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A PRELIMINARY LIST OF BULGARIAN SARCOPHAGINAE (DIPTERA)

DALIBOR POVOLNÝ
and
JURIJ VERVES

College of Agriculture, Brno, Czechoslovakia
Biological Faculty, University of Kiev, Ukrainian Socialist Republic

The senior author visited several times Bulgaria, mostly on service and holidays of the years 1956 (Sandanski and Vichren between May 26th and June 3rd), 1959 (Melnik and Sandanski between June 23rd and 25th), 1965 (Balčik, Varna, Nessebar between July 19th and July 23rd), 1968 (Russe, Razgrad, Balčik, Varna, Nessebar between June 22nd and Juli 5th), 1970 (Russe, Razgrad, Varna, Nessebar, Pomorje, Sozopol, Achtopol between June 25th and July 10th), 1971 (Russe, Razgrad, Šumen, Balčik, Varna, Sozopol, Ropotamo, Achtopol (between June 28th and July 14th) and 1987 (Vidin, Bělogradčik, Michajlovgrad, Vraca, Canyon of Isker, Lakatnik, Sofia, Vitoša, Pernik, Golo Brdo, Struma, Stob, Rila Planina, Blagojevgrad, Bansko, Pirin, Vichren, Sandanski, Melnik, Velingrad, Kazanlak, Šipka Pass, Sliven, Varna, Cape Kaliakra, Cape Emine, Sozopol, Pobiti Kamni, Trgoviště, Veliko Trnovo and Pleven between July 13th and July (27th), and finally 1988 (Pobiti Kamni, Cape Kaliakra, Sozopol between July 27th and August 3rd). On these occasions especially the search after the male preconnubial aggregations of Sarcophagini was undertaken with the aim to collect as represenetative series of males of this group as possible. During a short visit of Sofia (in July 1987) the material of the Bulgarian Sarcophaginae was studied which is preserved in the Zoological Institute of the Bulgarian Academy of Sciences (courtesy Dr. Bureš, Dr. Lavčiev etc.).

The following resulting paper is a brief review of the Bulgarian Sarcophaginae based on the paper of Drenski (1957) who summarized the records of the older authors dealing with this group in Bulgaria (Nědělkov, 1912; Jacentkovský, 1936, 1939 and Enderlein, 1936). The records published by Gregor & Povolný (1959) and the above occasional collections of the senior author complete the present faunal picture of the Bulgarian Sarcophaginae. The main aim of this paper is mainly to review the Bulgarian taxa and to complete the picture of their distribution in Bulgaria. In two cases new synonymies and several notes on the taxonomy of the species treated are given. In the appendix a revisionary key to the species of the subgenus Boettcherella Enderlein, 1928 of the genus Heteronychia Brauer et Bergenstamm, 1889 and a proposal of a restriction of the collective genus Parasarcophaga Johnston et Tiegs, 1921 is given

due to the fact that the latter was based on a plesiomorphic character. Finally, several table reviews are presented, which seem to be especially representative of certain preconnubial aggregations of the Bulgarian Sarcophagini, especially respecting their special habitats.

Despite several papers devoted to this group in Bulgaria and irrespective af a considerable number of taxa recorded the present knowledge of this froup in Bulgaria is still not satisfactory, mainly because most of the faunal data are based on rather limited material. In several instances no authentic specimens could be found confirming their presence in Bulgaria and in other cases the older identifications should be reexamined. This situation results from the fact that practically the entire up-to-date research was based on individual and occasional field work missing the necessary profesional endeavour. Under such circmstances even the following review has a tentative character offerring just a brief picture of the extremely interesting Bulgarian sarcophagine fauna. For the above reason it is difficult to characterize it more generally, but it is apparent that it is strongly influenced by the pontomediterranean element and that especially the Bulgarian Makedonia might still hide important taxa not recorded, so far, from Bulgaria.

Thanks are due to Dr. V. Lavčiev, Institute of Zoology, Bulgarian Academy of Sciences, Sofia, for his support and to the staff of the Department of Entomology of the above Institute for assistance. Prof. Dr. H. J. Müller, Institute for Plant-Protection of Kleinmachov in Eberswalde, GDR, offered support with literature. Dr. Ludvík Hoberlandt, Editor in Chief of this Periodical, supported the press of this paper with much understanding for editorial and technical difficulties.

List of Bulgarian Sarcophaginae

1. *Blaesoxipha redempta* (Pandellé, 1896). The specific names „*agrestis*": Dear, 1980 (nec Robineau-Desvoidy, 1863) and *campestris* Robineau-Desvoidy are not available, because these species belong with the doubtful genus *Listeria* Robineau-Desvoidy, 1863 (see Lopes, 1953). This species is rather widely distributed in Bulgaria as seen from numerous localities given by Jacentkovský (1936) and Drenski (1957) (e.g. Blagojevgrad, Bačkovo, Preslav, Sliven, Veselie, Burgas and env.). For hosts see Verves (1985).

2. *Blaesoxipha litoralis* (Villeneuve, 1911). The species is concentrated mostly in Makedonia (Sliven, env. Petrič, Struma-valley, Kožuch, Petričko) — see Jacentkovský (1937) and Drenski (1957). For hosts see Verves (1985).

3. *Blaesoxipha cochlearis* (Pandellé, 1896). The species is known from Bulgarian Makedonia (Petrič, Strumeščnica in the valley of Struma) (Drenski, 1957). For hosts see Verves (1985).

4 *Blaesoxipha ungulata* (Pandellé 1896). Kravarska dera (Rila Planina) — see Jacentkovský (1936) and Krenski (1937). For hosts see Verves (1985).

5. *Blaesoxipha unicolor* (Villeneuve, 1912). Black Sea coast between Balčik, Varna and Sozopol — see Jacentkovský (1939) and Drenski (1957). For hosts see Verves (1985).

6. *Blaesoxipha plumicornis* (Zetterstedt, 1859) This species is obviously wide distributed in Bulgaria — see Jacentkovský (1936) — as *gladiatrix* Pand., and Drenski (1957) — as *laticornis* Meig. For hosts see Verves (1985).

7. *Blaesoxipha (Servaisia) rossica* (Villeneuve, 1912). Blagojevgrad and Sliven — see Drenski (1957). Hosts are thouroughly acridians (*Chorthippus albomarginatus, Ch. apricarius, Ch. bicolor, Ch. biguttulus, Ch. brunneus, Ch. mollis, Dociostaurus maroccanus, Eirenephilus longipennis, Euchortippus declivus, E. pulvinatus, Gomphocerus sibiricus, Pachytylus migratorius, Omocestus haemorrhoidalis, Stauroderus scalaris).*

8. *Blaesoxipha (Servaisia) erythrura* (Meigen, 1826). Sofia, Vitoša, western ridge of Stara Planina. After Drenski (1957) a comparatively rare species in Bulgaria. 2 ♂♂, Bansko, 17. 7. 1987. For hosts see Verves (1985).

9. *Tephromyia grisea* (Meigen, 1826). This species is widely distributed at lower elevations of Bulgaria and the senior author observed numerous specimens at many sampling sites (Veliko Trnovo, Razgrad, Šumen, Black Sea coast between Cape Kaliakra and Achtopol). The flies readily visit feces and decaying meat. Hosts are orthopterans, e. g. *Dociostaurus maroccanus, Oedipoda caerulescens* etc.

10. *Ravinia pernix* (Harris, 1780). The most current synonym of this species is *striata* auct. (nec Fabricius, 1794, nom. praeocc. — see Pape, 1986). The species is widely distributed in Bulgaria (Bělogradčik, Sofia, valley of Struma, Plovdiv, Kazanlak, Pleven and the entire coastal zone of the Black Sea) and it reaches considerable altitudes (at Vichren up to 2.000 m a. s. l.) avoiding only forested territories. The species develops in (rabbit and sheep) feces, rarely in dry meat, dead insects and snails. It is also a facultative predator of other coprophagous maggots. It was also reared from live caterpillar of *Loxostege sticticalis* (Pyralidae), from pupae of *Lymantria dispar* (Lymantriidae), from larvae of *Oryctes nasicornis* (Coleoptera) and is claimed to be involved in human intenstinal myasis. The flies appear after midday during its hottest hours.

11. *Helicophagella agnata* (Rondani, 1860). This is mostly a rare species accompanying shady decidous (beech) forests of Central Europe. The only record Drenski's (1957) from Kjustendil-Chisarlk is probably not representative, as evidenced by own purely occasional finding of several males above the Rilski Monastery and in the forested territory of Vitoša above Sofia at about 1500 m. It seems that the species is consequently more distributed in little destroyed forested montane ranges especiallly in western Bulgaria. The species was reared from the snail *Helix aspersa.*

12. *Helicophagella crassimargo* (Pandellé, 1896). This species is probably widely distributed throughout Bulgaria preferring especially poor soils. In our material the species is individually represented by males collected near Russe, Sofia, Veliko Tirnovo, Pobiti Kamni (Varna)

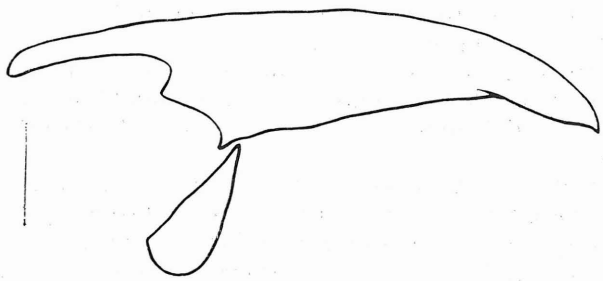

Fig. 1: *Helicophagella macrura,* cercus and coxite.

and Vichren. It develops facultatively in feces and is a facultative parasitoid of snails (reared from *Helicella virgata*). The species may disappear from its habitats during hot high-summer days. Other records from Bulgaria were published by Drenski (1957).

13. *Helicophagella maculata* (Meigen, 1835). This is a subtropical species first recorded by Gregor & Povolný (1959) from the valley of Struma in Bulgarian Makedonia. The species visits individually carcasses of small vertebrates (fish, crabs) and feces in the entire coastal zone of Black Sea (Varna, Cape Kaliakra, Sozopol), where it obviously participates on their decomposition. It was also bred from the tenebrionid beetle *Pimelia grandis latestei.* (Tables 5—10).

14. *Helicophagella melanura* (Meigen, 1826). This a very common synanthrope in Bulgaria visiting frequently (human) feces and animal carcasses (fish, small mammals, moluscs, crabs), bird nests (*Delichon urbica, Hirundo rustica*). It develops occasionaly also in snails, e.g. *Arion hortensis, Helix aspersa*; locusts (*Chortippus brunneus*); in beetle larvae (*Oryctes nasicornis*) and is claimed to be also involved in myiasis of animals and man.

15. *Helicophagella marcrura* (Rohdendorf, 1937). 2 ♂♂, Russe, June 25th 1970. A new record for Bulgaria although the species is known to occur rarely in the basin of Tisza river and it was recently collected also in southern Slovakia (Štúrovo). It seems that it occurs along the stream of Danube. (Figs. 1, 2).

16. *Helicophagella noverca* (Rondani, 1860). The few records by Drenski (1957) are certainly not representative of the distribution of this species in Bulgaria, especially concerning its forested montane elevations. It was collected in Vitoša above Sofia and in beech forests above Rilski Monastery (July, 1987). The larvae develop in dying snails and may attack also live snails (*Helix stauropolitana, H. pomatia*).

17. *Helicophagella novercoides* (Böttcher, 1913). Drenski (1957) gives the only record from Petričko (Makedonia), but the species is typical of the alpine slopes of Vichren, where it was dominant at elevations between 1.200—2.200 m a.s.l. (June 1956, July 1987). The species is

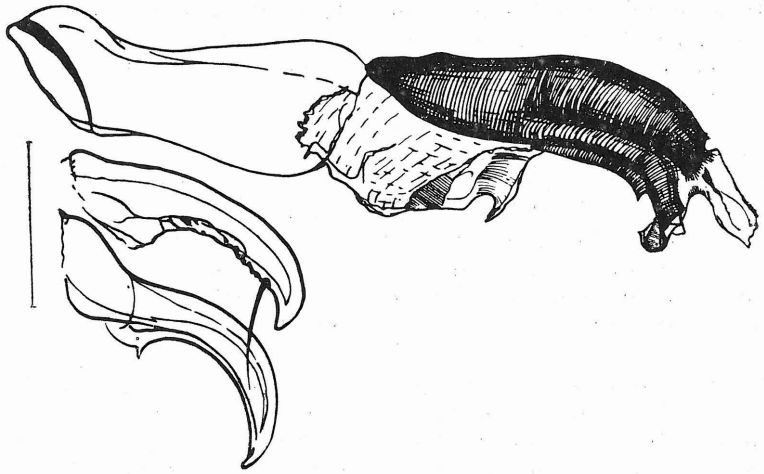

Fig. 2: *Helicophagella macrura,* paraphallus and gonites. (Russe, 25. 6. 1970). Abscissa in all figures equals 0.25 mm.

typical of alpine limestone cliffs of Jadran, the Alps and the Carpatians, and Vichren is certainly not the only typical habitat in Bulgaria as evidenced by a male taken occasionally at Isker valley (July 15th 1987). The species is highly heliophile. Its bionomics remains unknown. (Tables 1, 2).

18. *Helicophagella rosellei* (Böttcher, 1912). The species is very comon in the Central European deciduous forest (mainly beech) zone up to its montane borderline at about 1.200 m (Slovak Carpatians). It seeems that it appears to be even more alpine in Bulgaria (9 ♂♂, Vitoša at about 1700 m, 16. 7. 1987). Numerous males were also collected in the beech forest above the Rilski Monastery (July, 1987) together with *Helicophagella noverca.*

19. *Kramereomyia anaces* (Walker, 1849). 2 ♂♂, Stob, 17. 7. 1987 on the hilltop of "earth pyramids" — together with *Heteronychia bezziana* (Böttch.). This is the first record from Bulgaria, although one may expect a wider distribution of this species there. The species accompanies steppe-like habitats. It was reared from the snail *Helix acuta* (see also Tab. 5).

20. *Bellieriomima subulata* (Pandellé, 1896). 2 ♂♂, beech forest under Šipka Pass, July 20th 1987; 3 ♂♂, Bansko, July 19th 1987. The species accompanies individually the deciduous forest zone of Central Europe (mostly together with *H. noverca* and *H. rosellei* being, however, more thermophilous not exceeding 600—800 m a. s. l.). Its maggots develop in snails, but flies were also reared from pupae of *Lymantria dispar* (Lepidoptera). See also Drenski (1957).

21. *Arachnidomyia sexpunctata* (Fabricous, 1794). The species was usually treated as "*Pierretia clathrata* Meig.". Drenski (1957) knows two

records from Bulgaria (Struma valley, Makedonia and Dimitrovo). 1 ♂, Russe, June 23rd 1970. The species occurs mostly in lowgland forests along river valleys. The considerable distance between the abave Bulgarian habitats seems to indicate that this rather rare species is more distributed in Bulgaria than we know. The species develops in egg-sacks of arachnoids (*Araneus cornutus* and *Clubiona* spp.).

22. *Pierretia nemoralis* (Kramer, 1908). 2 ♂♂, deciduous forest above Bělogradčik, July 15th 1978. The species accompanies dry deciduous, especially beech forests of Central Europe, but it occurs also on the hilltops of the Carpatians (e.g. High Tatra) up to 2.100 m a.s.l. It seems that the species might be present in western Bulgarian montane forests, especially in their little influenced stands. Bionomics is unknown. (see also Tab. 1).

