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Results of the investigations on Heteroptera in Slovakia made by the Moravian museum (Aradidae, Pyrrhocoridae)

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STEHLÍK J. L. & HEISS E. 2001: Results of the investigations on Heteroptera in Slovakia made by the Moravian Museum (Aradidae, Pyrrhocoridae). *Acta Musei Moraviae, Scientiae biologicae* (Brno) **86:** 177–194. – Remarks on the distribution and bionomy of species of the Aradidae and Pyrrhocoridae. *Aradus ribauti* E. WAGNER is new for Slovakia. The subfamily Aradinae is represented by 18 species, Aneurinae by 2, Mezirinae by 1 species. The family Pyrrhocoridae is represented by 2 species.

Key words: Hemiptera, Heteroptera, Aradidae, Pyrrhocoridae, distribution, remarks, Slovakia

Introduction

This paper follows on previous publications on the distribution and biology of species of various families of Heteroptera in Slovakia, based on materials from this insect order kept in the collections of the Moravian Museum in Brno (STEHLÍK & VAVŘÍNOVÁ 1991, 1993, 1994, 1995a, 1995b, 1996, 1998a, 1998b, 1999). The introductory part (STEHLÍK & VAVŘÍNOVÁ 1991:185–219) contains all the basic data and ways in which it has been approached.

For each of the species, the first paragraph of the text summarises the faunological data on the Heteroptera from Slovakia available between 1805 and 1990 (a detailed list of references may be found on pp. 210–216 of the introductory part mentioned above). In the "Literature" section, in the data on some localities, the number of the biogeographical district (in parentheses) is accompanied by a question mark. In these cases it is not clear to which of these districts the locality belongs (general information on a locality usually situated at the border of two or even three biogeographical districts or subdistricts).

Material from the first author and collaborators' or acquired for the collections of the Moravian Museum, appears in the second paragraph. The localities are arranged according to biogeographical districts, denoted by Arabic numerals (Fig. 1). In cases in which the Arabic numeral is followed by a letter, this denotes a sub-district. The districts and sub-districts have been defined according to our modification of a paper by DOSTÁL (1960), refined on the basis of additional sources. Dostál's classification has the advantage that the author has also established a hierarchy of the biogeographical units (district, territory, subregion, region). The higher units also make it possible to compare more extensive territories and, moreover, they even have Latin denominations. The characteristics of Dostál's higher biogeographical units have been supplemented by

vegetation tiers after Raušer & Zlatník (1966); for particulars, see the introductory part (Stehlík & Vavřínová 1991: 199–205) for particulars.

All the specimens examined were collected in the 20th century, so only the final two numbers of a year have been used in the data given. The climatic regions mentioned in the commentaries have been established after Quitt (1970, 1971), see the introductory part (Stehlík & Vavřínová 1991: 192–196).

The commentary to each species begins with an abbreviation indicating the pertinence of the species to a particular biogeographical element. In a vast majority of cases, we have adhered to Josifov (1986) in this respect. For those species which do not occur in the Balkans, the pertinence to the various elements has been establsihed by ourselves.

Abbreviations

A list of abbreviations used to denote the pertinence of species to biogeographical elements (after Josifov 1986)

Aalp	Arcto-Alpine species
AM (l)	Atlanto-Mediterranean species sensu lato
BMo	Boreo-montane species
E	Western European-Siberian species known to occur in Europe only
End	Endemic species
ES	Euro-Siberian species
HS	Holarctic species
HM	Holomediterranean species
HM (l)	Holomediterranean species reaching central Europe in the north
HP	Holopalearctic species
C	Cosmopolitan species
CZS	Cosmopolitan species of tropical and subtropical zones
CA	Central Asian species
Mch	Manchurian species
NA	Nearctic species
NM	Northern Mediterranean species
NM (l)	Northern Mediterranean species reaching central Europe in the north
Or	Oriental species
PM	Ponto-Mediterranean species
PM (l)	Ponto-Mediterranean species of wider distribution towards the west and north-west
SES	Southern Eurosiberian species
WES	Western Eurosiberian species
WP	Western Palaearctic species

Abbreviations of morphs

b = brachypterous morph
m = macropterous morph

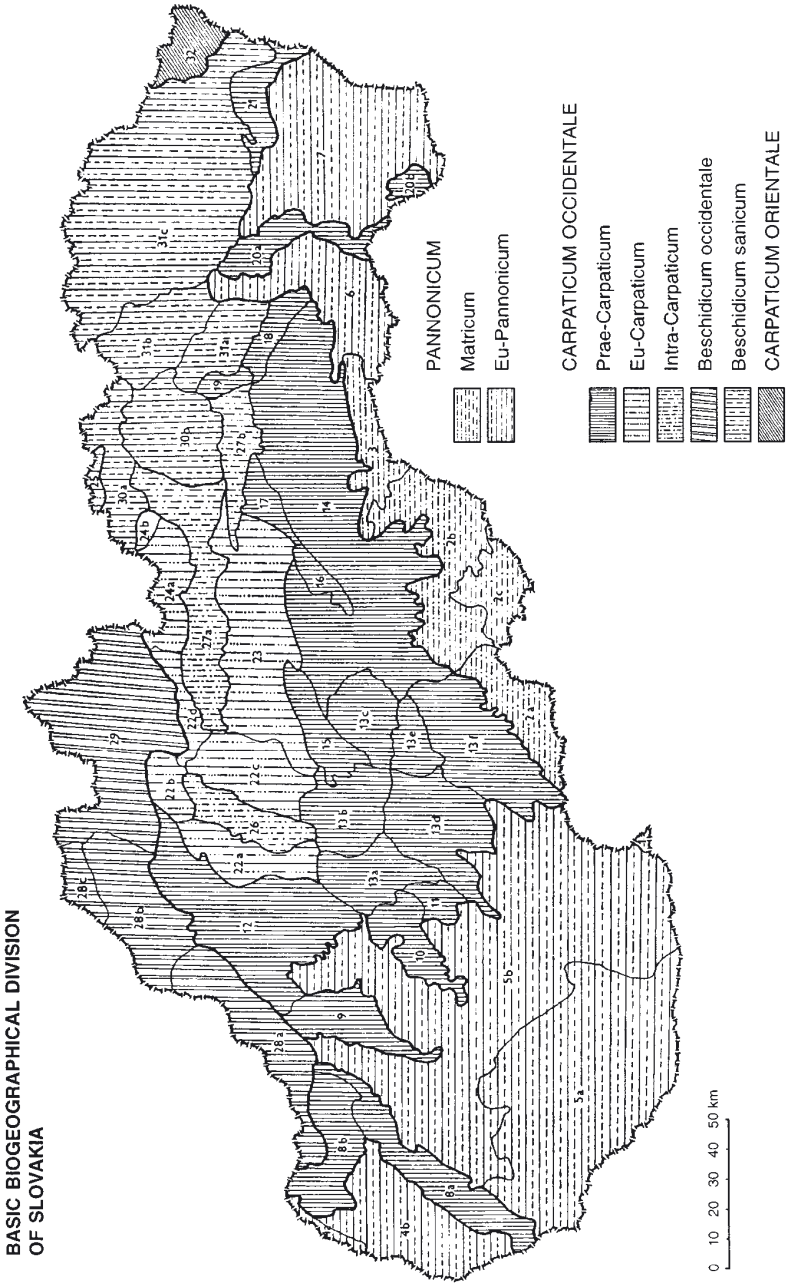

Fig. 1. Basic biogeographical division of Slovakia.

