglobosus* Stål, 1858 (Helotrephidae) (Kerkis 1926, Larsén 1938 – and our recent yet unpublished data), we arrive at the following coincidences and differences in morphological and developmental characters.

The differentiation of ovarioles starts in most water bugs in the second or third instar, in *I. cimicoides* as well. The trophic syncytium starts to be formed in either instar 2 or 3 in the



Figs 9–12 Development of ovarioles and lateral oviducts in females of *Ilyocoris cimicoides*. 9 – the ovariole of about 1–2-months-old female, situation in September or October in Central European populations 10 – the ovariole of overwintering, diapausing female, situation from mid November to mid March. 11 – the ovariole of mature, egg laying female, situation occurring from about mid April 12 – a part of the lateral oviduct with two descending mature (= chorionated) eggs exhibiting „economical" way space (note the opposite orientation of the micropilar plates). che – mature (=chorionated) eggs (heavy and regularly dotted), cl – corpus luteum, lo – lateral oviduct, f – follicle, gc – germarium, o – oocyte, vio – oocyte with apparent yolk deposition well discernible in total native micropreparations in phase contrast (gently and irregularly dotted)

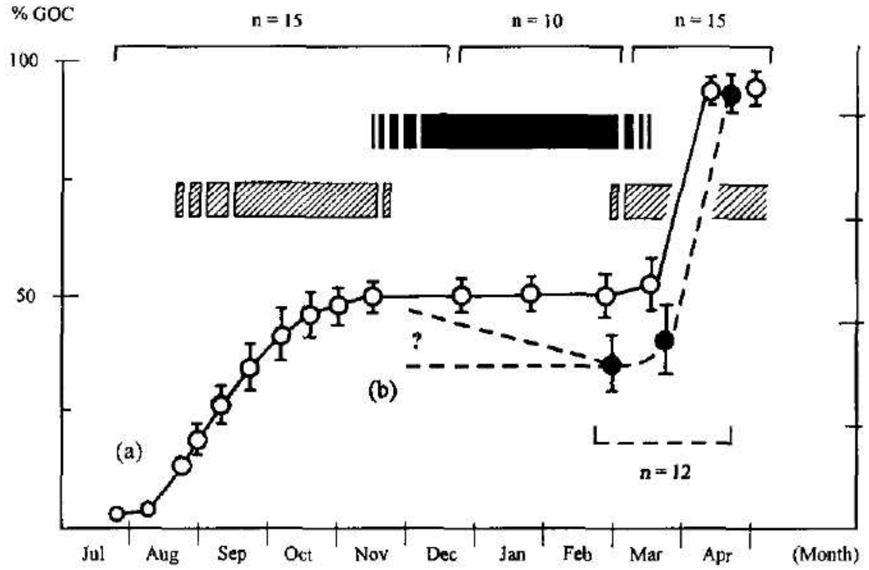


Fig 13 The growth of distal oocytes in adult females of Ilyocoris cimicoides throughout the year at localities in South and North Bohemia Continuous line (a) – common situation, disrupted line (b) – situation in overwintering females at the one locality in Pacov highland with unfavourable winter conditions. % GOC – growth of largest oocyte in vitellarium (percentage of maximal length) OVW – the black area – indicates a period of overwintering VG – the oblique lined area – indicates the periods of vitellogenesis n – number of specimens measured The question mark indicates a section of %GOC line (b), the course is for absence of data doubtful Vertical bars indicate the margin between minimal and maximal values

germarium of telotrophic ovarioles of most aquatic bugs. The formation of the trophic syncytium in *I. cimicoides* starts, somewhat later, in the fourth nymphal instar. In *I. cimicoides*, the first egg chambers in a vitellarium with previtellogenetic oocytes form in the fifth instar, but vitellogenesis starts relatively late, in 1–2 months old adult females.

The ovarioles in *I. cimicoides* show an irregular growth in nymphs, especially in the fourth and fifth nymphal instars. However, the ovarioles of mature females are of the same length.

Descending, mature eggs (females in April) , which are asymmetric, are arranged in a special space-saving way in the lateral oviducts. The origin of the separate, following descending eggs is from different ovarioles. In our opinion, the process of opposite orientation of separate eggs in lateral oviducts can be genetically programmed, and manipulated by musculature of pedicel and distal portions of ovarioles. This process is an unique functional character within the aquatic bugs. It can be judged as an autapomorphy of *Ilyocoris* or in Naucorinae (*Naucoris, Ilyocoris*) respectively.

Judging from Rawat's (1939) and Papáček's & Soldán's (1987) data on the development of the common oviduct, vagina and spermatheca, these organs develop in the same way in *Ilyocoris* and *Notonecta.* The progressive development of these structures from two ectodermal invaginations occurs in instar 4 and 5. Some morphological and histological features of the spermatheca in adults was described by Larsén (1938). We can add the following facts. The spermatheca invaginates in the same asymmetrical way in *Ilyocoris, Aphelocheirus, Notonecta, Plea* and *Helotrephes.* The asymmetrical invagination of the spermatheca can be considered a