23. *Pierretia nigriventris* (Meigen, 1826). The few localities indicated by Drenski (1957) certainly do not nearly reflect the general distribution of this culturophile species in Bulgaria. The species occurs also in the alpine zone at about 2.000 m a.s.l. (Vichren), but it was observed also at the Pass of Šipka, in Sozopol etc., mostly common in shady ruderal habitats. The species develops in snails and insects (adults of *Apis mellifera, Bombus terrestris,* Apidae) and was reared from snails *Cornuella* sp., *Robania* sp., *Helicella ericetorum itala, Helix* sp., *Helix aspersa, Helix cantianiformis, H. pomatia, Monacha* sp., *Theba cantiana*; it also attacks acridians and locusts (*Schistorcerca gregaria*) and lepidopterous pupae. It was reared from beetles *Carabus* sp., *Carabus coriaceus, Necrophorus* sp., *Necrophorus humator, Blaps* sp. and *Blaps mucronata.* (see also Table 1, 2).

24. *Pierretia socrus* (Rondani, 1860). Its correct name was substantiated by Pape (1986), as the species was usually trested as „*Pierretia rostrata* Pand.". Irrespective of two localities from Bulgaria recorded by Jacentkovský (1936) and Drenski (1957) (Bačkovo and Sliven), this species is a rare but characteristic member of the sarcophagine taxocenoses visiting decaying small carcasses and feces on the Black Sea shore (e.g. Cap Emine, Pobiti Kamni) — a phenomenon known also from the seaside of the Baltic and the Nordsee. In Central Europe it usually occurs on sunlit hilltops of forested mountains and hills with their increasing elevation from the west to the east from 500—1.600 m a.s.l. as seen also in Bulgarian Vichren (June 3rd 1956), (see also Tables 1, 3, 8).

25. *Pierretia soror* (Rondani, 1860). This is a species inhabiting submontane to montane limestone cliffs as is also evidenced by its presence in the slopes of Vichren between 1.200—2.200 m a.s.l. (June 3rd 1956, July 18th 1987). Drenski (1957) mentions few specimens from Skakavica and Kjustendilsko. The maggots develop in both dead and live snails (*Helix aspersa* and *Helix* sp.).

26. *Pierretia villeneuvei* (Böttcher, 1912). The species is rare and it occurs mostly in lowland forests of Central Europe (South Moravia, Balaton). 1 ♂, Russe, June 21st 1968 and 2 ♂♂, Zimnicea (Romanian Danube

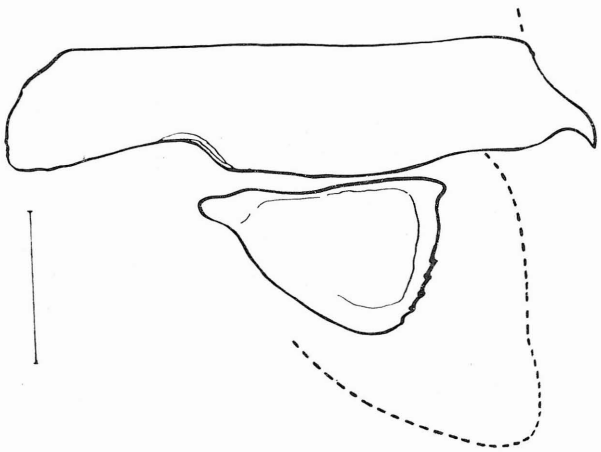

Fig. 3: *Thyrsocnema kentejana,* cercus and coxite.

shore), July 15th 1971. This two findings corroborate its presence in the Bulgarian Danube river basin (see also Drenski, 1957).

27. *Ascelotella granulata* (Kramer, 1908), **comb. n.** The species should be treated within the frame of the genus *Ascelotella* Enderlein, 1928 due its following characters: r1 with bristle, 3rd abdominal segment without marginal bristles, 7th and 8 th abdominal segment of male (terminalia) bare, lateral arms of apical plate in distiphallus and ventral arms well developed, 6th tergite in female (genitalia) bilobed. The species is locally common in humid forests of western Europe and becoms increassingly rare more eastwards in the lowland forests of Central Europe (Morava, Dyje, Danube, Balaton). 1 ♂, Russe, June 21st 1968 and later 5 ♂♂, Zimnicea (Romanian Danube shore), (July 15th 1971) both habitats are inside the lowland forest on the Danube. This confirms Drenski's theory that the species occurs in this territory.

28. *Thyrsocnema incisilobata* (Pandellé, 1896). The species is widely distributed in Bulgaria, but as many sarcophagines do, it might disappear during the hot summer days or withdraw into shady habitats. The larvae are predators on muscoid maggots in feces, especially of sheep. They rarely develop in other substrates, e.g. snails and inspects, bird and small mammal nests. They facultatively parasitize snails (*Helix lactea*) and acridians (*Dociostaurus maroccanus*) and predate on pupae of moths (*Lymantria monacha*). They may cause urogenital myiasis in man.

29. *Thyrsocnema kentejana* Rohdendorf, 1937. 2 ♂♂, Vitoša above Soffia (near „Stony River"), July 16th 1987. The species is new to Bulgaria and this discovery is biogeographically important, as it corroborates the arcto-alpine disjunction of its western populations. Bionomics is not known (see Figs. 3, 4).

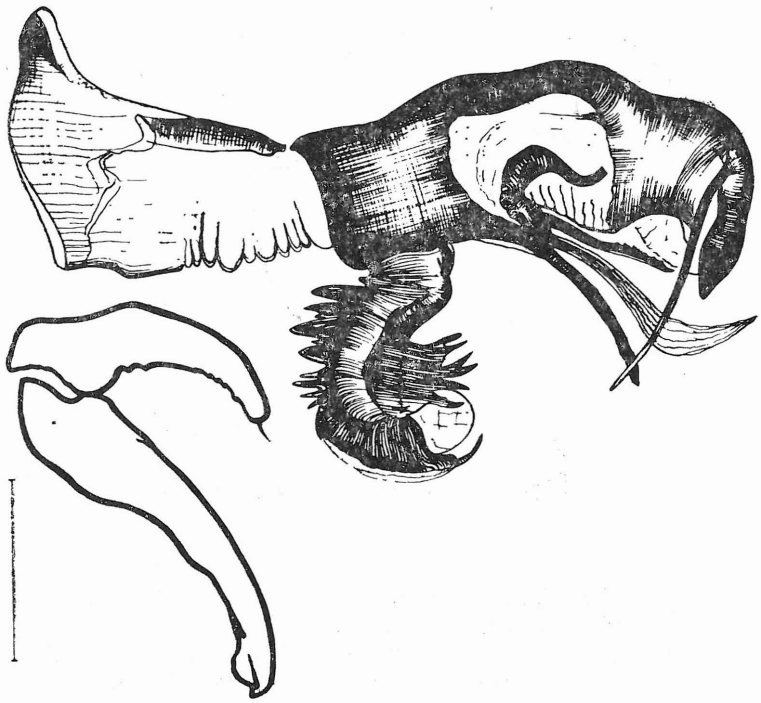

Fig. 4: *Thyrsocnema kentejana,* paraphallus and gonites. (Vitoša, Stony River, 16. 7. 1987).

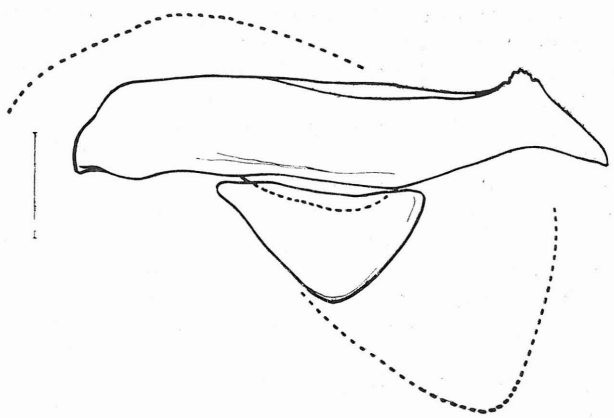

Fig. 5:*Discachaeta cucullans,* cercus and coxite.

30. *Discachaeta arcipes* (Pandellé, 1896). 2 ♂♂ and 3 ♂♂, Pobiti Kamni (Varna), July 12th 1965 and June 28th 1970 respectively; 13 ♂♂, Veliko Trnovo, 24th July 1987. The species might be more distributed in Bulgaria than we know (Drenski, 1957). Maggots are parasitoids of snails (*Euomphalia strigella, Helicella obvia*).

31. *Discachaeta cucullans* (Pandellé, 1896). The species was locally common in the limestone cliffs of Pobiti Kamni (near Varna) in June and July (e.g. 1965, 1970, 1987). In view of its record from Petrič (Drenski, 1957) one may presume that it might be present in more undisturbed limestone habitats of lower elevations in Bulgaria. Bionomics unknown (See also Figs. 5, 6).

32. *Discachaeta pumila* (Meigen, 1826). This species is locally common in western Europe (e.g.Thuringia) and becomes increasingly rare eastwards, whereby it rises partly to submontane and montane elevations. Drenski (1957) gives only one record (environs of Sandanski). Bionomics is unknown.

33. *Heteronychia* (*Boettcherella*) *mutila* (Villeneuve, 1912). The species was common in the cliffs of Pobiti Kamni (June, July 1965, 1968, 1970, 1987) and common in the slopes of Vichren (at about 1200—2000 m a.s.l.). Its is known to occur also in Sliven (described as *Heteronychia nedelkoffi* Lehr.) so that further records may be expected in Bulgaria. Bionomics is not known (See also Tables 1—5, and Figs. 7—10).

34. *Heteronychia (Boettcherella) setinervis* (Rondani, 1860). This rare species was recorded by Jacentkovský (1936) from Preslav and Sliven.

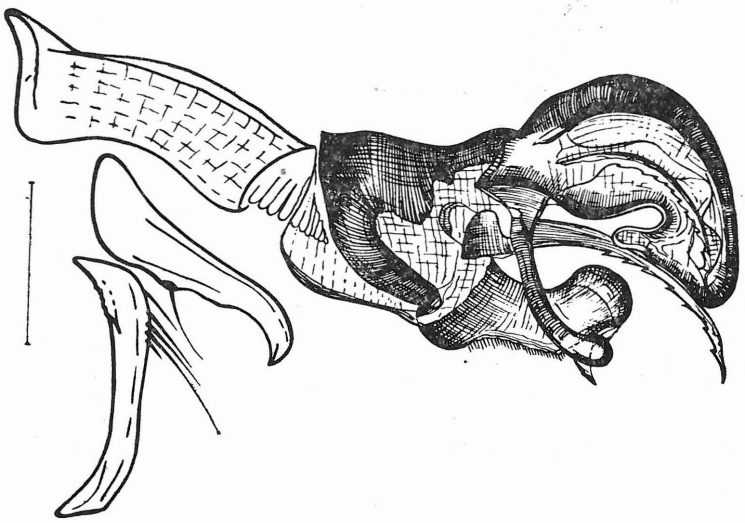

Fig. 6: *Discachaeta cucullans,* paraphallus and gonites. (Pobiti Kamni, 21. 7. 1987).

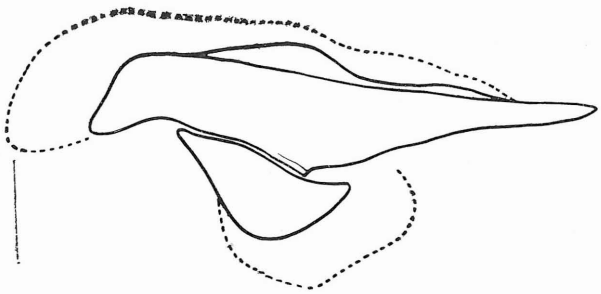

Fig. 7: *Heteronychia mutila,* cercus and coxite.

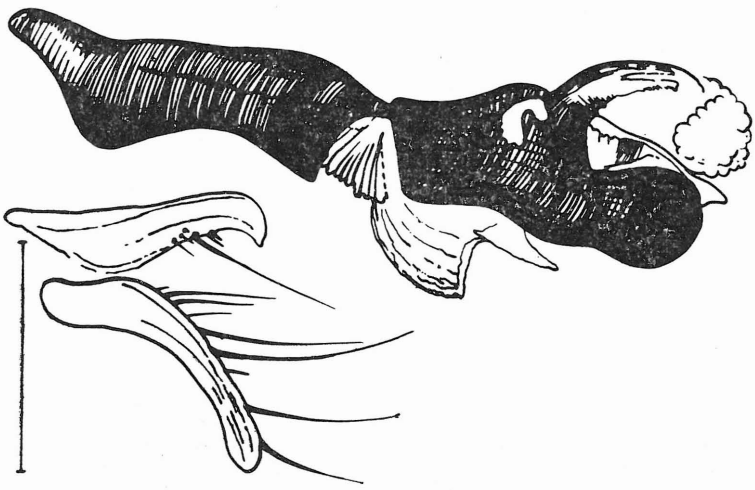

Fig. 8: *Heteronychia mutila,* paraphallus and gonites. (Pobiti Kamni, 21. 7. 1987).

1 ♂, Pobiti Kamni, 28th June 1970. A very important record of this expansive mediterranean species. Bionomics unknown (See Figs. 10a, 10b).

35. *Heteronychia* (*Ctenodasypygia*) *graeca* (Rondendorf, 1937). The presence of this species in Bulgaria (Alibotuš Planina and Carev vrch — after Drenski, 1957) is confirmed by another male (Pobiti Kamni near Varna, July 27th 1987). Bionomics is unknown (See Table 5 and Figs. 11, 12).

36. *Heteronychia* (*Ctenodasypygia*) *fertoni* (Villeneuve 1911). The species was recorded from Bulgaria by Drenski (1957) from the region of Sandanski (north to Petrovo) in Bulgarian Makedonia. The revision

of this record appears to be important, although the occurrence of this species in Bulgaria seems to be possible. Bionomics is unknown.

37. *Heteronychia* (*Ctenodasypygia*) *siciliensis* (Böttcher, 1913). The only record from Bulgaria (Mičurin) by Drenski (1957) should be re-examined, although the species may well occur in Bulgaria. Bionomics is unknown.

38. *Heteronychia* (*Ascelotis*) *balanina* (Pandellé, 1896). A striking species recorded by Drenski (1957) from Kjustendil-Chisarlka and Petrič north from Kolarovo under Belasica. Bionomics unknown.

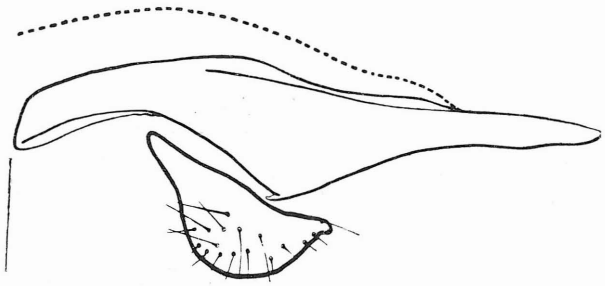

Fig. 9: *Heteronychia mutila,* cercus and coxite.

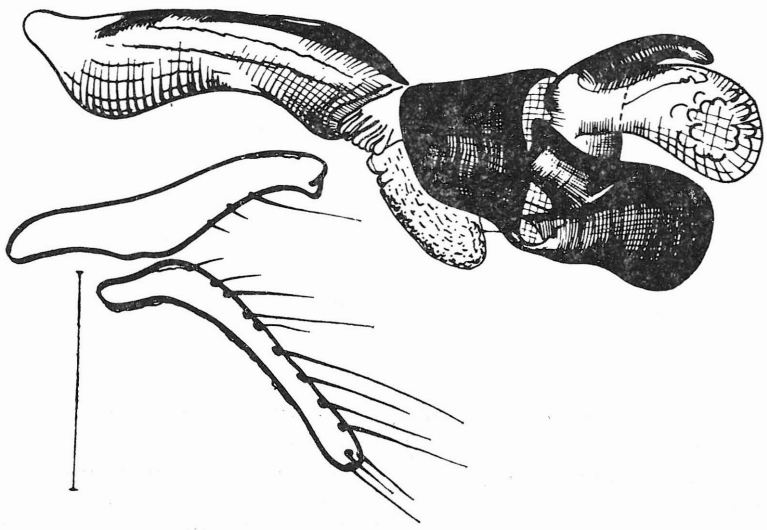

Fig. 10: *Heteronychia mutila,* paraphallus and gonites. (Vichren, 18. 7. 1987).