Abbrevitation of collector's names

Kor	Korbel L.	Pč	Poláček K.
Kul	Kulhánek R.	Pd	Pádr Z.
L	Lauterer P.	Po	Pospíšilová L.
Lö	Löbl I.	Ro	Rozkošný R.
Ma	Marek O.	St	Stehlík J.
Os	Osvald J.	Šu	Šustek Z.
P	Pospíšil K.	T	Tešová I.
Pt	Ptáček	V	Valenčík M.
Pa	Palásek J.	Vř	Vavřínová I. see Tešová
Pal	Palásek M.		

The Aradidae were extensively studied by Hoberlandt and Štys in the former Czechoslovakia, with the first author concentrating much of his attention an other families of Heteroptera. Consequently the sampling is not as rich as it is in other Heteroptera groups. That is also due different sampling methods and a lesser endowment of species generally.

Synopsis of species

ARADIDAE

Aradinae

Aradus aterrimus aterrimus Fieber, 1864

Literature. Hoberlandt (1944): Oravský Podzámok, 7.35 (Hoberlandt) (29).

ES. According to Massee (1954), this species occurs in piles of chestnut wood chips, made by woodcutters during the course of working the chestnut woods (*Castanea*) of Kent, in south-east England. All stages of the bug occur in the piles of chips, and it believed to be associated with a mould generated by their decay. Has been recorded from *Trametes versicolor* in Italy (Tamanini 1981) and from burned pine forest in Scandinavia (Heliövaara & Väisänen, 1983). The indication by Wagner (1966), that *A. aterrimus* sucks the roots of *Helianthemum* seems to be confirmed by the observations of the second author, who found it under flat stones on a sunny slope in similar conditions as *A. pallescens* (Herrich-Schaeffer, 1839). The only record from Slovakia was made at an altitude of 500–600 m in the moderately warm climatic region MT 1.

Aradus betulae (Linnaeus, 1758)

Literature. Horváth (1886): Michalovce (7); Vranov n. Toplou (7); Simonka Mt. (20a); Sninský kameň Mt. (21); Bardějov (31b or c); Kamenica nad Cirohou (31c); Ruská Poruba (31c); Snina (31c); Brancsik (1887): Trenčín, vicinity(12); Petricskó (1892): Banská Štiavnica (→ Sklené Teplice), along the path; under bark, 8.8.1889; Horváth (1897a): no concrete data; Ortvay (1902): Bratislava, wide vicinity- no concrete data (?);

BALTHASAR (1937a): Muráň, wide vicinity(16); HOBERLANDT (1955): Kováčov (1); Gabčíkovo (5a); PiešŹany (5b); Kremnica (13b); Léšt (13f); Kralovany (22c); ROUBAL (1959): Jur pri Bratislave, 17.6.52 (f. *ferruginea* KIRITSHENKO) (5a or 8a); Trenčín, Považský Inovec Mts., 7.52 (f. *ferruginea* KIRITSHENKO, f. *meridionalis* KIRITSHENKO) (9); Zvolen, 4.53, 6.54 (f. *ferruginea* KIRITSHENKO, f. *meridionalis* KIRITSHENKO) (13); Banská Bystrica, 5.56 (f. *ferruginea* KIRITSHENKO) (15); Remetské Hámre, 7.53, 7.54, 8. 55, 8.56 (f. *ferruginea* KIRITSHENKO) (21); Vrútky, 4.55 (f. *meridionalis* KIRITSHENKO, (26); Komárník, 25.7.55 (f. *ferruginea* KIRITSHENKO) (31c).

Material examined

1 Burda Hills. (Kováčovské kopce Hills): no concrete data, 120–313 m, 22.7.53 (L) 1 ♀; Kováčov, andesitee slope, 120–150 m, 20.6.56 (G) 1 ♂; ditto, 5.57 (G) 6 ♂ 6 ♀ 2 nymphs (5. instar).
4b Malacky, 165–195 m, 22.7.75 (Hl) 1 ♀.
5b Nové Mesto nad Váhom, 200–270 m, 8.56 (L) 93 ♂ 62 ♀ 197 nymphs; ditto, 29.8.56 (L) 41 ♂ 16 ♀ 61 nymphs.
8a Kuchyňa, Ostrý vrch Hill, **Δ** 540, 12.5.78 (V) 1 ♂ 2 ♀.
9 Považský Inovec Mts., up **Δ** 1,042, 29.5.67 (Os) 1 ♀.
12 Bojnice, 320–400 m, 13.4.61 (Br) 1 ♀.
13b Kremnica, 480–900 m, 20.4.51 (Ko) 1 ♂1♀.
13f LéšŹ, military exercise grounds, 500–600 m, 4.53 (Ko) 2 ♀; ditto, 6.54 (Ko) 7 ♂ 4♀.
14 Košické Hámre, 400 m, 19.6.49 (Pa) 1♀ .
18 Margecany, 300–400 m, 6.61 (G) 1 ♂1♀.
21 Remetské Hámre, 250–500 m, 7.57 (G) 4 ♂1 ♀ 1 nymph (5.instar); ditto, 6.59 (G) 1 ♂ 1 ♀; ditto, 7.73 (G) 1 ♂; ditto, 1.7.89 (Kul) 1♀.
22b Viničky, vicinityof the Bodrog River and a hill near **Δ** Somoš, 94–180 m, 30.6.74 (L) 5 ♀.

