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The bug fauna (Heteroptera) of agricultural grasslands in the Schaffhauser Randen (SH) and Rottal (LU), Switzerland, with updated checklists of Heteroptera of the Cantons Luzern and Schaffhausen

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We investigated 45 meadows of three different management types in the Schaffhauser Randen (Canton Schaffhausen) and 31 extensively managed meadows in Rottal (Canton Luzern). We recorded 140 species of bugs in the Canton Schaffhausen and 78 in the Canton Luzern. Based on the literature and our own findings we give species-lists for the Cantons of Schaffhausen and Luzern. From the Canton Schaffhausen 207 bug species are known and 201 from the Canton Luzern. The biogeography of some species of special interest is discussed in detail. Three species from the Schaffhauser Randen are new records for Switzerland: *Physatocheila harwoodi* CHINA, 1936, *Polymerus microphthalmus* (WAGNER, 1951) and *Strongylocoris steganoides* (J. SAHLBERG, 1875). The previous records of the latter should be revised.

Keywords: grassland, Heteroptera, Canton Luzern, Canton Schaffhausen, Switzerland

INTRODUCTION

True bugs (Heteroptera) are an ecologically very diverse group, including phytophagous, saprophagous and predatory species (DOLLING, 1991). Furthermore, some species are generalists while others are specialists. The larval stages and adult individuals live in the same habitat and respond sensitively to environmental changes (MORRIS, 1969, 1979; ACHTZIGER, 1995; OTTO, 1996). Some families, especially the Miridae, are very susceptible to chemical sprays used in agricultural production and may therefore be good indicators of ecological change (FAUVEL, 1999). Previous studies have shown that the richness of the bug fauna correlates strongly with total insect diversity (DUELLI & OBRIST, 1998). These properties and the fact that, despite their diversity, they are a manageable group in terms of numbers of species, make the heteropteran bugs an attractive insect group for ecological studies in agricultural systems. Unfortunately, little is known about the distribution and biology of these insects and only few studies are concerned with the complete heteropteran fauna of individual habitats or regions (FAUVEL, 1999). In Switzerland, the number of publications concerning Heteroptera is less than half the corresponding number for Baden-Württemberg in Germany (OTTO, 1994; RIEGER, 1996). According to the literature, 758 species of Heteroptera are known in Switzerland (OTTO, pers. comm., 1997) and 724 in Baden-Württemberg, Germany (RIEGER, 1996).

The aim of this paper is to contribute to the knowledge of the true bugs of Switzerland, with a focus on the regions of Schaffhausen and Rottal (Luzern). The

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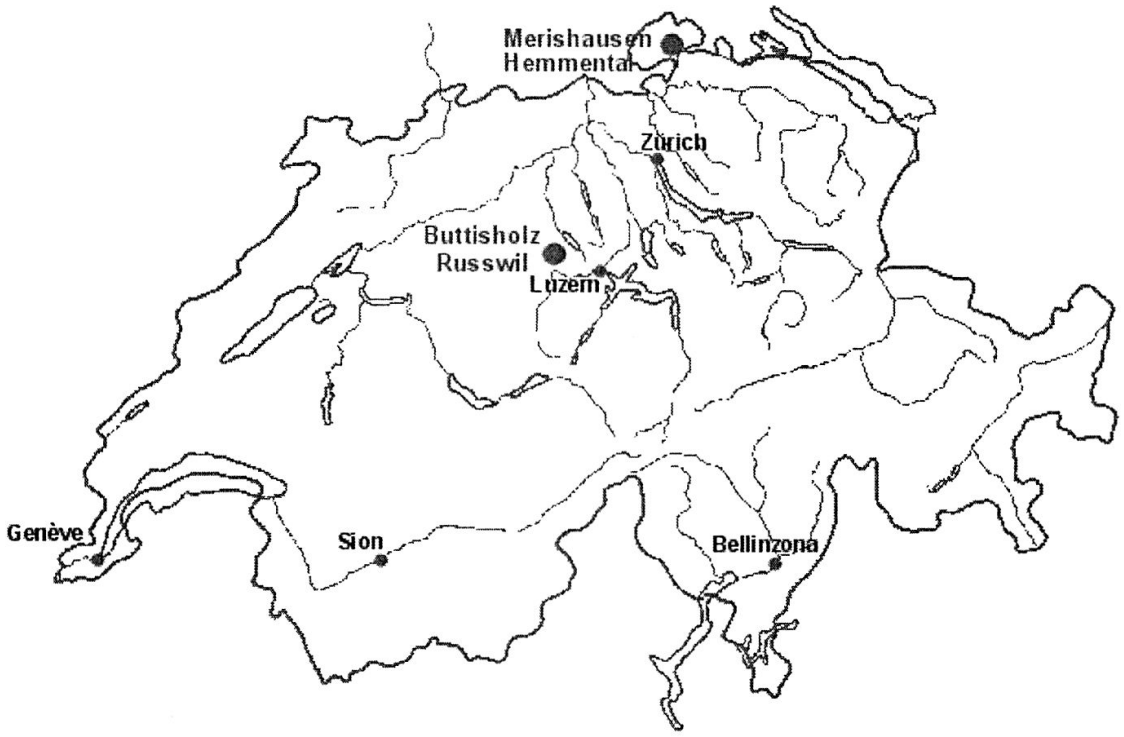