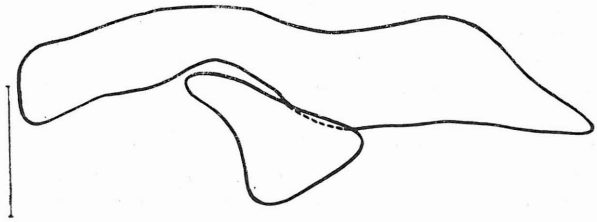

Fig. 10a: *Heteronychia setinervis,* cercus and coxite.

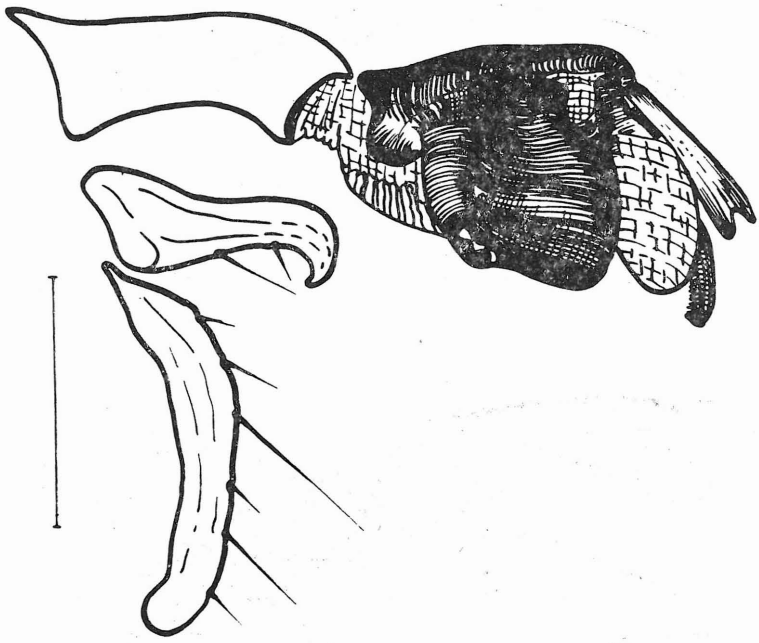

Fig. 10b: *Heteronychia setinervis,* paraphallus and gonites. (Pobiti Kamni, 28. 6. 1970).

39. *Heteronychia* (*Pandelleola*) *filia* (Rondani, 1860). Irrespective of the records by Jacentkovský (1936) and Drenski (1957) the species appears to be very common in Pobiti Kamni near Varna (June, July, 1965, 1970, 1971, 1987) and it should occur elsewhere in well protected limestone habitats of mediterranean Bulgaria. Larvae are parasitoids of snails (Helicidae).

40. *Heteronychia (Eupierretia hirticrus* (Pandellé, 1896) **comb. n.** This species treated traditionally as *Helicophagella* seems to belong to the subgenus *Eupierretia* Rohdendorf, 1937 of the genus *Heteronychia* Brauer & Bergenstamm, 1889 due to its elongate and hook-formed ventral lobes and elongate epandrium its membranal appendix being poorly developed, and showing long and narrow styli. The species is widely distributed on sunlit hilltops especially on limestone and loess in Central Europe. Jacentkovský (1936) and Drenski (1957) give but two records from Bulgaria (Sliven and Burgas), although it seems that the species might be widely distributed and locally common (e.g. Pobiti Kamni, Veliko Trnovo).

41. *Heteronychia* (*Eupierretia*) *pauciseta* (Pandellé, 1896). This is another rare representative of this genus and the only record by Drenski (1957) from Bačkovo should be urgently revised.

42. *Heteronychia* (*Eupierretia*) *porrecta* (Böttcher, 1913). An alpine species restricted to limestone cliffs above timberline of the Alps (South Tirolia), Carpatians (Malá Fatra, Slovakia), Yougoslavian limestone Alps and Bulgarian limestone ranges (Kastenec) (described as *Heteronychia bulgariensis* Lehrer, 1977). The species occurs also in Vichren between 1200—2200 m a.s.l. (June 1956, July 1957) (see also Tables 1, 2).

43. *Heteronychia* (*Eupierretia*) *vicina* (Macquart, 1835). Drenski (1957) records this species only from Kjustendil, Chisarlk. Similarly as *H. porrecta* this species accompanies undisturbed limestone cliffs of the deciduous forest zone between 500—1200 m a.s.l. and does not seem to exceed the timberline. 3 ♂♂, Vichren, 18th July 1987 at about 1200 m (see Table 2).

44. *Heteronychia* (*Eupierretia*) *enderleini* (Jacentkovský, 1937). Verves (1986) synonymized this species with *Heteronychia* (*Eupierretia*) *schineri* (Bezzi), but as is clearly seen from the paper and figures by Povolný & Staněk (1969) *H. (E.) enderleini* (Jac.) shows clear relation to *Heteronychia* (*Eupierretia*) *vicina* (Macq.) representing either a small form of the latter or a slightly different species. The holotype male was collected near Bačkovo on August 9th 1935.

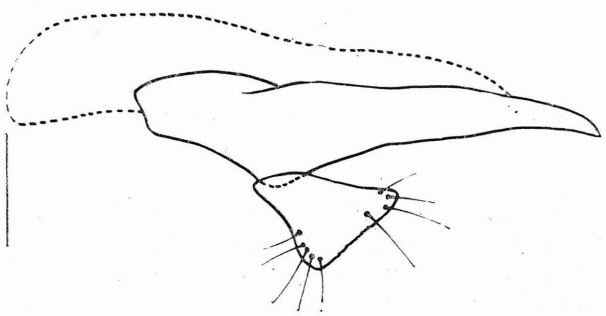

Fig. 11: *Heteronychia graeca,* cercus and coxite.

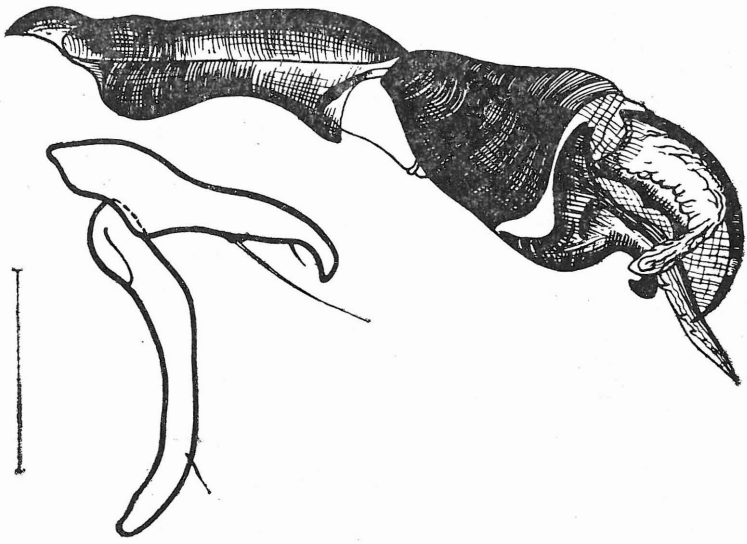

Fig. 12: *Heteronychia graeca,* paraphallus and gonites. (Pobiti Kamni, 27. 7. 1987).

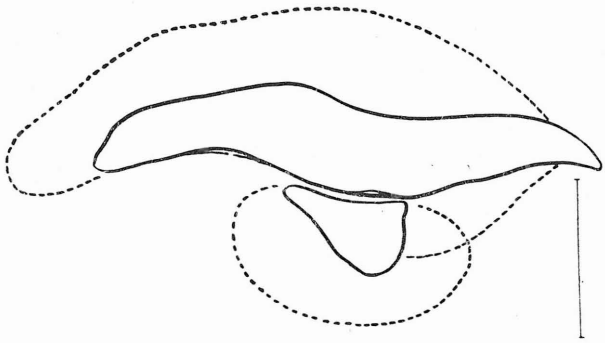

Fig. 13: *Heteronychia portschinskyana,* cercus and coxite.

45. *Heteronychia* (*Eupierretia*) *portschinskyana* (Rohdendorf, 1937). The species was collected in the Alibotusch Mountains by Drenski and described as *Heteronychia atanassovi* Lehrer, 1977. 2 ♂♂, Pobiti Kamni, 27th July 1987 (see Table 4, Figs. 13, 14).

46. *Heteronychia* (*Eupierretia*) *proxima* (Rondani, 1860). The species is recorded from near Dimitrovgrad (Golo Brdo), Blagojevgrad and Pet-

ričko by Drenski (1957). Its is a species of South Siberian distribution and is widely distributed in warmer habitats of Europe and Asia especially in limestone habitats. In our material the species is represented from Vidin and Veliko Trnovo (July, 1987). The larvae are parasites of the snail *Euomphalia strigella.*

47. *Heteronychia* (*Eupierretia*) *schineri* (Bezzi, 1891) Jacentkovský (1936) and Drenski (1957) recorded just two localities (Kravarsko delo in Rila Mountains and Vršac in Vračansko). We collected numerous males in Rila Planina (Rilski Monastery) and in Veliko Trnovo (July, 1987). The species is locally not rare, mainly on limestone and loess, but it avoids alpine zone. Bionomics unknown.

48. *Heteronychia* (*Eupierretia*) *vagans* (Meigen, 1826). This is a widely distributed and usually common parasitoid of snails (*Succineidae, Eulota maacki*). The few records from Bulgaria by Drenski (1957) certainly do not reflect its distribution in Bulgaria. It is common in shady shrub formations and forest margins along the Black Sea coast and elsewhere in Bulgaria (e.g. Bèlogradčik, Sofia, Plovdiv, Michajlovgrad — July, 1987).

49. *Heteronychia* (*Heteronychia*) *ancilla* (Rondani, 1865). Drenski (1957) records only one finding from Lom on the Danube. 2 ♂♂ were captured on a dry slope above the seaside in Albena Beach near Zlatni Piaseci (June 1965 and June 1968). This rare mediterranean species reches its northern limit in southern Slovakia. Host is unknown.

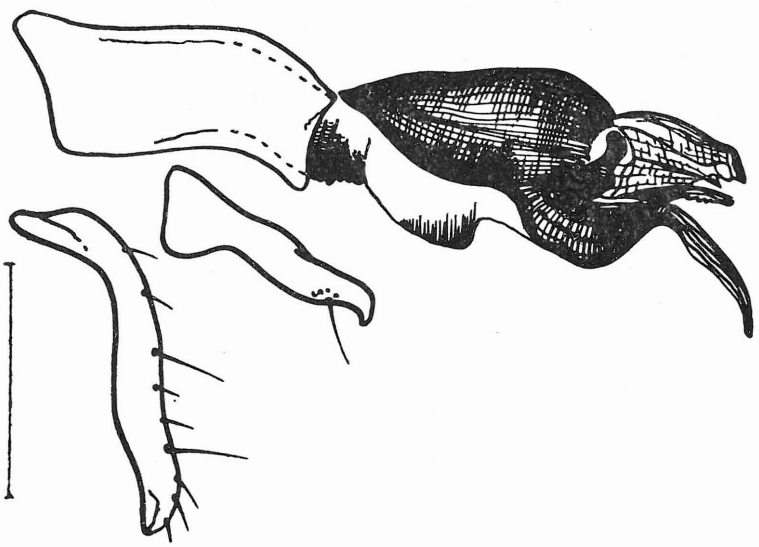

Fig. 14: *Heteronychia portschinskyana,* paraphallus and gonites. (Pobiti Kamni, 12. 6. 1965).

50. *Heteronychia* (*Heteronychia*) *benaci* (Böttcher, 1913) This species is known only from Italy, Jugoslavia and Bulgaria (several records by Jacentkovský, 1936 and Drenski, 1957).

51. *Heteronychia* (*Heteronychia*) *bezziana* (Böttcher, 1913). This is a strictly limestone bound taxon widely distributed from the mountains of the Balkan Peninsula and the Dalmatian coastal ranges up to the Alps, the Carpatians and is present also in mountain ranges of Bulgaria between 500—1500 m a. s. l. Its northernmost habitat is the Bohemian Karst — a limestone territory in Central Bohemia. In Bulgaria the species is rather common in Vichren (e. g. July 18th, 1987), but is was also collected near Stob (in Makedonia) and in Vitoša mountains (rescribed as *Heteronychia drenskiana* Lehrer, 1977). It is a parasitoid of small snails of the genera *Chondrina* and *Clausilia* and it may occasionally occur in masses (See Tables 1, 2).

52. *Heteronychia* (*Heteronychia*) *rondaniana* (Rohdendorf, 1937). The species was currently treated as *H. depressifrons* auct. (nec Zetterstedt, 1845). It appears to be a rather thermophilous and psychrophilous taxon inhabiting lower elevations. Jacentkovský (1936) and Drenski (1957) record findings from Blagojevgrad, Skrt, Petričko and Makedonia (Struma, Strumeščnica) (see Figs. 15, 16).

53. *Heteronychia* (*Heteronychia*) *dissimilis* (Meigen, 1826). This species is common in humid lowland forests. It is greatly similar to *Heteronychia* (*Heteronychia*) *rohdendorfiana* Mihály, 1975, a usually much stouter species with long straight cercus, from which it was not discerned before 1959, when the species was described as *Heteronychia nigricauda* Pov. & Slam. — a hononymous name. The records by Drenski (1957) [e. g. Vitoša, Golo Brdo, Blagojevgrad and Rila (Borovec)] should be therefore reexamined, as *H. dissimilis* occurs mostly in humid lowland forests along the Danube (e. g. Vidin, Russe). It is a parasitoid of snails (*Monachoides* sp.).

54. *Heteronychia* (*Heteronychia*) *pontica* (Rohdendorf, 1937). Drenski (1957) records a couple from Mičurin on the Black Sea.

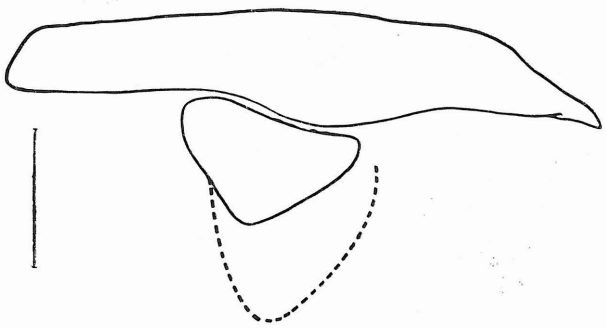

Fig. 15: *Heteronychia rondaniana,* cercus and coxite.

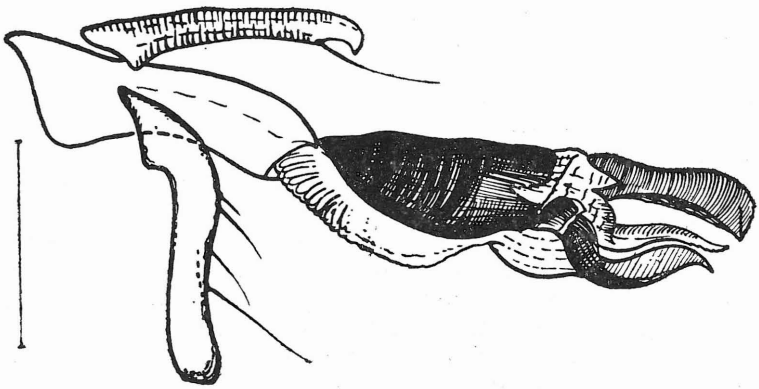

Fig. 16: *Heteronychia rondaniana,* paraphallus and gonites. (Sandanski, May 28th, 1956).