SES. Both adults and nymphs hibernate. This species is predominantly associated with *Fagus silvatica*, but has also been recorded on *Populus nigra*, *Quercus* sp. and other deciduous trees, where it feeds and develops on fungi of the genera *Fomes*, *Leptoporus* (TAMANINI, 1981) and *Trametes* (TAMANINI, 1961). When not feeding, imagines and nymphs are found under the loose, preferably dry, bark of dead trunks, still standing or fallen. This species occurs in Slovakia in the lowlands as well as at medium altitudes. On readily warmed substrates (e.g. intrusive rocks, such as. andesitees) this species reaches higher altitudes. However, it is absent fromn cold, high-elevation sites in northern Slovakia. Occurs at altitudes of 94 to 1,040 m in the all warm climatic regions, the moderately warm. MT 9, 8, 6, 5, 1 and in the cold CH 5.

Aradus betulinus FALLÉN, 1829

Literature. HORVÁTH (1897a): Kežmarok (27a or 30b); BALTHASAR (1937a): Trenčín (12).

Material examined

24a Javorina, 1,018 m, 10.7.51 (Pa) 2 ♂1 ♀; Podbanské, 940 m, 7.60 (G) 1 ♂; ditto, Tichá dolina Valley, 1,000–1,260 m, 11. 8.70 (St) 1 ♂; Tatranská Lomnica, 860–1,000 m, 4.58 (G) 1 ♀.

24b Belanské Tatry Mts. no concrete data, ? up cca 2.000 m, 8.7.57 (Pč) 4 ♂.
27a Tatranské Matliare, 870–900 m, 26.6.49 (Pa) 1 ♀; ditto, 30.6.50 (Pa) 1♀.
30b Levočská Dolina, 600 m, 8.56 (G) 2 ♂; ditto, 25.3.57 (G) 2 ♂.

ES. Adults and nymphs hibernate under the loose bark of the stumps of coniferous trees such as *Pinus silvestris*, *Picea abies* and *Larix decidua* (Heiss 1972). They have been collected on *Trametes serialis* and *Poria crassa* (Tamanini 1956), but also occur on other polyporous fungi. In Slovakia this species occurs at medium and high altitudes, i. e. at or above 300 m. On calcareous rocks it reaches and altitude of about 2,000 m. The species has been found only exceptionally in the warm climatic region T 2, and also in the moderately warm region MT 6, 1, but thrives in the cold regions CH 7, 5, 4, 3, 2.

Aradus brenskei Reuter, 1884

Literature. Štys (1976): Remetské Hámre, 7.73 (Žirovnický) 1 ♀ (21).

NM(1). It can be assumed that adults and nymphs hibernate, as do all members of the related "*betulae*"-group. Has been recorded from deciduous trees infested by fungi *Schizophyllum alneum* or *Trametes hispida* fungi (Tamanini, 1981). Shows a Mediterranean distribution and the finding in Slovakia is the northernmost locality recorded, as that reported from Denmark (Gyllensvärd, 1965 as "*longirostris*") was introduced or mislabelled. The only record from Slovakia was found at an altitude of 250 to 500 m, most probably in the warm climatic region.

Aradus cinnamomeus (Panzer, 1797)

Literature. Brancsik (1878, 1880): Trenčín, vicinity (12); Horváth (1897a): Viničky (20b); Kežmarok (27a or 30b); Balthasar (1937a): Bolešov (28a); Hoberlandt (1955): Púchov (28b) ; Turček (1964): Šafárikovo (2a); Kopčany (4a); Brodské (4b); Gbely (4b); Lozorno (4b); Malacky (4b); Stupava (4b); Rusovce (5a); Štrkovec (5a); PiešŹany (5b); Čemerné (7); Brezová pod Bradlom (8a or b); Brodzany (10); Kolíňany (10); Krnča (10); Velké Pole (10); Pružina (12); Handlová (13a or b); Nová Lehota (13a or b); Lutila (13b); Detva (13c); Zolná (13c); Banská Štiavnica (13d); Ostrá Lúka (13e); Hrušov (13f); Krásnohorské Podhradie (14); Oravce (15); Hlinné (20a); Kláštor pod Znievom (22a); Šútovo (22b); Vernár (23); Vikartovce (23); Liptovská Mara Dam (27a); Poprad (27a); Spišská Belá (27a); Dolní Súča (28a); Pruské (28a); Lysá pod Makytou (28b); Orlové (28b); Púchov (28b); Babrov (29); Raslavice (31b or 31c); not identified localities: Popradno; Chvojnice (Slov. centr.).

Material examined

4b Brodské, Dúbrava Wood, 0,5–1 km E of the village, pine wood on sand, 163 m, 3.9.87 (St) 1 ♀ b; Malacky, pine wood, 165–195 m, 3.6.55 (Pa) 1 ♀ b; ditto, 8.6.55 (Pa) 2 ♀ b; ditto, 9.6.55 (Pa) 1 ♀ b; Plavecký Štvrtok, 158 m, 5.5.59 (K) 14 ♀ b, 3 ♀ m.
5a Sládkovičovo, Bažantnica, W border of the Vincenhazi Wood, 122 m, 23.5.88 (St) 4 ♀ b.
5b Čenkov, 109 m, 30.7.58 (St) 2 ♀ b; Marcelová, Bošovský kopec Hill, **Δ** 140, sand, 25.5.88 (St) 1 ♀ b.
7 Strážské, 130–140 m, 1.3.59 (K) 23 ♂ m, 23 ♀ b, 1 ♂ 1 ♀ in copula.

ES. Adults and nymphs hibernate under bark scales at the base of the host tree or in the nearby substrate. *Aradus cinnamomeus* is the only primary pest in the family Aradidae, causing severe damage to *Pinus silvestris* in Eastern and Northern Europe (BRAMANNIS 1975, HELIÖVAARA 1984). Unlike other *Aradus*-species, which are typically fungivorous, *A. cinnamomeus* is specialised in feeding on the living tissues of Scots pine (*Pinus silvestris*), but also occurs on other species of *Pinus* and occasionally on *Larix* sp. Nymphs and adults live under the bark scales of living pine saplings, where they insert their stylets into young tissues of the phloem and xylem surrounding the cambium (HELIÖVAARA & LAUREMA, 1988). The development of *A. cinnamomeus* shows a two-year pattern of periodicity in most parts of Europe, but they reproduce in a three-year cycle in northern Europe. Its role as a pest has been also studied rather extensively by PUTSHKOV (1974), who gives a number of references, and by TURČEK (1964) in Slovakia. The latter work also cites several further studies. We may refer to these for more detailed information. In Slovakia this species is abundant and a pest. It occurs in the lowlands as well as at medium altitudes, but is absent from high, cold areas. Found at altitudes of 109 to 800 m in the all warm and moderately warm climatic regions (with the exception of MT 7).