Fig. 1. The research areas are located in the North of Switzerland (Canton Schaffhausen) and the Central part of Switzerland (Canton Luzern).

faunistic records presented here come from various studies at the Federal Research Station for Agriculture and Agroecology Zürich-Reckenholz about the influence of management techniques on biodiversity in rural landscapes (financial support by the Swiss National Science Foundation is acknowledged). The ecological results will be presented in separate papers (DI GIULIO, in prep.; SCHWAB, in prep.).

MATERIAL AND METHODS

One research area is located in the Schaffhauser Randen (Canton Schaffhausen, Tab. 1 and Fig. 1) and is part of the Swiss Jura. The soils are nutrient-poor limestone. The average yearly precipitation in Schaffhausen (437 m a.s.l.) is 866 mm, the highest rainfall occurring in summer and the lowest in late winter. The average mean annual temperature is 7.8 °C, with maximum in July (23.2 °C) and minimum in January (-3.9 °C) (SMA, 1998). From 1997 to 1999, we investigated 45 meadows of three grassland management types (medium intensive, moderately intensive and extensive) in four different locations of the Schaffhauser Randen (Tab. 1 and Fig. 1). In all four locations all three grassland types were investigated. The medium intensive meadows are regularly fertilized with slurry and cut 2–3 times per year. The vegetation is dominated by *Arrhenatherum elatius* and *Trisetum flavescens*. The moderately intensive meadows are fertilized occasionally with manure and cut twice a year. No single plant species is dominant but *Trifolium pratense* and *Trisetum flavescens* reach the highest mean cover values. The extensive meadows are not fertilized and are cut once or twice a year. The community is dominated by *Bromus erectus* (STUDER, unpublished data). All sites were sampled during at least one summer by sweep-netting, but frequency and number of sweeps per site varied. Besides, 10 meadows were sampled with a suction sampler of the type «Vortis» (ARNOLD, 1994) and 18 with Barber pitfall traps (CURTIS, 1980).

Tab. 1. The five investigated areas situated in the Canton Schaffhausen and Canton Luzern.

Area	Altitude (m asl)	Municipality	Swiss Coordinates	Geographical Coordinates
Zelgli/Mösli (SH)	800	Hemmental	683'500/ 289'000	8° 34'E / 47° 45' N
Hinterranden (SH)	830	Hemmental Siblingen	683'000/ 287'500	8° 34'E / 47° 44' N
Klosterfeld (SH)	670	Hemmental	687'000/ 288'000	8° 36'E / 47° 44' N
Merishausen (SH)	780-830	Merishausen	683'000/ 291'500- 687'500/ 293'000	8° 36'E / 46° 44' N
Rottal heights (LU)	750-830	Ruswil Buttisholz	650'000/ 220'000	8° 08'E / 47° 07' N