55. *Heteronychia* (*Heteronychia*) *thalhammeri* (Böttcher, 1913). This species is only known from Hungary and Bulgaria (Bačkovo, Preslav, Varna) (Jacentkovský, 1936; Drenski, 1957).

56. *Heteronychia* (*Spatulapica*) *haemorrhoa* (Meigen, 1826). This species acompanies warm (mostly lowland) forests of Europe. In Bulgaria it occurs mainly along the Danube, where it is common especially in undisturbed stands. For other records see Drenski (1957). It is a parasitoid of snails (*Helix, Cepaea*).

57. *Heteronychia* (*Spatulapica*) *haemorrhoides* (Böttcher, 1913).
Syn.: *Heteronychia mazurmovitshi* Verves, 1979, Zool. žurn., 58: 869, **syn. n.**

This is a rare, very thermophilous species distributed mostly in the warmest parts of Europe and very often misidentified with *H. haemorrhoa* (Meig.) et vice versa. Drenski's (1957) record from Cape Kaliakra is confirmed by its capture there (2 ♂♂, July 2nd, 1971) and by two next males collected in Pobiti Kamni (Varna) on July 12th, 1965 (see also Tables 4, 5, 6).

58. *Heteronychia* (*Spatulapica*) *boettcheriana* (Rohdendorf, 1937). The species occurs frequently together with *H. haemorrhoa* (Meig.), but it seems to be slightly more thermophilous. Its main distributional area in Bulgaria is the lowland forest territory of the Danube and of its right side tributaries (e. g. Razgrad, Šumen, Nikopol, Russe). For other records see Jacentkovský (1936) and Drenski (1957). It is a parasite of snails competing with *H. haemorrhoa.*

59. *Heteronychia* (*Spatulapica*) *depressifrons* (Zetterstedt 1845).
Syn.:*Heteronychia ukrainica* Verves, 1975, Ent. obozr., 54: 667, **syn. n.**

This is a widely distributed species known mostly under the name *Heteronychia obscurata* (Rohd.). It accompanies warm and shady deciduous forests of lower elevations, frequently together with *Heteronychia haemorrhoa* (Meig.) and *H. boettcheriana* (Rohd.), but it may also

be present somewhat higher, especially in southern slopes of the Carpatian beech stands. Its only record by Drenski (1957) from Vidin does not nearly reflect ist wide distribution in the Danube basin of northern Bulgaria (Vidin, Nikopol, Russe).

60. *Pandelleana protuberans* (Pandellé, 1896). This is thermophilous taxon confined to dry, sandy, loess and limestone habitats and warm forest stands on southern slopes. Drenski (1957) records it from Sandanski. Additional material 2 ♂♂, Melnik, July 21st, 1987 and 1 ♂, Vichren, July 18th, 1987.

61. *Bercaea cruentata* (Meigen, 1826). The species is generally distributed in Bulgaria except for higher montane elevations (above 700—800 m a.s.l.) as evidenced also by Drenski (1957). The species dominates sarcophagine aggregations visiting sea animal carcasses, feces and offal along the Black Sea shore (e.g. Achtopol, Sozopol, Slnčev Brag, Cape Emine, Varna, Zlatni Piaseci, Balčik, Cape Kaliakra atc.). The larvae develop in feces, but also in decaying meat, in dead snails, echinoderms, insects, carcasses of small mammals and birds. It was also reared from nests of birds (*Troglodytes sedon*), from snails (*Cepaea nemoralis, Eobania vermicularis, Euparyphia pisana, Helix aspersa*), locusts (*Dociostarus marooccanus, Melanoplus* sp., *M. differentialis, Schistocerca cancellata, S. gregaria*) and chrysalids (*Laphygma frugiperda* — Lep.). It is suspected to produce myiasis (tissue and intestinal) af mammals including man.

62. *Kramerea schuetzei* (Kramer, 1909). Drenski (1957) mentions its presence between Silistra and Srebrna and speaks of "montane" habitats. This species is not represented in our material from Bulgaria. The species was probably a wide distributed taxon in forested areas of (Central) Europe from lowland forests up to about 800 m a.s.l., and is becoming rare. It seems that its population density decreased during the last decades, whereby the species is withdrawing from the West to the East af Europe. Its maggots develop in small asnimal carcasses and are facultative predators of lepidopterous pupae (*Aporia crataegi, Dasychira albodentata, Dendrolimus pini, D. sibiricus, D. spectabilis, Dyctioploca japonica, Lymantria dispar, L. monacha, Orgyia antiqua, Selenephera lunigera*).

63. *Robineauella caerulescens* (Zetterstedt, 1838). In Bulgaria the species lives mostly in forest habitats of submontane to montane elevatians, where it appears to be common (Jacentkovský, 1936; Drenski, 1957). The larvae develop in dead or dying insects and in carcasses of small mammals, birds and fish. Their laboratory rearing is easy on meat (especially on liver), because young larvae kill other competing larvae on most substrates exposed to oviposition in nature. With constant laboratory temperature (about 23 °C) and ilumination several generations of flies may develop. The larvae are also predacious on pupae of such Lepidoptera as Lymantriidae and of other bombycoid moths.

64. *Liopygia argyrostoma* (Robineau-Desvoidy, 1830). Drenski (1957) records just two localities (Petričko-Kožuch in the valley of Struma and Goče Delčev), although our observations indicate that this famous sy-

nanthropic species is generally distributed in lower elevations of the entire state territory of Bulgaria (see also Gregor & Povolný, 1959). The adults are important members of the sarcophagine aggregations in decaying small animal carcasses, feces and offal slong the entire Black Sea coast (between Cape Kaliakra and Achtopol). Contrary to Central and North Europe the species seems to be exposed there to a stronger competition pressure especially by *Liopygia crassipalpis* (Mcq.) the latter reaching its nortwestern limit in Central Europe in southern Slovakia (Nitra) and Lower Austria (Neusiedlersee) being a very rare immigrant in southern Moravia (during hot summers, e.g. 1981, 1988). The maggots of *L. argyrostoma* develop in dead invertebrate and vertebrate carcasses, feces, offal and the species is involved with myiasis af birds, mammals and man. It was also reared from bird nests (*Columba, Troglodytes*). It may occasionaly parasitize locusts and their egg sacks (*Dociostaurus maroccanus, Schistocerca gregaria, S. paranensis*) and lepidopterous pupae (*Lymantria dispar*) and beetles (*Lachnosterna* sp., *Melolontha melolontha*).

65. *Liopygia crassipalpis* (Macquart, 1839). Drenski (1957) records this subtropical to tropical species from the Makedonian valley of Struma, although the species is a generally distributed synanthrope in Bulgaria reaching elevations up to 1000 m (Šipka Pass). During the hot summer months the species belongs to frequent visitors of animal carcasses, feces and offal along the Black Sea shore between Kaliakra and Achtopol. The species is known as decomposer of the above substrates, and it was also reared from decomposing fruits and from such locusts as *Schistocerca cancellata* and *S. gregaria.* It is recorded as a fly responsible for myiasis in animals and man.

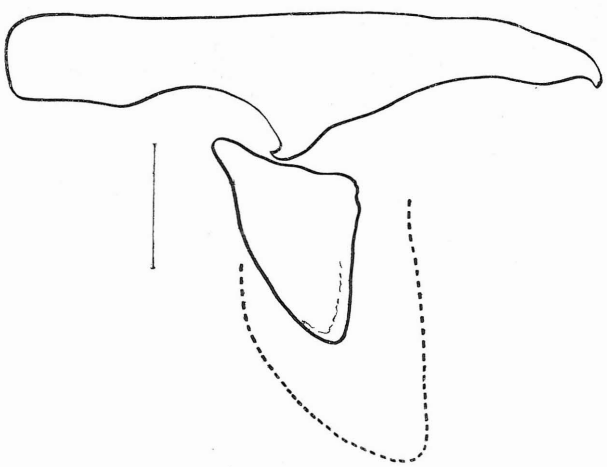

Fig. 17: *Liosarcophaga beckeri,* cercus and coxite.

66. *Liopygia uliginosa* (Kramer, 1908). Drenski (1957) records only Konstantinovo (near Varna) and he mentiones the coincidence between the occurrence of this species and the overpopulation of *Lymantria monacha.* The species seems to be a more or less obligatory parasitoid or pseudoparasitoid and predator of lepidopterous larvae (e.g. *Aporia crataegi, Dasychira albodentata, Dendrolimus pini, D. sibiricus, Euproctis chrysorrhoea, Euxoa segetum, Leucoma candida, Lymantria dispar, L. monacha, L. similis, Malacosoma neustrium, Orgyia antiqua, Selenephera lunigera, Vanessa xanthomelas*). Unlike *Liosarcophaga tuberosa* (Pand.) and other deciduous forest bound insect parasitoids of this group this species disappears gradually from large areas of Central Europe being restricted to limited habitats (e.g. southern Slovakia, northern Hungary).

67. *Liosarcophaga tibialis* (Macquart, 1850). Drenski (1957) records only one finding from Bulgaria (Charmanli). The species was both collected and repeatedly reared from dead crabs, moluscs etc., along the Black Sea shore being locally rather common (e.g. Cape Kaliakra in July 1987, Cape Emine in July 1987, Sozopol in June—July 1970—1971). The pecies participates on sarcophagine communities decomposing animal carcasses on sea beaches and elsewhere. The species was also occasionally baited on meat in the main railwaystation of Brno (July 17th 1969) and reared from a dead myxomatic rabbit near Bzenec in southern Moravia (September 9th, 1972) both cases being obviously a result of artificial vectoring this species by train, as the populations of this subtropical species are not established in Central Europe. The flies were also reared from dead snail and insects (especially locusts — e.g. *Docio-*

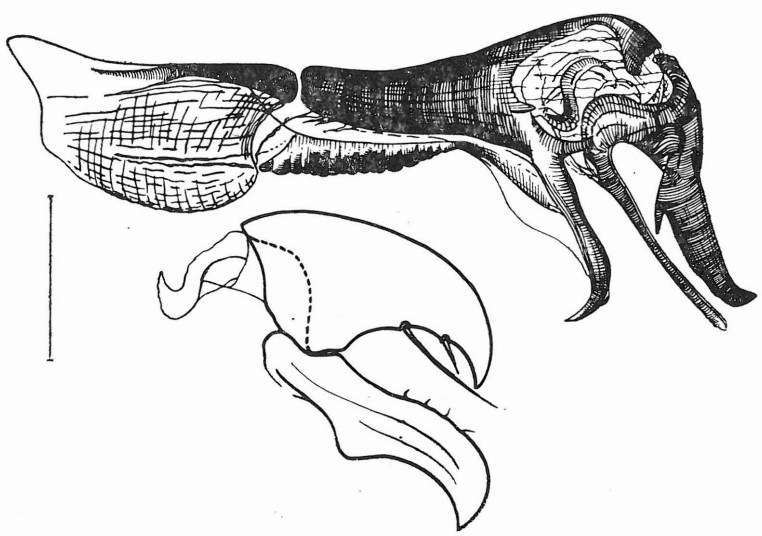

Fig. 18: *Liosarcophaga beckeri,* paraphallus and gonites (Sozopol, 26. 6. 1970).

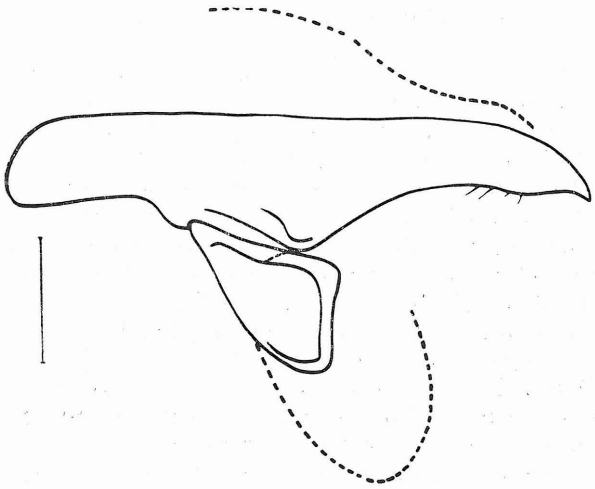

Fig. 19: *Liosarcophaga aegyptica,* cercus and coxite.

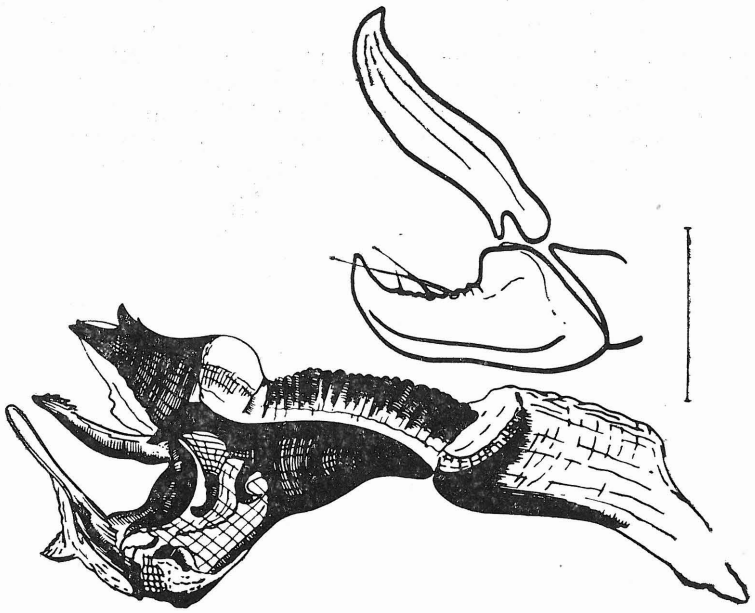

Fig. 20: *Liosarcophaga aegyptica,* paraphallus and gonites. (Cape Kaliakra, 23. 7. 1987).

staurus maroccanus, Schistocerca gregaria) and may possibly participate on myiasis of mammals (See also tables 6—11, and Figs. 17, 18).

68. *Liosarcophaga aegyptica* (Salem, 1935). The only record by Drenski (1957) from Balčik is a little confusing as he speaks of "Parasarcophaga parkeri Pand." In our material the species is represented by numerous males from Veliko Trnovo (July 1987), Pobiti Kamni (June—July 1965, 1968, 1970 and 1987) and it seems to be distributed also along the entire coast of Black Sea (Cape Kaliakra, Cape Emine, Sozopol) participating on decomposition of animal carcasses. The flies were reared from maggots developing in decaying meat, feces and offal, they are predators of beetles (*Scarabeus sacer, Pisterotarsa gigantea zoubkoffi*) and cause myiasis in sheep (Tab. 3—6, 10; Figs. 19, 20).

69. *Liosarcophaga emdeni* (Rohdendorf, 1970). This species was recorded (as *Parasarcophaga teretirostris* Pand.) by Jacentkovský (1936), Drenski (1957) and by Gregor & Povolný (1959) from several localities (Preslav, Bačkovo, Sliven, Plovdiv, Pleven, valley of Struma and Melnik). It is a parasitoid and/or predator of bombycoid caterpillars (especially Lymantriidae) accompanying warm forest habitats of Europe and Asia. Its northern and western distributional limit in Central Europe is not cleared. Anyhow, the close related and possibly vicariating *Liosarcophaga teretirostris* (Pand.) collected e. g. in Thuringia was not yet discovered in Czechoslovakia, where only *L. emdeni* seems to be present.

70. *Liosarcophaga dux* (Thomson, 1868). After both Jacentkovský (1936) and Drenski (1957) this tropical species is widely distributed in Bulgaria. Our field observations evidence a wide distribution of this species along the Black Sea shore (Kaliakra, Balčik, Albena, Zlatni Piaseci, Varna, Slnčev Brag; Emine, Nessebar, Sozopol, Mičurin, Achtopol etc.).Together with *Bercaea cruentata* (Meig.) this species seems to dominante the sarcophagine associations and aggregations (Tables 6, 7, 9) on small carcasses (especially fish, crustacians and moluscs).