Aradus conspicuus (HERRICH-SCHAEFFER, 1835)

Literature. BRANCSIK (1880): Soblahov (12); HORVÁTH (1886): Slovenské Nové Mesto (20b); Sninský kameň Mt. (21); Snina (31c); SABRANSKY (1891): Bratislava, **Δ** Kamzík, under bark of beech stumps (8a); HORVÁTH (1897a): no concrete data; ORTVAY (1902): Bratislava, wide vicinity,–no concrete data (?); HOBERLANDT (1955): Inovec Mt., (9); Trenčín (12), Léšt (13f); Remetské Hámre (21); Oravský Podzámok (29); unidentified locality: Klišová.

Material examined

3 Plešivec, 220–600 m, 5.60 (G) 1 ♂.
5b Čajkov, 1 km N of the village, SE by the entrance to the Bukovská dolina Valley and vicinityof the Čajkovský potok Brook, 190–300 m, 1960 (Ko) 1 ♀.
6 Košice, 200–300 m, 6.62 (G) 1 ♀.
8a Smolenská Nová Ves, 220–300 m, 18.5.62 (K) 5 ♂ *7* ♀ 4 nymphs (5. instar).
14 Hnúšta, 300–340 m, 11.7.57 (Pč) 1 ♂.
16 Muráň, Muráň Mts. 550–1,000 m, 5.60 (G) 1 ♀.
18 Margecany, 300–400 m, 6.59 (G) 2 ♂.
21 Remetské Hámre, 250–500 m, 7.57 (G) 1 ♂ 2♀.

ES. Adults and nymphs hibernate. The species is predominately associated with deciduous trees such as *Fagus*, *Populus*, and *Quercus*, but is also found occasionally on coniferous trees. It feeds on polyporous fungi of the genera *Polyporus*, *Leptoporus*, *Fomes* and *Trametes* (syn. *Cariolus*) (GYLLENSVÄRD 1958, HEISS 1972, TAMANINI 1981). Hides under loose, dry bark of stumps or fallen trees, where it can be collected by removing the bark. This species is widely distributed in Slovakia but has been found both in lowlands and at high altitudes with cold climate. The bug occurs from altitudes of

190 m., on readily warmed substrates (intrusive rocks) up to 1,040 m. Found in the warm climatic regions T 3, 2, 1 and the moderately warm MT 10, 9, 8, 5, 1.

Aradus corticalis (Linnaeus, 1758)

Literature. Rumi (1807): Spišská Nová Ves (30a); Brancsik (1878): Trenčín, vicinity(12); Brancsik (1880) : Skala (28a); Horváth (1886): Hrušov (3); Mad (f. *annulicornis* Fabricius) (5a); Michalovce (also f. *annulicornis* Fabricius) (7); Somotor (f. *annulicornis* Fabricius) (7); Slovenské Nové Mesto (20b) (f. *annulicornis* Fabricius) (20b); Kežmarok (27a or 30b); Spišská Nová Ves (27b); Horváth (1897a): no concrete data; Sabransky (1891): Bratislava (?); Petricskó (1892): Banská Štiavnica, **Δ** Kalvaria, on the crossbars of a fence (13d); Ortvay (1902): Bratislava, wide vicinity, no concrete data (with f. *annulicornis* Fabricius) (?); Balthasar (1937a): Bratislava-Petržalka (5a); Malé Karpaty Mts. (8a); Modra (8a); Hoberlandt (1944): Trenčín (Čepelák) (12); Oravský Podzámok, 7. 35 (Hoberlandt) (f. *annulicornis* Fabricius) (29); Hoberlandt (1955): PiešŽany (f. *annulicornis* Fabricius) (5b); Košice (6); Kremnica (13b); Tatranské Matliare (27a).

Material examined .
24a Pribylina, Račkova dolina Valley, 1,000–1,400 m, 8.6.70 (Ro) 2 ♀; ditto, edges of streams, 10.6.70 (Ro) 1 ♀; Pribylina (→ Jakubovany), 780–820 m, 8.6.65 (Ro) 1 ♂.
27a Jamník, 720–750m, 6.60 (G) 2 ♂;Liptovský Hrádek, 650–720 m, 9.7.69 (P) 1 ♀.
30b Levočská Dolina, 600 m, 8.56 (G) 6 ♂ 3 ♀; ditto, 25.3.57 (G) 2 ♂ 1 ♀.

ES. Adults and nymphs hibernate. Develops on polyporous fungi such as *Fomitopsis pinicola* (Heliövaara & Väisänen, 1983), *Fomes marginatus* (Tamanini, 1956), primarily associated with pine trees (*Pinus*, *Picea*, *Abies*, *Larix*) but is also known to occur on *Quercus* and *Salix*. Is mostly found on or under bark of stubs in sunny clearings and prefers rather dry habitats. This species occurs in Slovakia from the lowlands to the High Tatra Mountains. Found at altitudes of 100 and 1,400 m in the all warm climatic regions, the moderately warm MT 11, 10, 9, 8, 6, 3, 1 and in the cold CH 7, 5.

Aradus depressus depressus (Fabricius, 1794)

Literature. Brancsik (1880): Soblahov (12); Horváth (1886): Modrý Kameň (13f); Cejkov (20b); Bardějov (31b or 31c); Snina (31c); Petrogalli (1887): Harmanec (22c); Sabransky (1891): Bratislava, under bark of pear-trees (?); Petricskó (1892): Banská Štiavnica, **Δ** Kalvaria, on the crossbars of a fence, 20.3.1888 (13d); Horváth (1897a): no concrete data; Balthasar (1937a): Bratislava-Petržalka (5a); Podunajské Biskupice (5a); Bernolákovo (5b); Malé Karpaty Mts. (8a); Bolešov (28a); Hoberlandt (1955): Nitra (5b); Trenčín (12); Lést (13f); Blatnica, Dědošova dolina Valley (22c); Oravský Podzámok (29); Országh (1966): Jur pri Bratislave, Jurský šúr (5a); Štepanovičová (1970,1973): Báb (5b); Štepanovičová & Lapková (1984): Podunajské Biskupice, Kopáč (5a).

Material examined
5b Nitra, vicinity, 180–200 m, 20.5.70 (Pt) 1 ♂.
12 Bojnice, orchards behind the Zoo, 320–400 m, 4.5.61 (Br) 1 ♀.
13d Sitno Mt. (Ilia), **Δ** 1,010, 13.6.60 (Kor) 1 ♂.
13f LéšŹ, military exercise grounds, 500–600 m, (Ko) 1 ♀.
21 Remetské Hámre, 250–500 m, 6.59 (G) 1 ♀; ditto, 7.63 (G) 1 ♀; ditto, 1.7.89 (Kul) 1 ♂.