The other study sites are located in the eastern hills of Rottal (Canton Luzern, Tab. 1 and Fig. 1). The area is composed of hilly molasse and a few moraines. The soils tend to be wet and various forms of gleyic brown soils (gleyic camisoles) can be found. The average annual precipitation in Luzern (456 m a.s.l) is 1154 mm, with highest rainfall in summer and lowest in late winter. The mean annual temperature is 8.3 °C, with the maximum mean monthly temperature in July (17.4 °C) and the minimum in January (-0.7 °C) (SMA, 1998). The whole area is used very intensively for agriculture. During 1999, 31 extensively managed meadows were investigated in an area of approximately 8 km^2 in the communities of Ruswil and Buttisholz. The vegetation is very heterogeneous, in some sites dominated by grass and in others by forbs. Overall, *Trifolium repens*, *Poa trivialis* and *Ranunculus repens* are the most abundant plants, all of them typical of intensively used meadows which are heavily fertilized and cut early and frequently. Also common are *Lolium multiflorum* and *Dactylis glomerata*, both of them characteristic species of intensive management and wet soils. All sites were sampled monthly from May to August with a standardized sweep net method and with Barber pitfall traps during 10 weeks.

If not specified in the text, the keys of WAGNER (1952, 1966, 1967, 1971, 1973, 1975) and PÉRICART (1972, 1990) were used for the determination of species. R. HECKMANN discussed the faunistic records. A reference collection of the species is located in the entomological collection of the Swiss Federal Institute of Technology (ETHZ).

RESULTS

In total, 167 species have been recorded in both regions, which amounts to 22 % of the 758 (OTTO, pers. comm.) known species of Switzerland. Most species were collected with a sweep net (156) and only 11 species were caught only in pitfall traps or suction samplers (Tab. 2). As there is no Red List of endangered species for Switzerland, those of Baden-Württemberg (RIEGER, 1986), Bayern (ACHTZIGER *et al.*, 1992) and Germany (GÜNTHER *et al.*, 1998) were taken as a basis for assessing the conservation values of the investigated sites (Tab. 2). In the Schaffhauser Randen, we recorded 140 species (12'080 specimens). 29 species (21 %) are listed in the Red Lists for Germany. In Rottal, 78 bug species (1'129 specimens)

Tab. 2. Species list of the investigated meadows in the Schaffhauser Randen (Canton Schaffhausen) and the Rottal heights (Canton Luzern).
Columns: M: Merishausen, H: Hinterranden, K: Klosterfeld, Z: Zelgli. SH and LU.: Total number of individuals recorded in the two Cantons. Met.: Sampling method used; n: Sweep net, s: Suction sampler, p: Pit fall traps. R.L.: 1: Baden-Württemberg (D), 2: Bayern (D), 3: Germany. "*": Species specialized on plants not normally occurring in meadows (trees, shrubs, ferns) and which probably have been drifted by the wind. The nomenclature of the species list from Ceratocombidae to Miridae (excluding the arrangement in the subfamily Mirinae) follows the Catalogue of the Heteroptera of the Palaearctic Region (AUKEMA & RIEGER, 1995, 1996, 1999). The subfamily Mirinae (changed names adapted from the above catalogue) of Miridae and the Pentatomorpha follow the Verzeichnis der Wanzen Mitteleuropas (GÜNTHER & SCHUSTER, 1990).

SPECIES	M	H	K	Z	SH	LU	Met.	R.L.
CERATOCOMBIDAE								
Ceratocombus coleoptratus (Zetterstedt, 1819)	+				6		s	2
SALDIDAE								
Saldula c-album (Fieber, 1859)						3	p	1
Saldula orthochila (Fieber, 1859)	+				1		n	
Saldula saltatoria (Linnaeus, 1758)	+	+			2	11	n/p	
TINGIDAE								
Acalypta carinata (Panzer, 1806)	+				4	1	p	1,2
Acalypta marginata (Wolff, 1804)	+		+		90	3	n/p	2
Campylosteira verna (Fallén, 1826)	+	+			18		n/s/p	2,3
Catoplatus fabricii (Stål, 1868)	+	+	+		71		n/p	2,3
Kalama tricornis (Schrank, 1801)	+	+	+	+	22	9	n/s/p	2
**Physatocheila harwoodi* China, 1936				+	1		n	2,3
Tingis reticulata Herrich-Schäffer, 1835						5	n/p	
NABIDAE								
Himacerus major (A. Costa, 1842)						1	p	2
Himacerus mirmicoides (O. Costa, 1834)	+		+		7	20	n/p	
**Himacerus apterus* (Fabricius, 1798)						3	n	
Nabis flavomarginatus (Scholtz, 1847)				+	3		n	
Nabis brevis brevis Scholtz, 1847	+		+		34	4	n/p	
Nabis ferus (Linnaeus, 1758)	+	+	+	+	5	18	n/p	
Nabis pseudoferus pseudoferus Remane, 1949	+	+	+	+	131	2	n/s/p	
Nabis punctatus punctatus A. Costa, 1847	+	+	+		18		n	1,2
Nabis rugosus (Linnaeus, 1758)	+		+	+	10	11	n/s/p	
ANTHOCORIDAE								
**Acompocoris alpinus* Reuter, 1875	+				1	1	n	2
Anthocoris nemorum (Linnaeus, 1761)	+			+	2	40	n	
**Temnostethus pusillus* (Herrich-Schäffer, 1835)	+				1	1	p	
Orius majusculus (Reuter, 1879)			+		2	9	n	
Orius minutus (Linnaeus, 1758)	+			+	3	6	n	