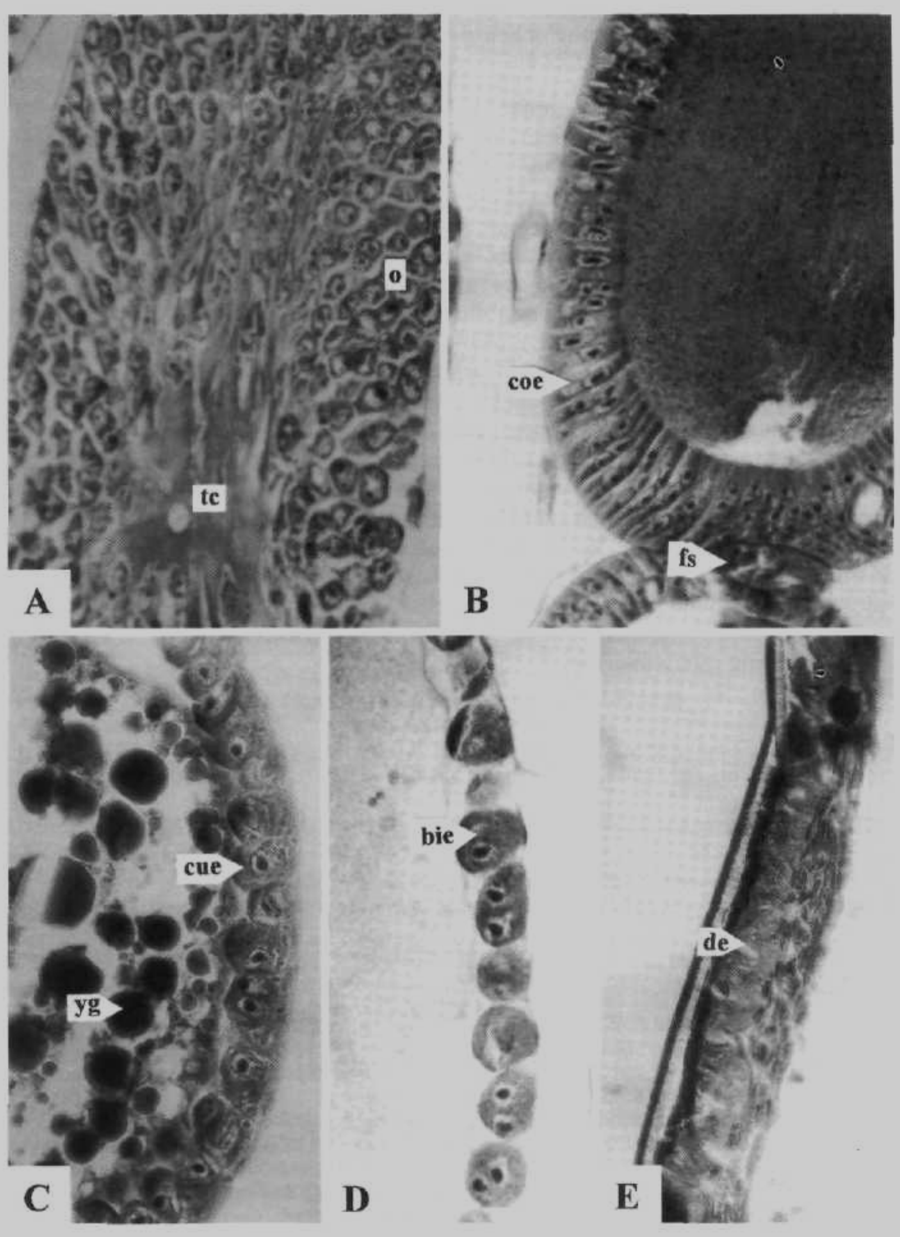


Plate 1. Some histological aspects of internal reproductive organs in *Ilyocoris cimicoides:* A – nymph, instar 4, longitudinal section through the germarium, trophic core (tc) fully differentiated, oocytes (oc) situated laterally. B – adult before starting of diapause, proximal egg chamber with columnal follicular epithelium (coe) (fs – follicular stalk). C – adult after diapause, vitellogenetic egg chamber with cubic follicular epithelium (cue) (yg – yolk grains). D – adult after diapause, binucleate epithelial cells (bie) of the wall of egg chamber shortly before secretion of chorion. E – the same, chorion secretion and degeneration of follicular cells (de).

synapomorphy of Naucoridae, Aphelocheiridae, Notonectidae, Pleidae and Helotrephidae (= Naucoroidea, Notonectoidea and Pleoidea)

Life cycle, overwintering and oogenesis

Kramer (1935), Papáček (1988) and Papáček & Hausírková (1987) stated that preimaginal development and oogenesis in *I cimicoides* is strongly dependent on temperatures in the field Larsén (1938) found degenerative changes in the ovarioles of overwintering females of *Notonecta* exposed to extremely hard winter conditions Our finding of overwintering females with extremely small oocytes at Pacov highland in South Bohemia suggests also that hard winter conditions can influence growth of oocytes in *Ilyocoris* as well However, by our data it is no possible to distinguish the two main possibilities, (1) small oocytes of overwintering females was affected by reductional degenerative changes, (2) the overwintering females from the one locality under our study was only „very late" adults with early state of oogenesis before overwintering Growth of oocytes and vitellogenesis completely case during the whole overwintering diapause However, growth, vitellogenesis and chorion secretion of eggs occur rapidly after overwintering For example, the growth of oocytes doubles during a three or four week period in March and April

The males of *I cimicoides* reach sexual maturity in the autumn, and part of their population overwinters (Papaček & Gelbič 1989) Spermatozoa were found even in the spermatheca in a some of immature females collected before overwintering These facts show the „bet-hedging" sexual strategy (sensu Tauber et al 1986) of *I cimicoides,* which is selected by two antagonistic pressures – sexual competence of mature spermatozoa and uncertainty of survival of individual specimens during overwintering

Acknowledgements

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