22c Blatnica, Dědošova dolina Valley, 630–700 m, 20.–22.7.51 (St) 2 ♀.
31b Livovská Huta, Minčol Mt., pastures, 900–1,160 m, 20.6.65 (Po) 2 ♂ 2 ♀.
31c Medzilaborce, 330–400 m, 15.4.59 (K) 2 ♂ 2 ♀; ditto, 1.6.61 (K) 3 ♂ 2♀.

ES. As in presumably all *Aradus*-species, adults and nymphs hibernate. The most common of the European species feed on several polyporous fungi, such *Trametes versicolor*, *T. gibbosa*, *T. odorata*, *T. zonatus*, *Oxyporus populinus*, *Epuraca biguttata*. On *Betula*, *Populus*, *Acer*, *Alnus*, *Quercus*, *Fagus* and other deciduous trees. The developmental cycle and bionomy is covered by FÖRSTER (1953). The species occurs in Slovakia in the lowlands as well as at medium and higher altitudes. On readily warmed substrates (limestone, andesitee, etc.) it occurs up to rather high altitudes. Found between 130 and 1,160 m in the warm climatic regions T 5, 4, 3, 2, the moderately warm MT 10, 8, 6, 5, 1 and in the cold CH 5, 3.

Aradus distinctus FIEBER, 1861

Literature. HOBERLANDT (1955): Kováčovské kopce Hills (1); Štúrovo (5b): Košice (6); ŠTEPANOVIČOVÁ & LAPKOVÁ (1984) Podunajské Biskupice, Kopáč (5a).
Note. BALTHASAR (1937a) notes: According to HORVÁTH it is known only from Košice. No work has come to our notice in which HORVÁTH gave that locality.

Material examined
1 Kováčov, 120–150 m, 5.61 (G) 1 ♀ b.
5a Jur pri Bratislave, 130 m, 1960 (Lö) 1 ♂ m.
5b Čenkov, sand, on a path, 109 m, 17.6.58 (St) 3 ♀ b; ditto, 1959 (Lö) 1 ♀ b; ditto, 19.5.59 (St) 1 ♀ b; Marcelová, Bošovský kopec Hill, sand, **Δ** 140 m, 25.5.88 (St) 1 ♀ b; Štúrovo, 125 m, 15.5.56 (Pa) 1 ♀ m.

E. Adults hibernate, most probably also nymphs. Seems to be associated with *Populus nigra*, where it is found under the loose bark of stubs or under leaves, stones and detritus in sandy habitats at the base of living trees. Thermophilic species: found only in southern Slovakia. Occurs on readily warmed substrates (e.g. limestone, andesitee), but also on sandy sites, often found running on the ground here. Occurs at altitudes of 109 to 300 m the warm climatic regions T 5, 2.

Aradus erosus FALLÉN, 1807

Literature. PETRICSKÓ (1892): Banská Štiavnica, **Δ** Kysihýbel, 10. 6.1889 (13d); HOBERLANDT (1944): Oravský Podzámok, 7.35 (Hoberlandt) (29); HOBERLANDT (1955): Javorina (24a); Tatranské Matliare (27a).

WES. Adults and nymphs hibernate. This generally rare species has been found in N Tirol, Austria by the second author and in Bavaria by Seidenstücker (pers. comm.) only on stubs of *Picea* abies infested by *Gloeophyllum odoratum*, but it is also recorded from *Abies*. This species is generally limited to higher altitudes, in northern Slovakia also reported from medium altitudes. Found between 470 and 1,400 m in the moderately warm climatic regions MT 9, 1 and in the cold CH 4.

Aradus kuthyi Horváth 1899

Literature. Hoberlandt (1955): Kováčovské kopce Hills (1).

Material examined
1 Kováčov, andesitee slope, 120–150 m, 5.61 (G) 1 ♀.
13e Pstruša, 350–400 m, 14.6.60 (Kor) 1 ♀

PM? Phenology unknown: has been recorded to date from Albania, Austria, the Czech Republic, Hungary and Slovakia. This rare, probably endemic species has been found under the bark of *Quercus* sp. trunks. Rarely found, only in southern Slovakia at warmer places with andesitee substrate. It occurs at altitudes of 120 to 400 m in the warm climatic region T 5 and the moderately warm MT 8.

Aradus lugubris Fallén, 1807

Literature. Brancsik (1878, 1880): Trenčín, vicinity (12); Horváth (1897a): Bardějov (31b or 31c); Balthasar (1937a): Nízké Tatry Mts. (23); Bolešov (28a).

ES. Both phenology and bionomy are unknown. Widespread but rare in Europe. Reported from coniferous trees such as *Pinus*, *Picea* and *Juniperus*. In Scandinavia, the species occurs in burned forests. *A. lugubris* is also rare in Slovakia and the localities in which it was found are difficult to characterise. They range to an altitude of over 211 m., but cannot be specified for the record from the Nízké Tatry Mts. Recorded to date from the warm climatic region T 5 and the moderately warm MT 8.

Aradus mirus Bergroth, 1894

Literature. Hoberlandt (1944): Košice, 8.33 (Hoberlandt) 2 ♂ 3 ♀ (6); Trenčín (Čepelák) 1 ♀ (12).

End. Adults and nymphs most probably hibernate. Originally described from Austria, this species recorded only from the Czech Republic, Hungary and Slovakia. It was collected in Austria by beating branches of drying *Pinus nigra* and *Pinus sylvestris*. The ecology is still unknown. This species usually occurs on warm, stony slopes. Found to date at altitudes of 230 to 350 m in the warn climatic regions T 3 , 2.

Aradus obtectus Vásárhelyi, 1988

Literature. Vásárhelyi (1988): Zvolen – no concrete data 2 ♂ (13); Zvolen, 4.53 (Olexa) 1 ♂ (13); Kremnica, 5.55 (Olexa) 4 ♀ (13b); Dobroč, 30.9.73 (Nohel) 2 ♀ (14); Alpa kisky (rekte Kýšky, Vyšná Revúca), cca 900 m, 29.7.72 (Štys) 1 ♂ 3 ♀ (22c); Horný Harmanec, 2.8.72 (Štys) 2 ♀ (22c); Vrútky, 4.55 (Olexa) 1 ♂ (26).

Material examined
30b Levočská Dolina, 600 m, 8.56 (G) 2 ♂ 9 ♀ 1 nymph; ditto, 23. 3.57 (G) 7 ♀.