SPECIES	M	H	K	Z	SH	LU	Met.	R.L.
MIRIDAE								
**Bryocoris pteridis* (Fallén, 1807)						1	n	
Campyloneura virgula (Herrich-Schäffer, 1835)			+		1	1	n	
Dicyphus annulatus (Wolff, 1804)			+		10		n	
Dicyphus globulifer (Fallén, 1829)	+				2		n	
Dicyphus errans (Wolff, 1804)						1	n	
**Dicyphus pallidus* (Herrich-Schäffer, 1836)						6	n/p	
**Dicyphus stachydis stachydis* J. Sahlberg, 1878						1	n	
Deraeocoris morio (Boheman, 1852)	+		+		9		n	1,2,3
Deraeocoris ruber (Linnaeus, 1758)	+			+	2	10	n	
Pithanus maerkelii (Herrich-Schäffer, 1838)						15	n/p	
Leptopterna dolobrata (Linnaeus, 1758)	+	+	+	+	4152		n/p	
Stenodema calcarata (Fallén, 1807)						40	n	
Stenodema holsata (Fabricius, 1787)	+			+	7	78	n/p	
Stenodema laevigata (Linnaeus, 1758)	+	+	+	+	164	8	n/pi	
Stenodema virens (Linnaeus, 1767)						3	n	
Megaloceraea recticornis (Geoffroy, 1785)	+	+		+	222		n/p	
Notostira elongata (Geoffroy, 1785)	+				1	1	n	
Notostira erratica (Linnaeus, 1758)	+	+	+	+	1065	177	n/s/p	
Trigonotylus caelestialium (Kirkaldy, 1902)	+	+	+	+	157	1	n/s	
Phytocoris longipennis Flor, 1860	+				1		n	
Adelphocoris lineolatus (Goeze, 1778)	+	+	+		473	4	n	
Adelphocoris seticornis (Fabricius, 1775)	+	+	+	+	696		n/p	
Brachycoleus pilicornis pilicornis (Panzer, 1805)				+	1		n	2,3
Calocoris affinis (Herrich-Schäffer, 1835)	+				2	3	n	
**Calocoris alpestris* (Meyer-Dür, 1843)						8	n	2
Closterotmus biclavatus (Herrich-Schäffer, 1835)	+				1		n	
Closterotomus norvegicus (Gmelin, 1790)	+		+		12	322	n/p	
**Grypocoris sexguttatus* (Fabricius, 1777)	+				1		n	2
**Rhabdomiris striatellus striatellus* (Fabricius, 1794)						1	n	
Hadrodemus m-flavum (Goeze, 1778)	+	+	+	+	239		n	
Stenotus binotatus (Fabricius, 1794)	+				1	1	n	
**Dichrooscytus intermedius* Reuter, 1885	+			+	2		n	
Apolygus lucorum (Meyer-Dür, 1843)			+		1		n	
Apolygus spinolae (Meyer-Dür, 1841)			+		2		n	
Lygocoris pabulinus (Linnaeus, 1761)	+				4	35	n	
**Lygocoris viridis* (Fallén, 1807)						3	n	
Lygus pratensis (Linnaeus, 1758)	+	+	+	+	677	1	n/s	
Lygus rugulipennis Poppius, 1911	+	+	+	+	371	161	n/s/p	
Lygus wagneri Remane, 1955	+			+	4		n	
Orthops basalis (A. Costa, 1853)	+	+	+		6	4	n	
Orthops campestris (Linnaeus, 1758)	+				1	2	n	
Orthops kalmii (Linnaeus, 1758)	+	+			10		n	
**Pinalitus atomarius* (Meyer-Dür, 1843)						1	n	1,3
**Pinalitus visicola* (Puton, 1888)						1	n	1,2
Charagochilus gyllenhalii (Fallén 1807)	+		+	+	19	1	n/s/p	
Polymerus nigrita (Fallén, 1829)	+		+	+	13		n	