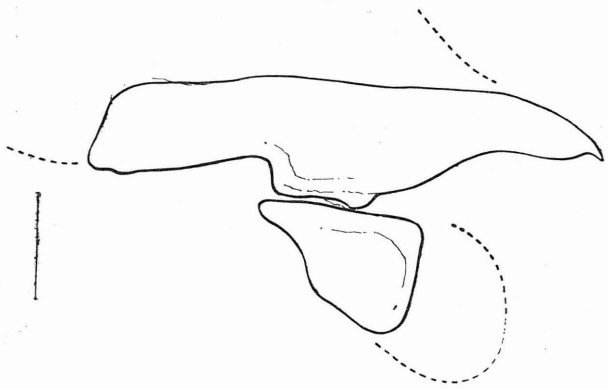

Fig. 21: *Liosarcophaga dux*, cercus and coxite

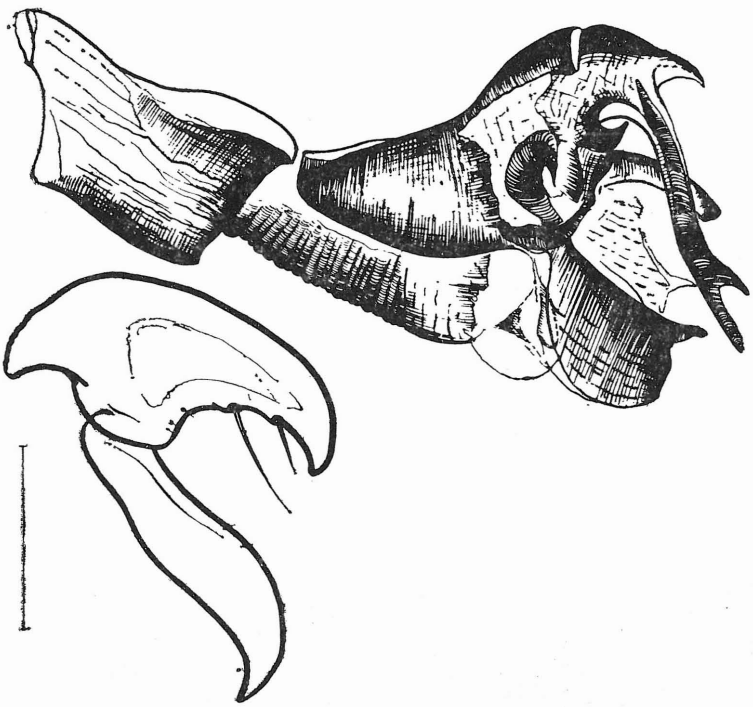

Fig. 22: *Liosarcophaga dux,* paraphallus and gonites. (Cape Kaliakra, 23. 7. 1987).

71. *Liosarcophaga harpax* (Pandellé, 1896). This holartic species seems to be widely distributed in Bulgaria (Jacentkovský, 1936; Drenski, 1957). It accompanies forest stands up to their submontane elevations being a parasitoid of insects, especially of lepidopterous pupae (reared from *Aporia crataegi, Dasychira albodentata, Dendrolimus pini, D. sibiricus, D. spectabilis, Dictyoploca japonica, Lymantria dispar* and *L. monacha, Stilpnotia salicis*), but may also develop in vertebrate and other invertebrate carcasses. Similarly as several related taxa of this group the species dicappears from Central Europe, where it was common and withdraws to the European South East.

72. *Liosarcophaga jacobsoni* (Rohdendorf, 1937). Most localities recorded by Jacentkovský (1936) and Drenski (1957) are concentrated in Makedonia, where the species was also recorded from Struma by Gregor & Povolný (1959), and only one male is recorded from Cape Kaliakra. According to own observations this very thermophile species occurs also in Central Bulgaria (Kazanlak in July, 1987) and mainly in the coastal zone of Black Sea (e. g. Cape Kaliakra in July 1971 and 1987; Cape Emine in July 1987 and repeatedly near Sozopol). This species decomposes

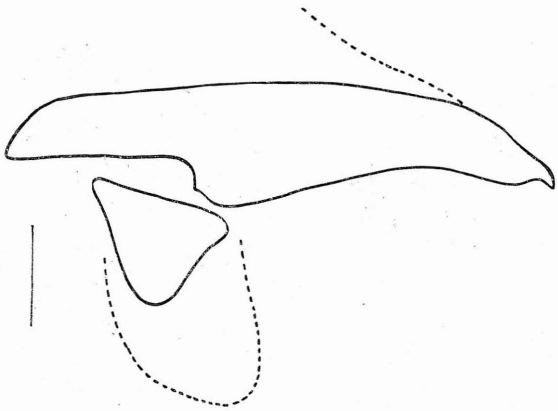

Fig. 23: *Liosarcophaga jacobsoni,* cercus and coxite.

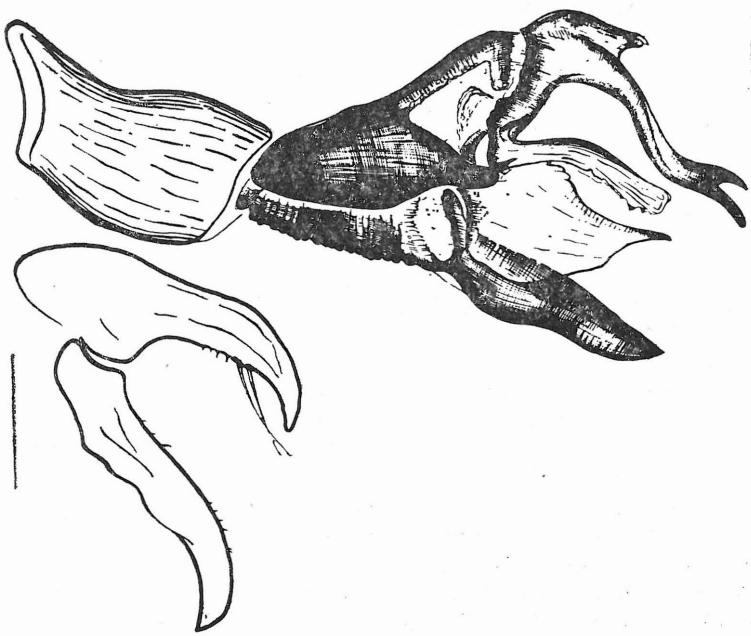

Fig. 24: *Liosarcophaga jacobsoni,* paraphallus and gonites. (Cape Emine, 22. 7. 1987.

small animal carcasses. In central Europe the species reaches its northern limit in northern Hungary and in southern Slovakia (See Tables 6.—10. Fig. 23, 24).

73. *Liosarcophaga portschinskyi* (Rohdendorf, 1937). Our records confirm the presence of this species in sandy riverbed habitats of Struma (Gregor & Povolný, 1959) and along the Black Sea coast (Drenski, 1957), where it belongs to the feeders on small carcasses, feces and offal (together with *Bercaea cruentata, Liopygia crassipalpis, Liosarcophaga jacobsoni, L. aegyptica* and *Bellieria maculata*). It seems that *L. portschinskyi* is less common during the hottest high-summer days. Its larvae decompose meat of small carcasses (fish, birds, mammals) and snails (Helicidae) and may also attack lepidopterous pupae (*Lymantria dispar*).

74. *Liosarcophaga tuberosa* (Pandellé, 1896). This species accompanies extended (deciduous) forest stands being a facultative parasitoid and/or predator of lepidopterous (especially bombycoid) pupae (reared from *Dendrolimus pini, Lymantria dispar* and *L. monacha*). Jacentkovský (1936) and Drenski (1957) published numerous records (Blagojevgrad, Preslav, Sliven, Vrača, Kněža, Pleven, Plovdiv, Poljanovgrad, Burgas, Charmanli) thoroughly from territories with periodical overpopulation of *Lymantria dispar*. In our material the species is poorly represented by 2 ♂♂ (Cape Emine, July 22 nd, 1987, deciduous forest above the beach). The species was locally common in deciduous forest stands of Central Europe together with *Lymantria dispar*. During last decades the species disappeared from Bohemia and Moravia and it seems to be restricted to the oak stands of southern Slovakia and northern Hungary (Štúrovo, Turňa, Košice). Its similar withdrawal is observed in Ukrainian forests.

75. *Liosarcophaga similis* (Meade, 1876). The three records from Bulgaria by Jacentkovský (1936) and Drenski (1957) (Ropotamo, Mičurin, Strandža planina) probably do not reflect the real distributional picture of this species in Bulgaria, as is evidenced by purely occasional findings (Russe, June 1968; Plovdiv, July 1987). Unlike most other species of *Liosarcophaga, L. similis* is an occasional parasitoid of other insects

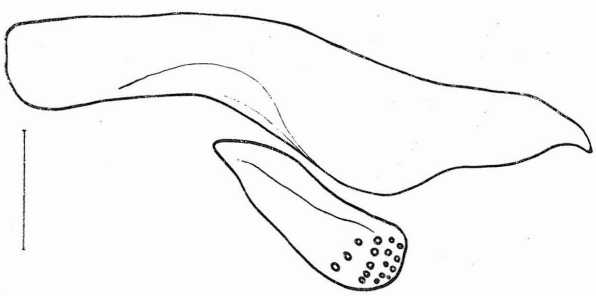

Fig. 25: *Parasarcophaga albiceps,* paraphallus and gonites. (Cape Emine, 22. 7. 1987).

attacking pupae of Lepidoptera (*Namestria oleracea*), snails (*Succinea* sp.) and it may generally develop in decaying organic substrates, mainly in meat.

76. *Parasarcophaga albiceps* (Meigen, 1826). A widely distributed species, common also in Bulgaria being a current synanthrope, and avoiding only montane zone (Jacentkovský, 1936; Drenski, 1957; Gregor & Povolný, 1959 and own observations). The maggots breed in decomposing animal carcasses and in meat generally, and are occasional predators of other fly maggots in feces. They also facultatively parasitize insect larvae (*Saperda populnea, Melolontha* sp., *Polyphylla fullo, Oryctes nasicornis* of Coleoptera; *Acantholyda posticalis* of Hymenoptera- Symphyta) and pupae (*Aporia crataegi, Dasychira albodentata, Dendrolimus albomarginatus, D. pini, D. segregatus, D. sibiricus, Lymantria monacha, L. dispar, Orgyia antiqua, Selenephera lunigera, Nonagria* sp. of Lepidoptera). *P. albiceps* belongs also to the community of flies decomposing mainly feces in the entire coastal zone of Black Sea (e.g. Cape Emine, 22nd July 1987 etc.) (see Tables 5, 8, 9, Figs. 25, 26).

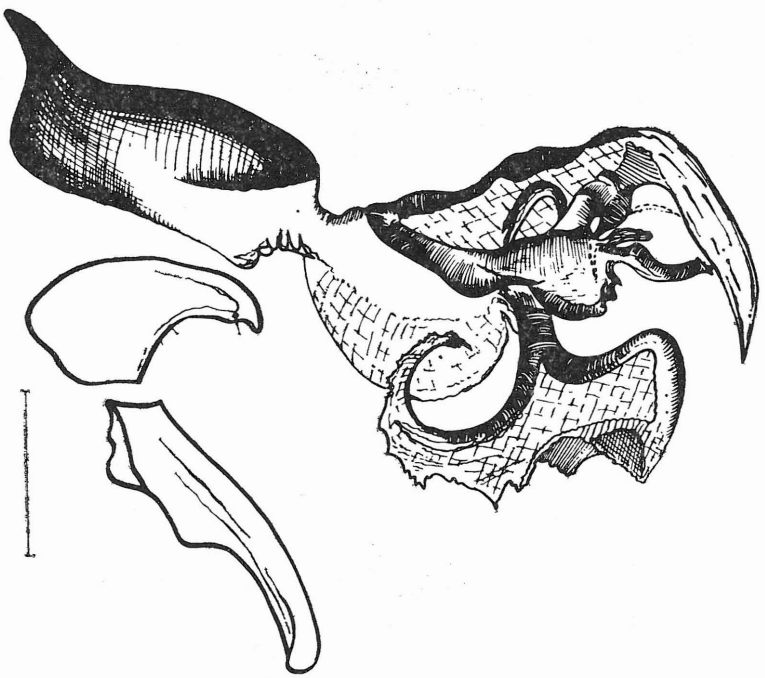

Fig. 25: *Parasarcophaga albiceps,* paraphallus and gonites. (Cape Emine, 22. 7. 1987).

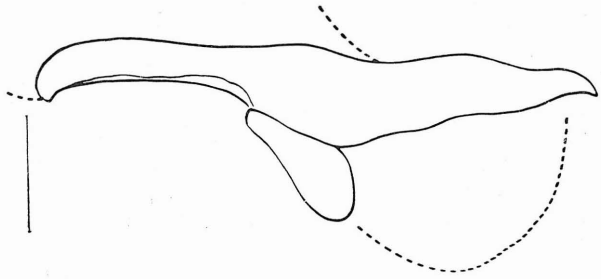

Fig. 27: *Parasarcophaga hirtipes,* cercus and coxite.

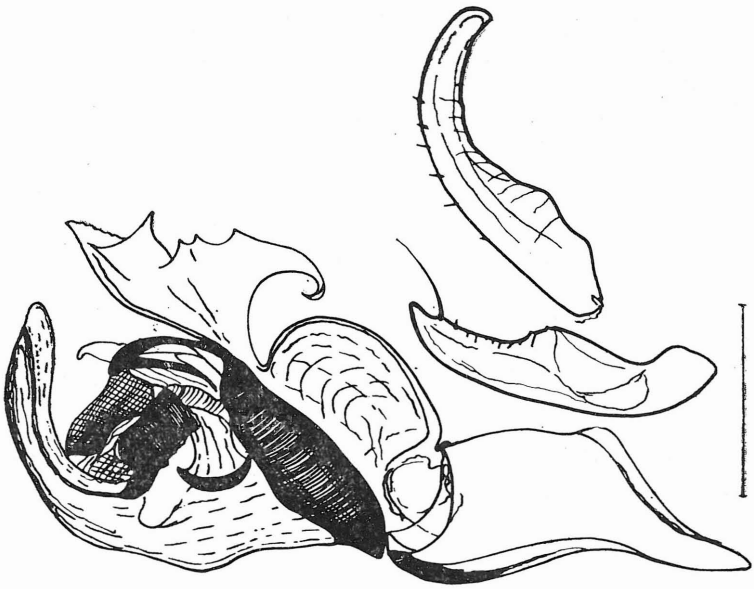

Fig. 28: *Parasarcophaga hirtipes,* paraphallus and gonites. (Melnik, 21. 7. 1987).

77. *Parasarcophaga hirtipes* (Wiedemann, 1830). 1 ♂, Kazanlak, July 20th, 1987; 1 ♂, Melnik, July 21st, 1987. This record is new not only to the fauna of Bulgaria, but at the same time the first record of this species in Europe. The two males were baited on feces at temperatures reaching up to 44 °C in shade (Figs. 27, 28).

78. *Rosellea aratrix* (Pandellé, 1896). This is a widely distributed species in Bulgaria (see Drenski, 1957). Our material includes only one

male from Razgrad, July, 10th, 1970. Irrespective of its wide distribution the species is rather uncommon. The maggots are facultative predators and/or parasitoids of insects (pupae of *Lymantria monacha,* adults of *Prionus coriarius*), but may obviously abandon predation and breed also in insect and animal carcasses generally.

79. *Sarcophaga bergi* Rohdendorf, 1937. The only Bulgarian record from Sliven (Jacentkovský, 1936) is strenghtened by an additional male from Kazanlak (July 20th, 1987). The species is pontomediterranean par excellence, but is probabaly rare being a stenoecious and thermophile form (Figs. 29, 30).