ES. In all probability, adults and nymphs hibernate, but no data are available. Closely related to *Aradus pictus* Baerensprung, 1859 from which is was not separated

before its description in 1988. Feeds on polypores, preferably on coniferous trees, but seems to occur on deciduous trees as well. To date, the species has been found only in central Slovakia. Reported sites have all been characterised by a readily warmed substrate (intrusive rocks, limestone). Found to date at altitudes of 300 to 900 m in the warm climatic region T 1 , the moderately warm MT 3 and in the cold. CH 5.

Aradus pallescens Herrich-Schaeffer, 1839

Literature. Hoberlandt (1944): Trenčín, 7. 36 (Čepelák) 3 ♂ m, 2 ♀ b (as *A. pallens* /sic!/ Herrich-Schaeffer) (12).

WES. In all probability, adults and nymphs hibernate, but no data are available. Literature reports it recorded from *Populus* and *Salix*, which might be only secondary. In Austria this species has been found under flat stones on the limestone gravel terraces of rivers, where *Salix* and *Populus* bushes were growing. The presence of *Helianthemum* sp. in that habitat leads to the assumption that *A. pallescens* is also associated with this plant, as is the closely related vicariant of higher mountains, *A. frigidus* Kiritshenko, 1913 (Tamanini 1955, Heiss 1983). Found at an altitude of 210 m in the warm climatic region T 2.

Aradus pictus Bärensprung; 1859

Literature. Brancsik (1880): Soblahov (12); Horváth (1897a): Lúčky pod Holicou (22d); Bardějov (as *A. varius* Fabricius) (31b or 31b); Hoberlandt (1944): Nízké Tatry Mts., VII. (Novický) (23).

NM(1). Adults and nymphs are presumed to hibernate, but no data are available. Feeds on polypores (e.g. *Fomes marginatus*) preferably on coniferous but probably also on deciduous trees. Confirmed records from Austria, Bulgaria, France, Greece, Italy and Romania, but those from the Czech Republic, Slovakia and Switzerland need verification, as most records of "*pictus*" from Middle- and Northern Europe belong to the closely related *A. obtectus* Vásárhelyi, 1988, which shares a similar habit.

Aradus ribauti E. Wagner, 1955

Material examined
5b Kamenín, 115 m, 15.5.80 (Kul) 1 ♂; Šulekovo, 156 m, 30.3.68 (Os) 1 ♀

WES. It can be assumed that adults and nymphs hibernate as do all members of the related "*betulae*"-group. The species was described from Southern France and is widespread in Southern Europe (Spain, France, Italy, Yugoslavia, Greece) but is also recorded from Austria, Hungary, Bulgaria as well as from Bielorussia, Ukraine, western and southern regions of Russia to Kazakhstan (European part). It is found on and under loose bark of *Populus*, sometimes associated with *Aradus betulae* (L.) and *Aradus krueperi* (Reut.). New record for Slovakia. Only known from the lowlands (115–156 m) of southern Slovakia in the warm climatic region T 5.

Aradus truncatus Fieber, 1861

Literature. Sabransky (1891): Bratislava, under bark of willows in the floodplain woods by the River Danube(5a); Hoberlandt (1944): Oravský Podzámok, 7.35 (Hoberlandt) (29).

E. In all probability, adults and nymphs hibernate, but not data are available. Has been collecteded under the bark of *Populus tremula* infested by *Phellinus igniarius* in Sweden (Coulianos, 1989) and in Finland, but is recorded from *Quercus* and *Acer* elsewhere. The ecology is unknown. Rarely found to date in Slovakia; at low to medium altitudes: from 130 to 550 m in the warm climatic region T 5 and the moderately warm MT 1.

Aradus versicolor Herrich-Schaeffer, 1839

Literature. Horváth (1886): Hrušov (3); Zemplinská Teplica (20a); Slovenské Nové Mesto (20b); Viničky (20b); Brancsik (1887): Soblahov (12); Sabransky (1891): Bratislava (?); Ortvay (1902): Bratislava, wide vicinity – no concrete data (?); Balthasar Kováčov (1); Hoberlandt (1944): Oravský Podzámok, 7.35 (Hoberlandt) (29); Hoberlandt (1955): Kováčovské kopce Hills (Burda) (1); Trenčín (12) ; LéšŽ (13f); Remetské Hámre (21); Štepanovičová (1967a): Ladscape in vicinity of Vihorlat Mts. (7).

Material examined

13f Ipel'ské Úl'any, 345–400 m, 31.5.80 (Do) 1 ♀.
21 Remetské Hámre, 250–500 m, 23.7.59 (Pa) 1 nymph (5. instar); ditto, 2.7.89 (Kul) 1 ♀.
30b Levočská Dolina, 600 m, 8.56 (G) 1 nymph (5. instar).
31c Medzilaborce 330–400 m, 1.6.61 (K) 1 nymph (5 instar).

NM. Adults and nymphs hibernate. Feeds on fungi such as *Trametes versicolor*, *T. gibbosa*, *Stereum hirsutum* and *Polyporus* species on deciduous trees, predominantly associated with *Fagus*, *Quercus* and *Populus*. The species is widely distributed in Slovakia. Its optimum range is in mountain regions (mostly with readily warmed substrates), but it is absent from the high mountain ranges (e.g. High and Low Tatras). Found at an altitude of 94 to 600 m in the warm climatic regions T 5, 3, 1 and the moderately warm MT 10, 8, 1.

Aneurinae

Aneurus (*Aneurodes*) *avenius avenius* (Dufour, 1833)

Literature. Hoberlandt (1944): Trenčín, 6.36 (Čepelák); Štepanovičová (1967a): Landscape in vicinity of Vihorlat Mts. (7); Štys (1974): Bratislava (?); Štúrovo (5b); Štúrovo, Modrý vŕšok Hill (5b); Kováčovské kopce Hills (1); Kečovo, Domica (3); Rožnava (14); Zádiel (3); Vihorlat Mts. (21); Remetské Hámre (21).

Material examined

3 Kečovo, Domica Cave, vicinity, limestone slope, 350–450 m, 8.5.50 (St) 1 ♂ 1 ♀; ditto, 5.60 (G) 1 ♂; Plešivec, Plešivecká planina Plateau, 250–700 m, 1.6.84 (St) 1 ♀.

5b Čenkov, sand, 109 m, 22.5.58 (St) 1 ♀; Štúrovo, 125 m, 5.57 (G) 1 ♀; ditto, Modrý vŕšok Hill, 150–230 m, 27.5.61 (Ko) 1 ♂ 1 ♀.
18 Margecany, 300–400 m, 6.59 (G) 1 ♀; ditto, 6.60 (G) 1 ♂.
21 Remetské Hámre, 250–500 m, 25.7.59 (Pa) 1 ♀.