SPECIES	M	H	K	Z	SH	LU	Met.	R.L.
Polymerus microphtalmus (Wagner, 1951)	+				1		n	
Polymerus unifasciatus (Fabricius, 1794)	+	+	+	+	745	2	n/s/p	
Capsodes gothicus gothicus (Linnaeus, 1758)				+	2		n	
Capsus ater (Linnaeus, 1758)	+	+	+	+	11		n	
Halticus apterus apterus (Linnaeus, 1758)	+		+	+	44	1	n/s	
Orthocephalus coriaceus (Fabricius, 1777)	+				2	3	n	
Orthocephalus saltator (Hahn, 1835)			+		3		n	
Strongylocoris steganoides (J. Sahlberg, 1875)	+		+	+	39		n/p	
**Blepharidopterus angulatus* (Fallén, 1807)						1	n	
Globiceps flavomaculatus (Fabricius, 1794)	+				2	2	n	
Globiceps fulvicollis Jakovlev, 1877	+		+		23		n/p	
**Heterocordylus tumidicornis* (Herrich-Schäffer, 1835)			+		1		n	
Heterotoma planicornis (Pallas, 1772)						1	n	
**Malacocoris chlorizans* (Panzer, 1794)	+				1		n	
**Cremnocephalus alpestris* Wagner, 1941						1	n	
Hallodapus rufescens (Burmeister, 1835)	+				2		n	1,2,3
Ambylytus nasutus (Kirschbaum, 1856)	+				2	2	n	
**Atractotomus magnicornis* (Fallén, 1807)	+			+	1	8	n	
**Atractotomus parvulus* Reuter, 1878	+				3		n	
Campylomma verbasci (Meyer-Dür, 1843)	+				1		n	
Chlamydatus pulicarius (Fallén, 1807)	+	+	+	+	215	1	n/s/p	
Chlamydatus pullus (Reuter, 1870)		+	+		2		n	
Criocoris crassicornis (Hahn, 1834)				+	1		n	
**Harpocera thoracica* (Fallén, 1807)						2	n	
Macrotylus herrichi (Reuter, 1873)	+	+		+	11		n	2
Megalocoleus molliculus (Fallén, 1807)	+			+	2	1	n	
**Phoenicocoris obscurellus* (Fallén, 1829)	+				1		n	
Plagiognathus arbustorum arbustorum (Fabricius, 1794)	+		+		4	10	n/p	
Plagiognathus chrysanthemi (Wolff, 1804)	+	+	+	+	1274		n/p	
**Plesiodema pinetella* (Zetterstedt, 1828)	+				1		n	
**Psallus perrisi* (Mulsant & Rey, 1852)						3	n	
**Psallus piceae* Reuter, 1878						2	n	
Psallus haematodes (Gmelin, 1790)						3	n	
**Psallus varians varians* (Herrich-Schäffer, 1841)						4	n	
ARADIDAE								
**Aradus cinnamomeus* (Panzer, 1794)	+				4	2	p	
PIESMATIDAE								
Piesma maculatum (Laporte, 1832)	+			+	2		n	
BERYTIDAE								
Berytinus clavipes (Fabricius, 1775)	+		+		10		n/p	
Berytinus minor (Herrich-Schäffer, 1835)	+	+	+	+	43	9	n/s/p	
Berytinus crassipes (Herrich-Schäffer, 1835)				+	1		n	2
Berytinus montivagus (Meyer-Dür, 1841)	+	+	+		16		n/p	1,2
Berytinus signoreti (Fieber, 1859)			+		1		n	2
Gampsocoris punctipes (Germar,1822)			+		1		n	