80. *Sarcophaga lasiostyla* (Macquart, 1843). Drenski (1957) mentions only Charmanli and Mičurin (as *S. carnaria meridionalis* Rod.). but in our experience this species occurs mostly in the lowland northern Bulgaria, mainly along the Danube and its right side tributaries. In our collections numerous males from Vidin and Russe are found, where the species was obviously common.

81. *Sarcophaga variegata* (Scopoli, 1793). This species is common in western and central Europe, but is obviously absent from essential parts of Bulgaria. The only serious records concentrate in the valley of Struma in Makedonia (see Gregor & Povolný, 1959) and Melnik (see also Table 10, 11).

82. *Sarcophaga subvicina* Rohdendorf, 1937. The presence of this species in Bulgaria is possible, but the existing records should be verified, because the only record from Pleven (Drenski, 1957) remains unclear. This species is common in western and central Europe but it becomes increasingly rare or absent from Hungary and from the other Balkan countries, where it seems to occur either in montane elevations or is absent at all.

83. *Sarcophaga ukrainica* Rohdendorf, 1937. 3 ♂♂, baited on feces, Bělogradčik, July 15th, 1987. This is a new record for Bulgaria and is distributionally very important, because the species accompanies the foothills of the Carpatians (southern Slovakia, Hungary, Romania, Ukraine),

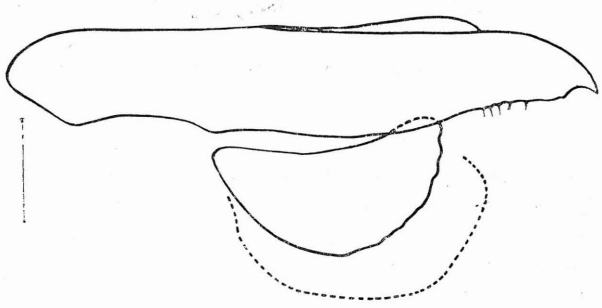

Fig. 29: *Sarcophaga bergi,* cercus and coxite.

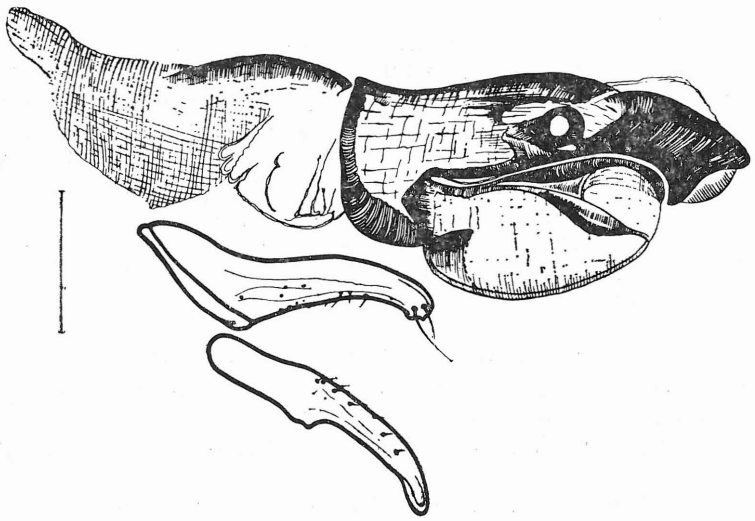

Fig. 30: *Sarcophaga bergi,* paraphallus and gonites. (Kazanlak, 20. 7. 1987).

but it is absent from the Balkan system. This record confirms biogeographical relations between certain faunal elements of the Carpatian and the Balkan montane fauna.

84. *Sarcophaga serbica* Baranov, 1930. The only Bulgarian record (Sliven) by Jacentkovský (1936) and Drenski (1957) should be revised irrespective of the fact that this species might occur in Bulgaria.

85. *Sarcophaga baranoffi* Rohdendorf, 1937. Drenski (1957) records this interesting species from Kjustendil. The species is known only jrom Kroatia and Slovenia (Jugoslavia) (eastern-adriatic element), and its presence in Bulgaria should be reexamined.

86. *Sarcotachinella sinuata* (Meigen, 1826). This species is probably the member of the tribe Johnsonini. The Bulgarian records (Drenski, 1957) from Pirin Planina, Banderica should be revised. The species is — similarly as in Hungary — probably focused in the lowgrounds of the Danube in northern part of the country as is also evidenced by two finds (2 ♂♂, Russe, June 22nd, 1968 and 1 ♂, Russe, June 28th, 1971). The maggots develop in carcasses (dead frogs), in nests of birds (*Dumetella carolinensis, Passer montanus*) and are parasitoids of locusts (*Camnula pelucida, Dociostaurus maroccanus, Melanoplus bivittatus, M. differentialis, M. sanguinipes*) and lepidopterous pupuae (*Nonagria typhae*). It seems that the species is endangered, as it gradually disappears from habitats, where it lived some twenty years ago.

Appendix

In this additional part two determination keys are given resulting from our recent study of the tribe Sarcophagini. As for the subgenus *Boettcherella* the following key presents, at the same time, a base for the revision of this interesting species group comprising (east) mediterranean and/or pontomediterranean taxa of monophyletic origin and confined frequently to dry limestone and similar thermophile and xerophile habitats of the Mediterranean. As for the genus *Parasarcophaga,* its restriction and the following division into several genera (treated throughly as subgenera before) seems to be inevitable, as the genus is based on a pleisiomorphic character.

Subgenus **Boettcherella** Enderlein, 1928

Enderlein, 1928: 49 (as genus); Rohdendorf, 1937: 336 (as a subgenus of Pierretia); 1965: 684, 693 (as a subgenus of *Heteronychia*).

Type-species: *Sarcophaga setinervis* Rondani, 1860 (by original designation).

Characters: Small or medium-sized grey flies with checkering pattern of abdomen. Thorax with three post-dc, ac 2 — 4 + 1 (2). R_5 open, r_1 frequently setose, costal spine long. Propleuron bare. Antenna and palpus black.

Males — All femora and partly tibia with long ventral velosity. Postabdomen elongate. Segments VI. + VIII. (so-called genital segment) with a row of marginals, V. sternite Y-shaped, its lateral arms with numerous spines at inner margin. Phallus not elongate. Membrane inflated medially and with pointed apical proces. Ventral processes well sclerotized, broad and not pointed. Lateral arms of apical plate vell developed.

Praegonites curved with obtuse tip, and with numerous dorsal hair-like bristles; postgonites straight, apically hook-formed, with a long ventral bristle. Genitalia black, epandrium usually reddish.

Females — Narrowest part of frons about $^1/_3$ of head width. VI. abdominal tergite complete (Fig. 34). VII.—X. tergites absent, VI. and VII. sternites elongate. Terminalia black, terminal part of tergite VI. entirely reddish.

The three known species of *Boettecherella* are mediterranean and/or east-mediterranean to ponto-mediterranean. The flies inhabit mesopyhtic dry forest-steppe formations, especially on limestone (limestone cliffs) near small rivers and/or lake beaches. Larval hosts are generally unknown, but very likely the larvae are parasitoids of terrestrial gastropodes.

Determination key

1. r_1 bare. Frons of male about 0.25—0.30 of head width; ventral processes of distiphallus short, membraneous; lateral arms of apical plate very short (fig. 33, below) . . . . . *H. (B.) boettcheri* (Villn.)
— r_1 hairy. Ventral processes of distiphallus elongate, well sclerotized; lateral arms of apical plate longer . . . . . 2.

2. Males . . . . . 3.
— Females . . . . . 4.
3. Cercus (fig. 31, above) straight narrow and pointed. Lateral arms of apical plate strongly widened apically (fig. 31, below) . . . . . *H. (B.) mutila* (Villn.)

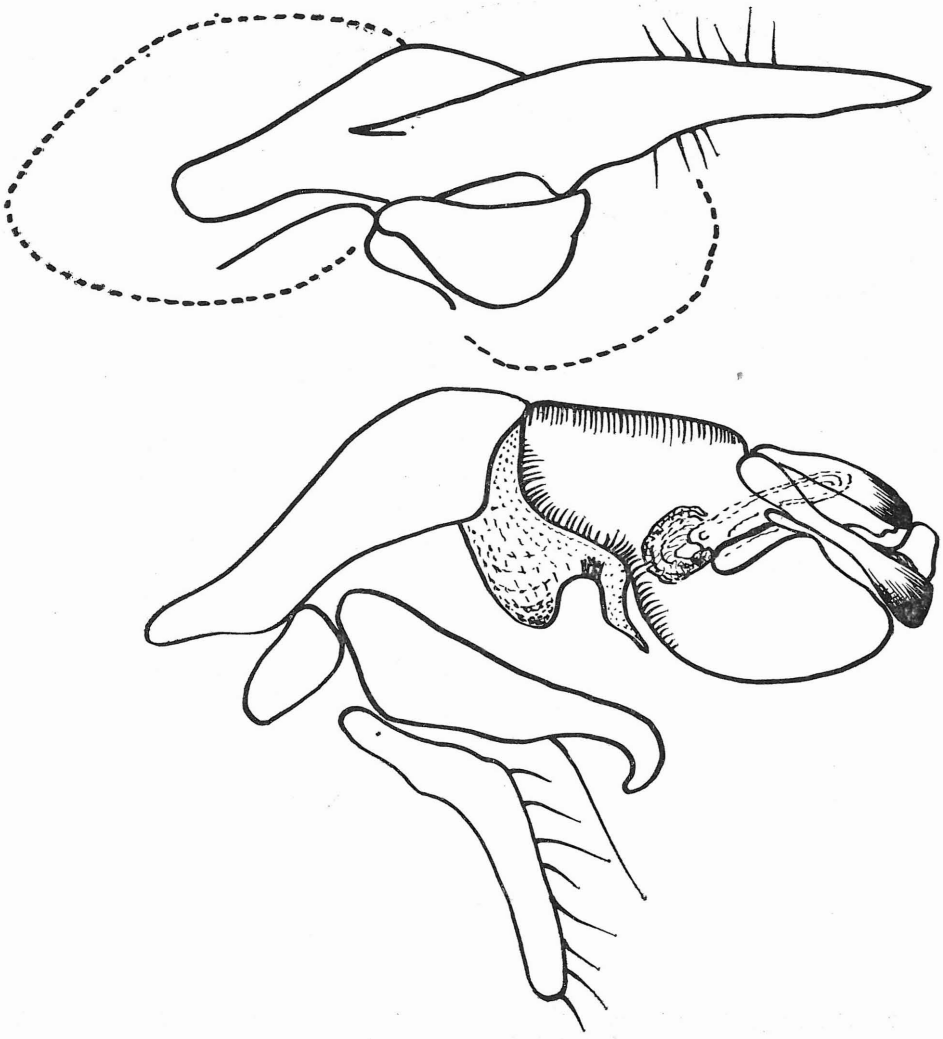

Fig. 31: *Heteronychia mutila.* Cercus and coxite (above), paraphallus and gonites (below). Schematic figures.

— Cercus with a distinct dorsal swelling (fig. 32 above). Lateral arms broadly oval (fig. 32 below) . . . . . *H. (B.) setinervis* (Rond.)

4. VIII. sternite of postabdomen well sclerotized with numerous short spines (fig. 34, right bottom) . . . . . *H. (B.) mutila* (Willn.)
VIII. sternite membraneous with a row of mid-long thick bristles (fig. 35) . . . . . *H. (B.) setinervis* (Rond.)

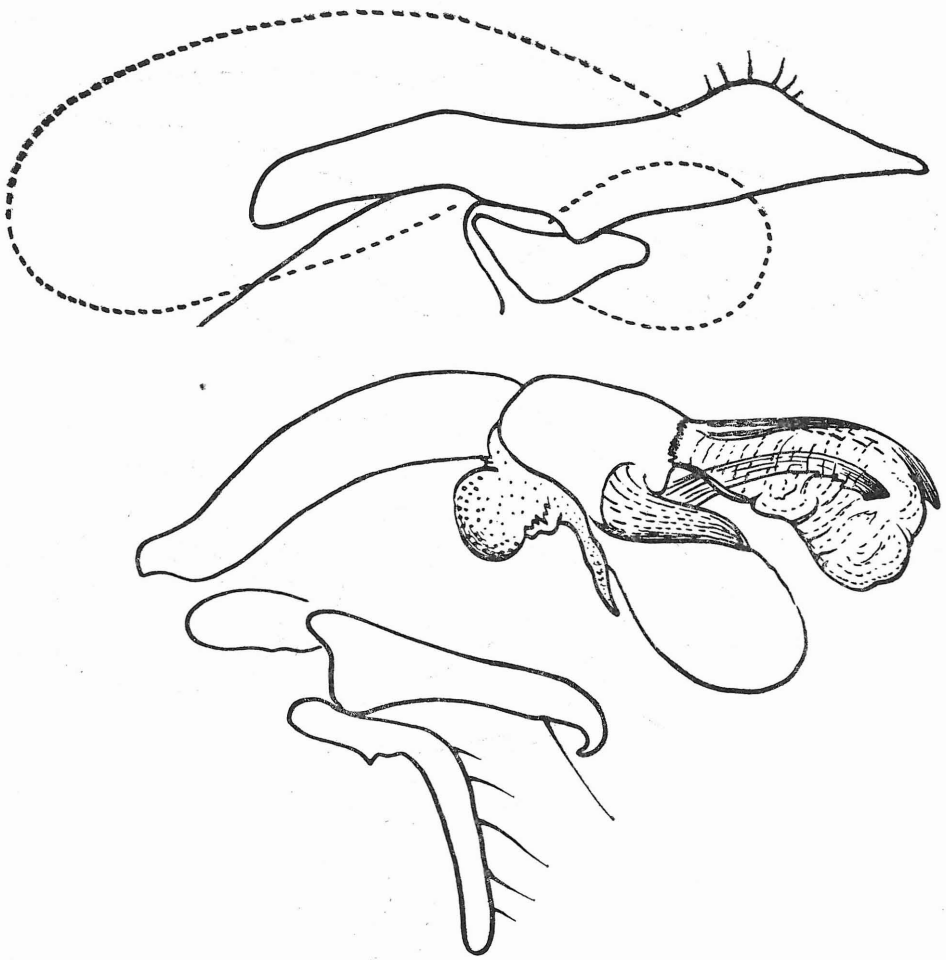

Fig. 32: *Heteronychia setinervis.* Cercus and coxite (above), paraphallus and gonites (below). Schematic figures.

Heteronychia (Boettcherella) mutila (Villeneuve,, 1912)

Villeneuve, 1912: 611 (*Sarcophaga*); Böttcher, 1913: 239. (*Sarcophaga*); Rohdendorf, 1937: 339 (*Pierretia*); Séguy, 1941: 146 (*Sarcophaga,* as var. of *setinervis*; Mihályi, 1979: 143 (*Heteronychia*).
Syn.: *nedelkoffi* Lehrerm 1977: 32 (*Heteronychia*).

♂ — Body length: 5—9.5 mm. Narrowest part of frons about 0.15——0.22 of head width. Frontal vitta about 1.5x widened onwards, its width at frons middle about 2—3x width of one parafrontal. Length of 3rd antennal segment 1.4—1.8x that of 2nd segment. Scutellum without ap and lat. All femora and tibiae with long dense hairs on ventral surface. Ctenidium absent. Section 3 of costa as long as section 5. III. abdominal tergite without medial marginals. Epandrium reddish-orange.

Distribution: Hungary (type-locality), Rumania, Jugoslavia, Bulgaria (type-locality of *nedelkoffi* is Sliven), Czechoslovakia (southern Slovakia), Greece, Cyprus, South Ukraine, Region of Krasnodar, Armenia, Georgia. Usually on limestone habitats and cliffs, rare on loess.