ES. Adults, eggs (VOIGT, *pers. comm.*) and, in all probability, also nymphs hibernate. This widespread species is found under the thin, loose bark of logs and branches lying on the ground, predominantly of deciduous trees such as *Fagus*, *Quercus*, *Carpinus*, *Tilia*, *Betula* and *Alnus*, but it is also recorded from *Larix*. It is not rare in Slovakia but its range is confined to the southern part of the country. It occurs in the lowlands but lives mainly in mountainous areas, usually where there are readily warmed substrates. Found at altitudes of 109 to 700 m in the warm climatic regions T 5, 3, 2, 1 and the moderately warm MT 8, 6.

Aneurus (*Aneurus*) *laevis laevis* (FABRICIUS, 1775)

Literature. BRANCSIK (1878, 1880): Trenčín, vicinity(12); SABRANSKY (1891): Bratislava (?); ORTVAY (1902): Bratislava, wide vicinity – no concrete data (?); BALTHASAR (1937a): Plešivec (3); HOBERLANDT (1944): Inovec Mts. 6.36 (Čepelák) (9); Trenčín, 6.36 (Čepelák) (12); ŠTYS (1974): Hajnačka (2c); Rožnava (14); DOBŠÍK (1988): Plešivecká planina Plateau (3).

Material examined
3 Zádiel, limestone, 250–700 m, 5.60 (G) 2 ♀.
5a Jur pri Bratislave, Jurský šúr, 130 m, 25.2.43 (Kor) 1 ♀.
6 Košice, 200–300 m, 6.62 (G) 1 ♀.
13f Modrý Kameň, Kalvaria Mt., **Δ** 494, 350–490 m, 27.5.89 (St) 1 ♀.
18 Margecany, 300–400 m, 6.59 (G) 6 ♂ 5 ♀.
21 Remetské Hámre (→ Vyšná Rybnica), by Rybnica Brook, 250–320 m, 4.7.74 (L) 13 ♂ 22 ♀ 2 nymphs (5. instar).

WES. Adults (VOIGT 1977) and, in all probability, also nymphs hibernate. This species is recorded from the same trees and habitats as *A. avenius* but seems to prefer a warmer climate. It has been found associated with polyporous fungi such *Trametes versicolor*, *Stereum hirsutum*, *Corticium* sp. and *Polyporus* sp. Found at altitudes of 130 to 1,040 m in the warm climatic regions T 3, 2, 1 and the moderately warm MT 8, 5, 1.

Mezirinae

Mezira tremulae (GERMAR, 1822)

Literature. BRANCSIK (1878, 1880): Trenčín, vicinity (12); CHYSER (1885): Sninský kameň Mt., 4.11.1884 (Chyser leg., det. Horváth) (21); HORVÁTH (1897a): Bratislava (?).

Material examined
4b Malacky, 165–195 m, 6.7.68 (Hl) 1 ♂.
8a Horné Orešany, 211–356 m, 1960 (Lö) 1 ♀.
21 Remetské Hámre, 250–500 m, 7.56 (G) 1 ♀; ditto, 7.73 (G) 1 ♀.

ES. In all probability, adults and nymphs hibernate. This rare species is found in fissures or under the loose bark of older stubs and trunks of deciduous trees infested by fungi, but also of *Abies*. Recorded only from southern Slovakia. Occurs in the lowlands but also mountainous areas with volcanic or limestone substrate. This interesting species has been found at altitudes of 211 to 1,000 m in the warm climatic regions T 5, 4, 2, 1 and the moderately warm MT 1.

PYRRHOCORIDAE

Pyrrhocoris apterus (Linnaeus, 1758)

Literature. Horváth (1870): Turna n. Bodvou (3), Drienovec (6), Jovice (3 or 14); Mocsáry (1875): Parchovany (7); Brancsik (1878): Trenčín (12); Fritsch (1880): Bratislava (?), Košice (6), Rožnava (14), Banská Bystrica (15); Petrogalli (1887): Harmanec (22c); Sabransky (1891): Bratislava (?); Petricskó (1892): Banská Štiavnica (13d); Malasevicz (1892): Lučenec, wide vicinity (2b); Horváth (1897a): no concrete data; Ortvay (1902): Bratislava, wide vicinity (?); Lörincz (1906): Košice (6); Balthasar (1937a): no concrete data; Országh (1966): Jur pri Bratislave (5a); Štepanovičová (1967b): Štúrovo (5b); Štepanovičová (1970, 1973, 1978): Báb (5b); Dobšík (1979): Hlohovec (→ Pastuchov) (9); Štepanovičová & Lapková (1984): Podunajské Biskupice (5a); Dobšík (1988): Plešivecká planina Plateau (3).

Material examined
1 Burda Hills (Kováčovské kopce Hills).
2b Ožďany (→ Tomášovce).
3 Zádiel.
4b Borský Mikuláš, Jakubov, Mikulášov, Sekule, Závod.
5a Zlatná na Ostrove.
5b Čenkov, Chotín, Gbelce, Levice, Mudroňovo, Nitra, Šurany, Vel'ké Zálužie.
7 Somotor.
8a Kuchyňa (Modranská skala Rock).
10 Nitra (Zobor Mt.).
13f LešŹ, Modrý Kameň.
20b Viničky.
27b Spišské Podhradie.
31c Sedliská (Podčičva colony).

WP. Post-hibernation adults emerge on sunny days as early as March and start mating immediately. This continues throughout the following months and so development is considerably prolonged.. The adults coming from early clutches probably mate and create an incomplete second generation (at least in warmer regions). Adults,

together with some nymphs of higher instars, can be observed in late autumn. Although the species tends towards Tiliaceae and Malvaceae, it is widely polyphagous and has a distinct preference for various kinds of seeds (for more details see STEHLÍK & HEISS, 2000). It is also necrophagous and a cannibal. It moves on the ground and in walls, often in in great masses. It is mainly brachypterous, and sometimes pterygopolymorphism can be observed in this species. It is widely distributed in the warm regions of Slovakia (thus records were not cited above for all localities). In the north, it has penetrated as far as the Zvolenská and Hornádská kotlina Basins and the Velká Fatra Mts. In northern regions, its occurrence is confined to limestone. It lives in various ecosystems, e.g. dunes, salt meadows and steppes, also in localities with rocky substrate, especially (limestone, andesitee), and often occurs in ruderal sites. It has been found at altitudes from 94 m on limestone to as high as at 600 m. It is distributed in all warm climatic regions; it has been found in the moderately warm climatic regions MT 9, 8, 6, 5, 3 and the cold CH 5.