SPECIES	M	H	K	Z	SH	LU	Met.	R.L.
LYGAEIDAE								
Nysius ericae (Schilling, 1829)			+		1	2	n	
**Kleidocerys resedae* (Panzer, 1797)						1	n	
Cymus melanocephalus Fieber, 1861						1	n	
Ischnodemus sabuleti (Fallén, 1829)		+			2		n	2
Platyplax salviae (Schilling, 1829)	+		+		19		n	
Plinthisus brevipennis (Latreille, 1807)	+		+		14		n/p	
Tropistethus holosericeus (Scholtz, 1845)	+		+		3		n	
Drymus latus Douglas & Scott, 1871	+				2		p	1,2,3
Drymus ryeii Douglas & Scott, 1865	+				2		n/s	
Drymus sylvaticus (Fabricius, 1775)	+				8		n/p	
**Gastrodes abietum* Bergroth, 1914	+				1	2	n	
Scolopostethus affinis (Schilling, 1829)	+				1		p	
Scolopostethus thomsoni Reuter, 1874	+				1	1	n	
Stygnocoris rusticus (Fallén, 1807)	+				2		s/p	
Stygnocoris sabulosus (Schilling, 1829)	+				2		s	
Graptopeltus lynceus (Fabricius, 1775)	+	+			53		n/p	
Rhyparochromus pini (Linnaeus, 1758)	+				46		p	
Peritrechus gracilicornis Puton, 1877	+	+	+	+	57		n/p	1,2
Megalonotus chiragra chiragra (Fabricius, 1794)	+	+			97	2	n/s/p	
Emblethis verbasci (Fabricius, 1803)			+		1		n	1
PYRRHOCORIDAE								
Pyrrhocoris apterus (Linnaeus, 1758)		+			1		n	
COREIDAE								
Syromastus rhombeus (Linnaeus, 1767)	+				2		n	1
Coreus marginatus (Linnaeus, 1758)			+		1		n	
Coriomeris denticulatus (Scopoli, 1763)	+		+	+	11		n	
ALYDIDAE								
Alydus calcaratus (Linnaeus, 1758)	+		+		6		n	
RHOPALIDAE								
Corizus hyoscyami (Linnaeus, 1758)	+		+		3		n	
Rhopalus parumpunctatus Schilling, 1829	+		+		2		n	
Rhopalus subrufus (Gmelin, 1790)	+				3		n	
Stictopleurus abutilon abutilon (Rossi, 1790)	+				3		n	
Stictopleurus punctatonervosus (Goeze, 1778)	+				1		n	
PLATASPIDAE								
Coptosoma scutellatum (Geoffroy, 1785)			+		16		n	
CYDNIDAE								
Sehirus luctuosus Mulsant & Rey, 1866	+	+			17		n/p	
Canthophorus impressus Horvath, 1881	+			+	2		n	1
Adomerus biguttatus (Linnaeus, 1758)	+	+	+	+	90		n/p	1
Legnotus picipes (Fallén, 1807)		+	+		3		n	2
THYREOCORIDAE								
Thyreocoris scarabaeoides (Linnaeus, 1758)	+				1		n	

SPECIES	M	H	K	Z	SH	LU	Met.	R.L.
SCUTELLERIDAE								
Eurygaster maura (Linnaeus, 1758)		+	+		22	1	n	
Eurygaster testudinaria (Geoffroy, 1758)			+		2		n	
PENTATOMIDAE								
Sciocoris macrocephalus Fieber, 1851	+				3		n	1,3
Sciocoris microphthalmus Flor, 1860	+				50		n	2
Aelia acuminata (Linnaeus, 1758)			+		3		n	
Neottiglossa pusilla (Gmelin, 1789)	+				2		n	
Rubiconia intermedium (Wolff, 1811)	+				1		n	2,3
Palomena prasina (Linnaeus, 1761)	+		+		2	6	n	
Palomena viridissima (Poda, 1761)			+		3	4	n	
Dryocoris vernalis (Wolff, 1804)			+		1		n	
Carpocoris fuscispinus (Boheman, 1849)	+	+	+	+	97	8	n/s/p	
Carpocoris purpureipennis (De Geer, 1773)	+	+	+	+	23	3	n	
Dolycoris baccarum (Linnaeus, 1758)	+	+	+	+	135		n/s/p	
Eurydema oleraceum (Linnaeus, 1758)	+	+	+		8		n/p	
**Pentatoma rufipes* (Linnaeus, 1758)	+				2		n	
Troilus luridus (Fabricius, 1775)	+				1		n/p	
**Arma custos* (Fabricius, 1794)						1	n	
Zicrona caerulea (Linnaeus, 1758)	+	+	+	+	18		n/p	2
Total number of species 167	**112**	**41**	**70**	**46**	**140**	**78**		

were recorded. Ten species account for more than 80 % of all specimens recorded and only 10 species (13 %) are listed in at least one of the Red Lists for Germany.