Heteronychia (Boettcherella) setinervis (Rondani, 1860)

Rondani, 1860: 390 (*Sarcophaga*); Böttcher, 1913: 130 (*Sarcophaga*); Rohdendorf, 1937: 336 (*Pierretia*); Séguy, 1941: 146 (*Sarcophaga*); Baranov, 1942: 629 (*Boettcherella*); Mihályi, 1979: 143 (*Heteronychia*).
Syn.: *seguyi* Lehrer, 1977a: Bull. Annls. Soc. roy. entomol. Belg.: 223 (*Heteronychia*).

♂ — Body length: 4—11 mm. Narrowest part of frons about 0.15——0.20 of head width. Frontal vitta about 1.5—2x widened onwards, its width at frons middle about 2.5—3.5x width of one parafrontal. Length of 3rd antennal segment 1.2—1.5x that of 2nd segment. ap of scutellum absent or present. All femora and hind tibia with long dense ventral hairs. Ctenidium absent. Section 3 of costa as long as section 5. III. abdominal tergite with a pair of short medial marginals or they are absent. Epandrium red or reddish-orange.

Distribution: Italy (type-locality is Parma), France, Hungary, Jugoslavia, Greece, Bulgaria, Rumania, Turkey (type-locality of *seguyi* is Denizli), Cyprus, Egypt, Israel, North Caucasus, Georgia, Armenia, Azerbajan, Central Asia, southern Kasachstan.

Heteronychia (Boettcherella) boettcheri (Villeneuve, 1912)

Villeneuve, 1912: 610 (*Sarcophaga*); Böttcher, 1913: 129 (*Sarcophaga*); Rohdendorf, 1937: 340 (*Pierretia*); Baranov, 1942: 556 (*Mehria*); Mihályi, 1979: 143 (*Heteronychia*).

♂ — Body length: 4—7 mm. Narrowest part of frons about 0.26—0.32 of head width. Frontal vitta parallel, at frons middle corresponding about 1—1.5 width of parafrontal. Length of 3rd antennal segment 1.2—1.5x that of 2nd segment. All femora and hind tibiae with numerous ventral hairs. Section 3 of costa 0.5—0.7x shorter than section 5. Apical bristles of scutellum absent. III. abdominal tergite without medial marginals. Epandrium reddish or dark brown.

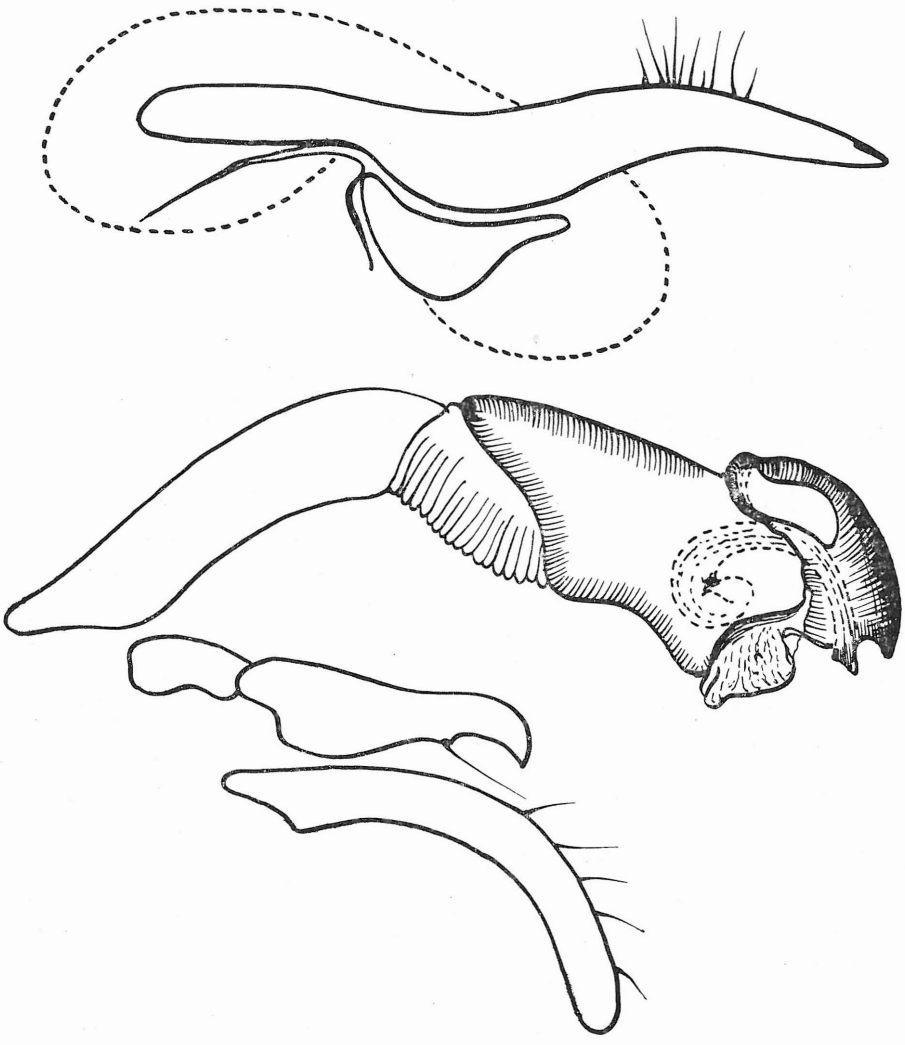

Fig. 33: ***Heteronychia boettcheri.*** Cercus and coxite (above), paraphallus and gonites (below). Schematic figures.

Distribution: Greece (type-locality is Poros Is.), Hungary, Jugoslavia, Cyprus, Israel. A rare species.

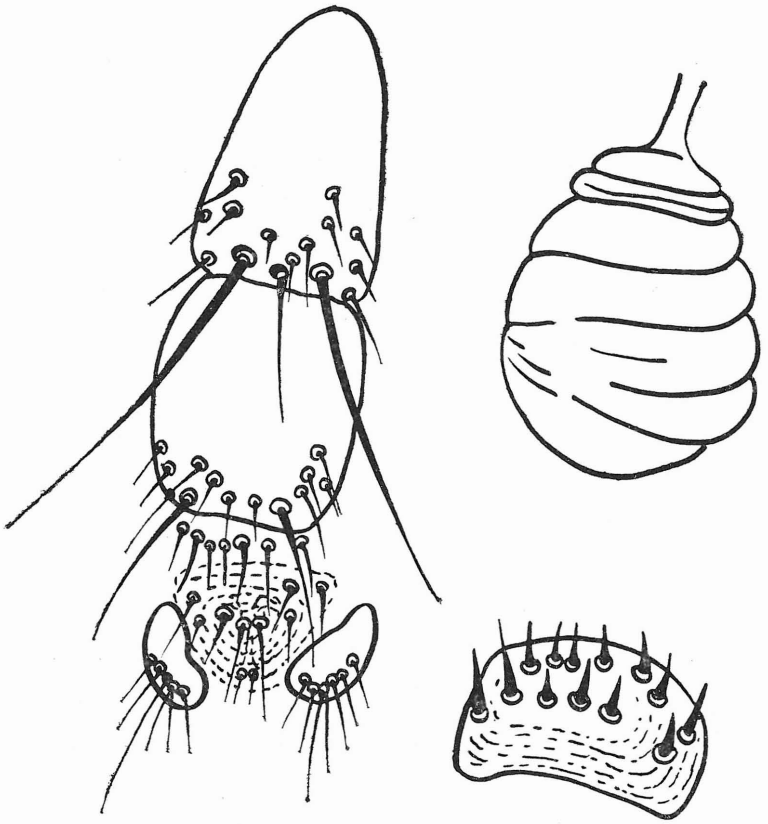

Fig. 34: Bottom right: *Heteronychia mutila:* VIII. sternite of female postabdomen. Right above: *Heteronychia setinervis,* female spermatheca. Left: *Heteronychia setinervis,* female postabdomen.

Restriction of the genus Parasarcophaga Johnson et Tiegs, 1921

This genus [sensu Rohdendorf (1937, 1965), Kano Field et Shinonaga (1967), Verves (1986) etc.] is the most extensive genus of the subtribe Parasarcophagina and, indeed, one of the most extensive genera of Sarcophaginae generally. Irrespective of some obvious relations between *Parasarcophaga* s. str. and its subgenera it appears to be cleared up that the present conception of this genus is untenable, mainly as it is based on a plesiomorphic character (the hair cover of the IVth male abdominal sternite). In the following an attempt is made to restrict *Parasarcophaga* in that it is generically separated from those subgenera

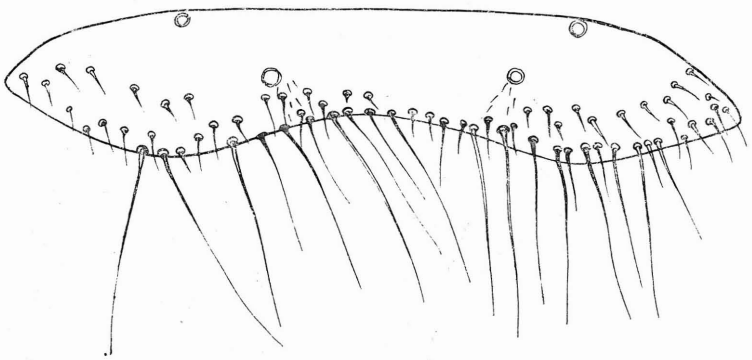

Fig. 35: *Heteronychia setinervis:* VIII. sternite of female postabdomen.

which were its part before (*Parasarcophaga* s. lat.) or which were included in other groups of the subtribe. These subgenera are reapprised to the generic level, whereby their subgenera are given in parenthesis.

1. IV. abdominal sternite of male with long hairs; membranal processes of paraphallus elongated, feather-formed . . . . . genus *Pterophalla* Rohd.
— IV. abdominal sternite of male with short hairs; membranal processes of paraphallus not feather-formed . . . . . 2.
2. Styli long and narrow, braid-formed, occasionally slight shortened or covered by membraneous pellicle, stick-formed . . . . . 4.
— Styli distinctly widened with elongate processes . . . . . 3.
3. V. sternite of male abdomen with conical projection at the base of posterior arms; lateral arms of apical plate of distiphallus (apical part of paraphallus) absent . . . . . genus *Rosellea* Rohd.
— V. sternite without conical projection; lateral arms elongate and narrow . . . . . genus *Ziminisca* Rohd.
4. Styli stick-formed and covered by membraneous pellicle . . . . . genus *Liopygia* End. (with subgenera *Liopygia* s. str., *Thomsonea* Rohd., *Engelisca* Rohd., *Jantia* Rohd., *Variosella* Hsue)
— Styli long and narrow . . . . . 5.
5. Lateral arms of apical plate well developed, elongate . . . . . genus *Liosarcophaga* End. (with subgenera *Liosarcophaga* s. str., *Baliisca* Verv., *Curranea* Rohd., *Jantiella* Rohd., *Kanoisca* Rohd., *Nihonea* Rohd., *Pandelleisca* Rohd., *Paratattisca* Rohd., *Phallanthisca* Rohd. and *Porophalla* Rohd.)
— Lateral arms short or absent . . . . . 6.
6. Apical part of cerci with numerous spines; membranal process not petiolate . . . . . genus *Prionophalla* Rohd.
— Apical part of cercus without spines; if some small spines are present (*Parasarcophaga* s. str.), membranal proces is petiolate . . . . . .

. . . . . genus *Parasarcophaga* Johns. et Tiegs (with subgenera *Parasarcophaga* s. str., *Hosarcophaga* Shin. et Tumrasv., *Baranovisca* Lop., *Phallonychia* Verv., *Sinonipponia* Rohd., stat. n.

Ecological notes on Bulgarian Sarcophagini

As has been yet pointed out in the introduction, our own investigations in and collections of Bulgarian Sarcophaginae were of occasional or tentative character as they resulted from visits of the country extending over more than thirty years. Irrespective of this situation several specially interesting habitats were repeatedly visited in which preconnubial aggregations could be observed. Due to the increasing devastation of nature generally and of Bulgarian nature specially (in view of the continuing ruderalization of considerable parts of Bulgarian landscape observed especially at lower elevations of the country) where representative material of sarcophagids and insects generally should be available, the application of this collecting strategy appears to be inevitable. The hilltopping of the male sarcophagids combined with their perching precopulatory behaviour is certainly a special occasion to obtain material representative both as for its species diversity and its quantitative representation. Some of especially characteristic results of such collectings are summarized in 12 tables enclosed which make it possible to obtain an at least tentative picture of some sarcophagine associations which appear to be especially characteristic of Bulgarian nature.

1. The limestone cliff formations

Two specially characteristic habitats were selected to obtain a picture of their sarcophagine taxocenosis, viz. Vichren in the Pirin Mountains and Pobiti Kamni, an ancient tertiary sea shore formation some 18 km eastwards from Varna near the Black Sea shore. It results from the tables 1 and 2 that, similarly as in the mediterranean limestone habitats (e.g. the Dalmatinian coastal ranges) generally, three species dominate Bulgarian montane and/or alpine limestone habitats, viz. *Helicophagella novercoides, Heteronychia bezziana* and *Pierretia nigriventris,* of which *H. novercoides* and *H. bezziana* are characteristic, at the same time, of similar habitats of the Alps and the Carpatians. While *H. novercoides* appears to be a true alpine species preferring the rocky alpine habitats above the timberline, *H. bezziana* is focused in considerable lower elevations preferring limestone cliffs inhabited by the colonies of snails of the genera *Chondrina* and *Clausilia* — its main host. *H. beziana* practically does not exceed elevations above 1000 m a.s.l. in the Carpatians. Its lowest lacalities known are the limestone cliffs of the Bohemian Karst (Central Bohemia) near Karlštejn at elevations of about 350 m a.s.l. where the species is extremely common.This is also the northernmost known extension of the distributional area of this species. It seems to be clear enough, too, that two next species are characteristic of the Bulgarian alpine limestone cliffs, viz. *Heteronychia porrecta* and *H. vicina,* of which especially the first one shows a typically alpine distribution

(Italian Dolomites, Slovakian Malá Fatra and alpine Ranges of Bulgaria, thoroughly above 1000 m a.s.l.). Also the presence of *Pierretia sororis* characteristic of limestone cliffs of submontane and montane elevations. The specificity of the mediterranean latitude of Vichren is documented by a rather common occurrence of *Heteronychia mutila* — a clearly mediterranean taxon reaching there the altitudes approaching 2000 m. Similarly the (occasionally common) presence of *Ravinia pernix, Pandelleana protuberans* and *Heteronychia rohdendorfi* indicate the extrazonal character of the male preconnubial association of sarcophagines occurring on the slopes of Vichren stressing their thermophilous character.

Contrary to this alpine character of Vichren, the tertiary limestone cliffs of Pobiti Kamni (Dikili Taš) are obviously representative of the (ponto) mediterranean face of this and of similar habitats at lower elevantions of Bulgaria (see tables 3, 4, 5). Their taxocenosis of sarcophagids is clearly dominanted by such parasitoids of snails as *Heteronychia mutila, H. filia, Discachaeta cucullans* and *D. arcipes,* whereby also the presence of other less common mediterranean helicophagous taxa is also characteristic, viz. *Heteronychia haemorrhoides, H. portschinskyana* and *H. gracea.* This helicophagous complex finds its counterpart in another group of purely mediterranean taxa responsible for the decomposition of such organic substrates as (small) animal carcasses and feces, viz. *Liosarcophaga crassipalpis, L. aegyptica, L. jacobsoni, Helicophagella maculata, Bercaea cruentata* and *Ravinia pernix.* The last two species spread secondarily (as culturophiles and/or synanthropes) to considerable parts of the Danube River Basin in the north including all warmer parts of Central Europe. It is a little surprising that such species as *Liosarcophaga dux* and *L. tibialis,* which are locally common along the beaches of the Black Sea, are practically absent inside Bulgaria or they are obviously very rare outside the maritime zone.