Pyrrhocoris marginatus (KOLENATI, 1845)

Literature. SABRANSKY (1891): Bratislava-Petržalka (5a); HORVÁTH (1897a): no concrete data; LÖRINCZ (1900): Beckov (9); BALTHASAR (1937a): Kováčov (1), Bernolákovo (5b), Devín (8a); Dobšík (1979): Hlohovec (→Pastuchov), Sedlisko, Soroš (9); DOBŠÍK (1988): Plešivecká planina Plateau (3).

Material examined

1 Burda Hills: Kováčov, andesitee slope, 120–150 m, 6.8.47 (Do) 1 ♂ b; ditto, 10.8.65 (Pč) 1 ♀ b.

2a Ipel'ské Predmostie, 140–160 m, 7.5.50 (St) 1 ♀ b.

2b Ožďany, pasture with xerothermophilous vegetation near serpentines, 310–317 m, 27.8.90 (St) 1 ♂ b 1 ♀ b 5 nymphs (5. instar).

2c Gemerský Jablonec, xerothermophilous vegetation on slopes N of the village, 250–400 m, 26.6.91 (St) 1 ♀ b.

3 Jablonov n. Turnou, limestone slopes, 330–700 m, 9.7.56 (Pč) 1 ♀ b; Plešivec, no concrete data, 211–222 m, 31.5.80 (Do) 1 ♀ b; ditto, Koniar, 430 m, 3.7.82 (Do) 1 ♀ b; ditto, 25.9.82 (Do) 1 ♂ b 1 ♀ b; ditto, 1.9.83 (Do) 1 ♀ b; Zádiel, limestone, 250–750 m, 17.7.62 (Ko) 1 ♀ b.

4b Jakubov, sand by Gamekeeper's lodge, 150 m, 18.10.68 (Po) 1 ♂ b; Malacky, sand, 165–195 m, 25.7.54 (Pa) 1 ♂ m; ditto, 30.7.70 (Hl) 1 ♀ b; ditto, Tretí rybník Pond, sand, borders of the grassy patches along the path to Druhý rybník Pond, 185 m, 9.10.68 (Po) 1 ♂ b; ditto, sand in the vicinityof the Štvrtý rybník Pond, 184 m, 9.10.68 (Po) 1 ♂ b; Sekule, Pláňava, 170 m, sand in the abandoned vineyards, 170 m, 20.9.68 (Po) 4 ♂ b; ditto, 24.9.68 (St, Po) 3 ♂ b 4 ♀ b; Vel'ké Leváre, Abrod (Mokré lúky Meadows), 150–155 m, 5.7.75 (Do) 3 ♂ b; Závod, sand, 160–166 m, 30.5.68 (St) 1 ♀ b; ditto, Hlboká mlaka, sand by railway line, 160–165 m, 31.10.68 (St)1 ♀ b; ditto, abandoned sand-pit, 158 m, 20 . 8 . 70 (Pč) 5 ♂ b 4 ♀ b .

5b Čajkov, 1 km N of the village, SE by the entrance to the Bukovská dolina Valley and vicinity of the Čajkovský potok Brook, 190–300 m, 7.60 (Ko) 1 ♂ b 1 ♀ b; ditto, 8.60 (Ko) 1 ♀ b; ditto, 1.7.61 (Ko) 1 ♂ b; ditto, 9.7.61 (Ko) 1 ♂ b; ditto, 6.8.61 (Ko) 1 ♀ b;

Čenkov, sand, 109 m, 17.7.51 (St) l ♀ b; ditto, 17. 7.53 (L) 1 ♀ b; ditto, 15.4.58 (St) 2 ♂ b 2 ♀ b; ditto, 21.5.58 (St) l ♀ b; ditto, 15.7.58 (St, Pd) 2 ♂ b 2 ♀ b; ditto, 16.7.58 (St) 1 ♂ b 2 ♀ b; ditto, 29.7.58 (St, T) 2 ♂ b l ♀ b; ditto, 7.68 (Ma) 1 ♂ 1 ♀ b; Marcelová, Bošovský kopec Hill, foot, sand, 120 m, 5.9. 89 (St) 5 ♂ b 6 ♀ b 3 nymphs (5. instar); ditto, 24.4.90 (St) 6 ♂ b 7 ♀ b; ditto, 25.4.90 (St) 4 ♂ b 2 ♀ b; Nána, **Δ** 231, 23.8.66 (St) 1 ♀ b; Radvaň n. D., Virt colony, Mašan, sand dune, 131 m, 24.4.90 (Vř) 1 ♂ b; Štúrovo, 125 m, 8.9.55 (Pal) 1 ♀ b.

7 Somotor, sand, 100 m, 7.59 (Ko) 1 ♀ b; ditto, 7.61 (Ko) 1 ♂ b.

8a Hradište pod Vrátnom, limestone slopes, 250–400 m, 28.5.50 (St) 1 ♀ b; Smolenice, 242–280 m, 11.5.63 (K) 1 ♀ b.

12 Trenčianská Teplá, E border of the town, vicinity of the stone pit, 250–300 m, 30.6.68 (L) 1 ♀ b.

13f Rykynčice, Pírovský vrch Hill, conglomerate slope, 280–300 m, 21.6.91 (St) 1 ♀ b.

20b Viničky, Babo, 94–200 m, 13.7.59 (Ko) 1 ♂ b 4 ♀ b.

21 Vihorlat Mts., no concrete data, 7.67 (Ma) 2 ♀ b.

28a Trenčianské Bohuslavice, Turecký vrch Hill, xerothermophilous vegetation on limestone slope, 230–300 m, 28.6.68 (Do) 3 ♀ b.

HM (l) + CA. Post-hibernation adults range free from early spring. Development is extended, and teneral adults have been observed from the last third of June, in July, in August, and to the last third of September. Some adults have even been observed ranging free nature as late as the end of October. The species occurs in warm localities, especially on dunes, but also in places with rocky substrate (1imestone, conglomerate, and andesite). It is often found under *Echium* (Boraginaceae). Most specimens are brachypterous; macropterous specimens are rare. The occurrence of this species is confined to the southern warm part of Slovakia, along the catchment area of the Váh River (here mostly on limestone cliffs). It penetrates northwards as far as Strážovská vrchovina Highlands. In Slovakia the species was found at an altitude of 94 m. On limestone it reaches approximately 700 m. It has been found in all warm climatic regions and the moderately warm MT 10, 8, 6.

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