Altogether 31 species have been found that do not belong to grassy habitats (see "*" in Tab. 2). Fourteen of them were found in Schaffhausen and 22 in Luzern. Most of these species were probably drifted by wind from trees and shrubs in the nearby woodlands and the forest edge. That species characteristic of the herbal layer of the forest edge can also live in moist meadows is confirmed by a much higher rate of vagrants in the Luzern than in the Schaffhauser meadows (JUDEX, 1999).

DISCUSSION

General discussion

Recent faunistic publications concerning the heteropteran fauna of Switzerland mostly deal with the entomologically more interesting southern part of the country, especially the Canton Ticino where till now 395 species have been found (PÉRICART, 1984; GÖLLNER-SCHEIDING & REZBANYAI-RESER, 1992; OTTO, 1992, 1994, 1995, 1996; REZBANYAI-RESER, 1993, 1997; OTTO & BÜRKI, 1996; OTTO & REZBANYAI-RESER, 1996; RAMPAZZI & DETHIER, 1997). The other Cantons are not well investigated and the fauna is much less well known than that of various regions of Baden-Württemberg. Tab. 3 gives a survey of the faunistic knowledge in the various Cantons of Switzerland in relation to data available from Central Europe (GÜNTHER & SCHUSTER, 1990), Switzerland (OTTO, unpublished list), Baden-Württemberg (RIEGER, 1996) and the Landkreis Konstanz in Baden-Württemberg (HECKMANN, 1989, 1990, 1993, 1996, 1999; HECKMANN & RIEGER, in prep.).

Tab. 3. List of absolute and relative species numbers of ecologically most important families caught in different regions.
Columns: EU: Central Europe (GÜNTHER & SCHUSTER, 1990). CH: Switzerland (OTTO, unpublished list and pers. comm., 1997: uncontrolled literature data). BW: Baden-Württemberg (RIEGER, 1996: literature data). KN: Landkreis Konstanz (HECKMANN, 1989, 1990, 1993, 1996, 1999; HECKMANN & RIEGER, in prep., unpublished verified records). TI: Canton Ticino (PÉRICART, 1984; REZBANYAI-RESER, 1993; OTTO, 1994, 1995, 1996; OTTO & BÜRKI, 1996; REZBANYAI-RESER, 1997: the 12 unpublished records of DETHIER excluded). SH: Canton Schaffhausen (Tab. 5). LU: Canton Luzern (Tab. 4). TG: Canton Thurgau (BLÖCHLINGER, verified records of unpublished list & pers. comm., 1999 partly based on HOFMÄNNER, 1928). Other families: Hydrocorisae, Amphibiocorisae and the "rest" of Geocorisae.

	ABSOLUTE NUMBERS								PERCENTAGE NUMBERS							
	EU	**CH**	**BW**	**KN**	**TI**	**SH**	**LU**	**TG**	**EU**	**CH**	**BW**	**KN**	**TI**	**SH**	**LU**	**TG**
Tingidae	74	49	45	22	20	10	4	10	7,0	6,5	6,2	5,4	5,2	4,8	2,3	3,8
Nabidae	18	16	14	11	7	8	8	7	1,7	2,1	1,9	2,7	1,8	3,9	4,5	2,7
Anthocoridae	52	36	33	23	18	7	9	12	4,9	4,7	4,6	5,6	4,7	3,4	5,1	4,6
Reduviidae	18	14	13	7	7	5	1	6	1,7	1,8	1,8	1,7	1,8	2,4	0,6	2,3
Miridae	401	271	284	164	156	76	100	95	37,8	35,8	39,0	39,9	40,8	36,7	56,5	36,1
Berytidae	14	10	10	7	2	7	1	4	1,3	1,3	1,4	1,7	0,5	3,4	0,6	1,5
Lygaeidae	155	116	110	62	58	25	19	30	14,6	15,3	15,2	15,1	15,2	12,1	10,7	11,4
Coreidae	27	23	17	7	10	5	1	5	2,5	3,0	2,3	1,7	2,6	2,4	0,6	1,9
Rhopalidae	17	15	14	10	10	5	2	8	1,6	2,0	1,9	2,4	2,6	2,4	1,1	3,0
Pentatomidae	70	52	43	26	28	18	12	23	6,6	6,9	5,9	6,3	7,3	8,7	6,8	8,7
Other families	251	157	141	72	67	31	44	63	23,7	20,1	19,5	17,5	17,5	15,0	21.9	24,0
Species number	**1061**	**758**	**724**	**411**	**383**	**207**	**201**	**263**	**100**	**71,4**	**68,2**	**38,7**	**36,0**	**19,5**	**18.9**	**24,8**