2. The Black Sea coast associations

The beach zone of the Black Sea shows extremely specialized sarcophagine associations (tables 6, 7, 8, 9, 10) which — regardless of the distance between the individual sampling sites (from Cape Kaliakra in the north to Sozopol in the south) — consist chiefly of cadavericolous taxa responsible for the decomposition of dead sea animals stranded in sand dunes and/or rocks having, thus, obvious sanitary importance. It is obvious from the above tables that the species composition may vary locally, and that this association — not very rich in species — is clearly dominated by *Liosarcophaga dux, Bercaea cruentata, Liopygia crassipalpis, L. argyrostoma, Liosarcophaga aegyptica, L. beckeri, L. jacobsoni* and *Helicophagella maculata.* This clearly mediterranean species complex comprising also several subtropical and tropical taxa (*L. crassipalpis, L. aegyptica, L. beckeri, H. maculata*) represents about 70%—80% sarcophagine taxa visiting these organic substrates. If we add some other less thermophile taxa, e. g. *Parasarcophaga albiceps, Helicophagella melanura, Ravinia pernix* and *Liosarcophaga portschinskyi* the entire niche of this habitat is practically occupied so that the remaining trophical

groups of sarcophagines appear to be rare (e.g. *Heteronychia haemorrhoa* or *Pierretia socrus*). It also shows that the species representation of this decomposer complex may vary locally, but this variation seems to be due to the immediate local situation of critical substrates irrespective of phenological and seasonal variation. Many taxa of this complex also tend to a secondary spread as culturophiles and synanthropes.

3. The Bulgarian Macedonia associations

These association seem to be less explored compared with the two above groups as is partly evidenced by recent discoveries of purely pontic or pontomediterranean taxa, viz. *Sarcophaga bergi, Helicophagella maculata* and *Parasarcophaga hirtipes.* It might be, therefore, expected that further new records will enrich our present knowledge. Although certain relations of this subtropical part of Bulgaria to the Black Sea coast are reflected in the common occurrence of such taxa as *Liopygia crassipalpis, Liosarcophaga jacobsoni, L. aegyptica* and *Helicophagella maculata* (including other current and more or less synanthropic species, viz. *Helicophagella melanura, Parasarcophaga albiceps, Ravinia pernix*) the Macedonian sarcophagine associations differ clearly in terms of population densities and also in the presence of taxa obviously absent from many parts of Bulgaria. These are e.g. parasitoids of earthworms (*Sarcophaga lasiostyla* and *S. variegata*), which seem to reflect the continental influence from the north extending through the rivers and streams on one hand, and the purely eastern mediterranean taxa of semidesert character (*Sarcophaga bergi, Parasarcophaga hirtipes*) on the other.

The bionomical specificity of the semidesert continental sarcophagine associations seems to be their striking density drop during the long dry and hot periods (especially during July and August) of the culminating summer the indication of which may be observed also further in the north (including Central Europe) during especially hot summers. This is a phenomenon not observed in the coastal zone of Black Sea, or at least not so striking, probably due to the vicinity of the sea.

It results from the above observations that the sarcophagine associations of at least two major bioms of Bulgarian nature remain rather poorly known. These are the forested areas, mainly those of montane and/or alpine ranges and the lowground forest along the Danube in the north. The purely occasional discovery of *Thyrsocnema kentejana* in the Vitoša Mountains above Sofia corroborates that still very substantial contribution to the Bulgarian sarcophagine fauna may be expected, especially when little disturbed and the withdrawing, endangered habitats be explored.

Table 1. Preconnubial aggregation of Vichren taken on June 3rd 1956 at about 1200 m a. s. l. between 10.00 h and 15.00 h at 18 °C

Species	Number of males	%
1. *Helicophagella novercoides*	27	27.3
2. *Pierretia nigriventris*	17	17.2
3. *Helicophagella noverca*	16	16.2
4. *Heteronychia bezziana*	11	11.1
5. *Heteronychia mutila*	8	8.1
6. *Pierretia soror*	7	7.1
7. *Helicophagella crassimargo*	4	4.0
8. *Heteronychia porrecta*	3	3.0
9. *Pierretia nemoralis*	3	3.0
10. *Pierretia socrus*	2	2.0
11. *Heteronychia rohdendorfi*	1	1.0
Total	99	100.0

Table 2. Preconnubial aggregation of Vichren taken on July 18th 1987 at about 2400 m a. s. l. between 10.00—15.30 h at 19 °C

Species	Number of males	%
1. *Helicophagella novercoides*	37	32.2
2. *Pierretia nigriventris*	22	19.1
3. *Heteronychia bezziana*	18	15.6
4. *Heteronychia mutila*	16	13.9
5. *Pierretia soror*	9	7.8
6. *Heteronychia porrecta*	5	4.3
7. *Heteronychia vicina*	3	2.6
8. *Ravinia pernix*	2	1.8
9. *Heteronychia rohdendordfi*	2	1.8
10. *Pandelleana protuberans*	1	0.9
Total	115	100.0

Table 3. Preconnubial aggregation of Pobiti Kamni taken on June 28th 1970 at about 150 m a. s. l. between 10.30—14.30 h at 27 °C

Species	Number of males	%
1. *Heteronychia mutila*	41	29.9
2. *Heteronychia filia*	28	20.4
3. *Liosarcophaga portschinskyi*	16	11.6
4. *Heteronychia hirticrus*	11	8.3
5. *Liosarcophaga emdeni*	9	6.6
6. *Discachaeta cucullans*	8	5.7
7. *Liosarcophaga aegyptica*	6	4.4
8. *Ravinia permix*	4	2.8
9. *Liosarcophaga jacobsoni*	4	2.8
10. *Discachaeta arcipes*	3	2.2
11. *Helicophagella maculata*	2	1.3
12. *Helicophagella melanura*	2	1.3
13. *Perretia socrus*	2	1.3
14. *Helicophagella crassimargo*	1	0.7
15. *Heteronychia setinervis*	1	0.7
Total	137	100.0

Table 4. Preconnubial aggregation of Pobiti Kamni taken on July 12th 1965, at about 150 m a. s. l. between 11.00 and 15.00 h at 28 °C

Species	Number of males	%
1. *Ravinia pernix*	46	22.2
2. *Heteronychia mutila*	37	17.8
3. *Discachaeta cucullans*	27	13.0
4. *Heteronychia filia*	25	12.0
5. *Liosarcophaga emdeni*	18	8.7
6. *Liopygia crassipalpis*	12	5.7
7. *Liosarcophaga aegyptica*	11	5.4
8. *Teteronychia hirticrus*	9	4.4
9. *Helicophagella melanura*	9	4.4
10. *Helicophagella maculata*	4	2.0
11. *Bercaea cruentata*	3	1.4
12. *Heteronychia portschinskyana*	2	1.0
13. *Discachaeta arcipes*	2	1.0
14. *Heteronychia haemorrhoides*	2	1.0
Total	207	100.0

Table 5. Preconnubial aggregation of Pobiti Kamni taken on July 27th 1987 at about 150 m a. s. l. between 10.00—12.00 h at 39 °C

Species	Number of males	%
1. *Heteronychia mutila*	21	17.2
2. *Discachaeta cucullans*	16	13.1
3. *Heteronychia filia*	16	13.1
4. *Ravinia pernix*	13	10.6
5. *Bercaea cruentata*	11	9.1
6. *Helicophagella melanura*	8	6.5
7. *Lyopygia argyrostoma*	7	5.7
8. *Parasarcophaga albiceps*	7	5.7
9. *Liopygia crassipalpis*	4	3.3
10. *Liosarcophaga emdeni*	4	3.3
11. *Heteronychis hirticrus*	3	2.4
12. *Kramereomyia anaces*	2	1.6
13. *Liosarcophaga aegyptica*	2	1.6
14. *Helicophagella maculata*	2	1.6
15. *Heteronychia portschinskyana*	2	1.6
16. *Liosarcophaga portschinskyi*	1	0.8
17. *Liosarcophaga jacobsoni*	1	0.8
18. *Heteronychia haemorrhoides*	1	0.8
19. *Heteronychia graeca*	1	0.8
Total	122	100.0

Table 6. Preconnubial aggregation of Cape Kaliakra taken on July 2nd 1971 at sea level between 10.00—13.00 h at 36 °C

Species	Number of males	%
1. *Liosarcophaga tibialis*	7	10.2
3. *Liosarcophaga argyrostoma*	7	10.2
4. *Liopygia crassipalpis*	3	4.3
5. *Helicophagella maculata*	2	2.8
6. *Pierretia socrus*	2	2.8
7. *Heteronychia haemorrhoides*	2	2.8
8. *Liosarcophaga aegyptica*	2	2.8
9. *Liosarcophaga jacobsoni*	1	1.5
10. *Parasarcophaga albiceps*	1	1.5
Total	69	100.0

Table 7. Preconnubial aggregation of Cape Kaliakra taken on July 23rd 1987 at sea level between 10.00—15.30 h at 43 °C

Species	Number of males	%
1. *Bercaea cruentata*	57	39.3
2. *Liosarcophaga dux*	54	37.2
3. *Liopygia argyrostoma*	10	6.9
4. *Liopygia crassipalpis*	9	6.2
5. *Liosarcophaga aegyptica*	6	4.2
6. *Helicophagella maculata*	6	4.2
7. *Liosarcophaga jacobsoni*	2	1.4
8. *Liosarcophaga tibialis*	1	0.7
Total	145	100.0

Table 8. Preconnubial aggregation of Cape Emine taken on July 22nd 1987 at sea level between 10.00 and 14.30 h at 41 °C

Species	Number of males	%
1. *Liosarcophaga tibialis*	24	28.0
2. *Liosarcophaga jacobsoni*	23	26.7
3. *Bercaea cruentata*	20	23.2
4. *Parasarcophaga albiceps*	8	9.3
5. *Liopygia crassipalpis*	6	7.0
6. *Pierretia socrus*	3	3.5
7. *Ravinia pernix*	2	2.3
Total	86	100.0

Table 9. Preconnubial aggregation of Sozopol at rocky coast on sea shore taken on June 26th 1970 between 10.00 and 15.30 h at 31 °C

Species	Number of males	%
1. *Liosarcophaga tibialis*	18	35.3
2. *Liosarcophaga jacobsoni*	7	13.7
3. *Parasarcophaga albiceps*	7	13.7
4. *Liopygia crassipalpis*	6	11.8
5. *Liosarcophaga dux*	5	10.0
6. *Helicophagella melanura*	3	6.0
7. *Helicophagella maculata*	3	6.0
8. *Liosarcophaga portschinskyi*	2	4.0
Total	51	100.0

Table 10. Preconnubial aggregation of Sozopol at rocky coast on sea shore taken on July 8th 1971 between 10.00—15.30 h at 35 °C

Species	Number of males	%
1. *Liosarcophaga dux*	18	29.0
2. *Liopygia erassipalpis*	16	25.8
3. *Liosarcophaga portschinskyi*	10	16.0
4. *Liosarcophaga jacobsoni*	4	6.3
5. *Parasarcophaga albiceps*	4	6.3
6. *Helicophagella melanura*	4	6.3
7. *Lisiosarcophaga aegyptica*	3	4.7
8. *Helicophagella maculata*	3	4.7
Total	62	100.0

Table 11. Preconnubial aggregation of Monastery Roženski near Melnik on a hilltop above the canyon (about 600 m a. s. l. taken on June 23rd 1959 between 10.00 and 15.00 h at 35 °C

Species	Number of males	%
1. *Helicophagella melanura*	52	36.4
2. *Sarcophaga variegata*	36	25.2
3. *Liosarcophaga portschinskyi*	12	8.4
4. *Ravinia pernix*	8	5.6
5. *Liopygia argyrostoma*	8	5.6
6. *Parasarcophaga albiceps*	7	4.9
7. *Heteronychia hirticrus*	7	4.9
8. *Liosarcophaga emdeni*	4	2.8
9. *Helicophagella maculata*	4	2.8
10. *Sarcophaga lasiostyla*	3	2.1
11. *Liosarcophaga jacobsoni*	2	1.4
Total	143	100.0

Table 12. Preconnubial aggregation of Monastry Roženski near Mel nik on a hilltop above the canyon (about 600 m a. s. l.) taken on July 21st 1987 between 10.00 and 14.30 h at 42 °C

Species	Number of males	%
1. *Helicophagella melanura*	37	44.5
2. *Ravinia pernix*	11	13.1
3. *Liosarcophaga portschinskyi*	9	10.7
4. *Liopygia crassipalpis*	7	8.3
5. *Parasarcophaga emdeni*	6	7.1
6. *Heteronychia hirticrus*	5	6.0
7. *Liosarcophaga jacobsoni*	3	3.5
8. *Pandelleana protuberans*	2	2.3
9. *Sarcophaga variegata*	2	2.3
10. *Parasarcophaga hirtipes*	1	1.1
Total	83	100.0

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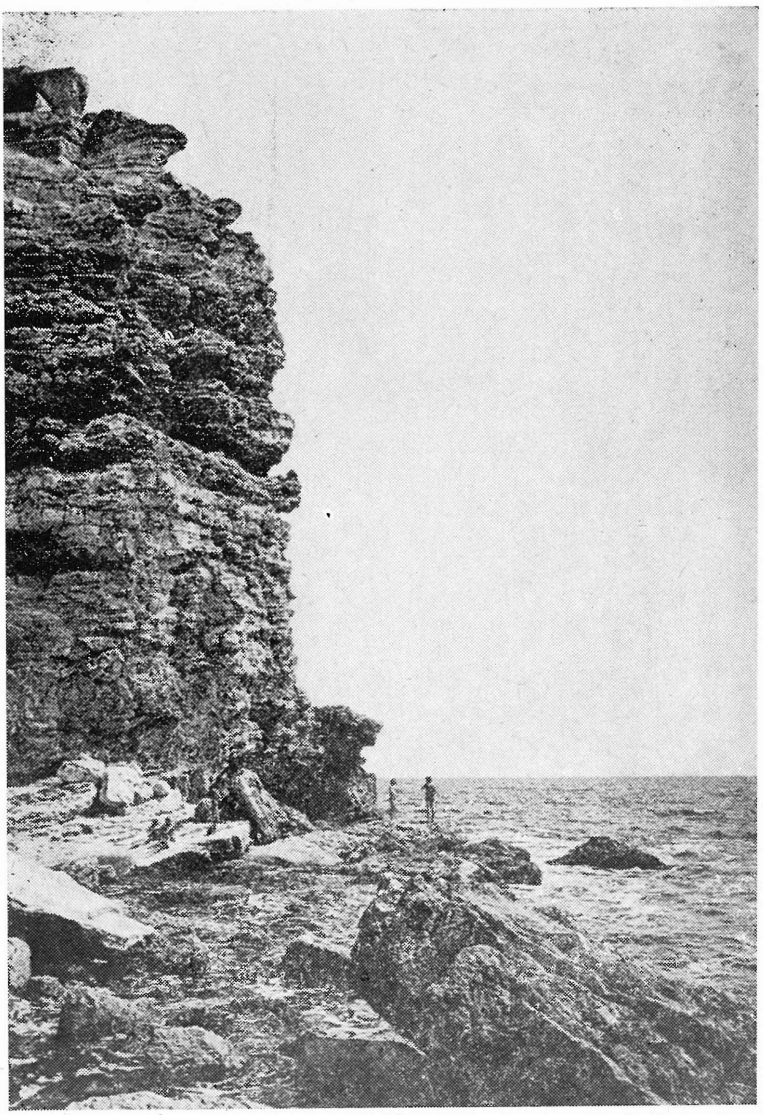
Notice: The abscissae in genitalia sketches correspond 0.25 mm.



Cape Kaliakra — a rocky site of the Black Sea shore. In such habitats the hilltopping of male Sarcophaginae takes place offerring the opportunity to obtain statistically significant samples.