One way to assess the ecological differences between regions of a country is to look at differences in species numbers of families known to be indicators for various climate types. The numbers of species in families like the Tingidae, Reduviidae, Lygaeidae, Rhopalidae, Coreidae, Berytidae and the Pentatomidae increase from boreal and alpine areas to mediterranean and tropical habitats. These taxa can therefore be used as indicator families of xero-thermophily. On the other hand, species numbers of Miridae and Anthocoridae decrease in the same direction, being indicators for more temperate climates (GÖLLNER-SCHEIDING, 1989a). Although the data are not complete, it is interesting to note that there is a good fit of the data from SH, KN and even TG which are located close together (Tab. 3). Moreover, there are big differences between these areas and the Canton Luzern which has the highest proportions of Miridae and the lowest proportions of xero-thermophilic Tingidae, Reduviidae, Berytidae, Lygaeidae, Coreidae and Rhopalidae.

We found more than one fifth of all known species of Switzerland in the meadows of the Schaffhauser Randen and the Rottal. The sites in the region of Schaffhausen, however, are much more diverse than those in Luzern, and we found nearly twice as many species and a much higher proportion of rare or endangered species. Most of the latter are xero-thermophilic species, which are restricted to dry and extensively managed meadows (DI GIULIO, in prep.). The climatic conditions in the Schaffhauser Randen not only favour these species directly, but in combination with the soil conditions, have limited the intensification of agricultural production. It is known for other taxa (e.g. butterflies and flowering plants) that many species can persist here which have disappeared from the other regions of Switzerland (ISLER-HÜBSCHER, 1980; SCHIESS-BÜHLER & SCHIESS, 1997).

Canton Luzern

Faunistic data are available from the Canton Luzern for the upland moor Balmoos near Hasle (REZBANYAI, 1980; GÖLLNER-SCHEIDING, 1981) and for the surroundings of the Vogelwarte Sempach (GÖLLNER-SCHEIDING, 1982). Later the Vogelmoos near Neudorf (GÖLLNER-SCHEIDING, 1990) was investigated and occasional records for different places in the Canton of Luzern were published (GÖLLNER-SCHEIDING, 1989b). The record of *Panaorus adspersus* MULS. & REY was added

Tab. 4. Check list of Heteroptera for the Canton Luzern. Nomenclature as in Tab. 2. The number of species in the different families are noted. The asterisks indicate the 26 new species for the Canton.

CHECK LIST OF HETEROPTERA FOR THE CANTON LUZERN	201

NEPIDAE	**2**
Nepa cinerea L.	
Ranatra linearis L.	
CORIXIDAE	**12**
Micronecta scholtzi Fieb.	
Callicorixa praeusta Fieb.	
Corixa punctata Ill.	
Hesperocorixa linnaei Fieb.	
Hesperocorixa sahlbergi Fieb.	
Paracorixa concinna Fieb.	
Sigara nigrolineata Fieb.	
Sigara semistriata Fieb.	
Sigara striata L.	
Sigara distincta Fieb.	
Sigara falleni Fieb.	
Sigara lateralis Lch.	
NAUCORIDAE	**1**
Ilyocoris cimicoides L.	
NOTONECTIDAE	**1**
Notonecta glauca L.	
Notonecta maculata F.	
Notonecta viridis Delc.	
PLEIDAE	**1**
Plea minutissima Lch.	
MESOVELIIDAE	**1**
Mesovelia furcata Muls. & Rey	
HYDROMETRIDAE	**2**
Hydrometra gracilenta Horv.	
Hydrometra stagnorum L.	
VELIIDAE	**4**
Microvelia pygmaea Duf.	
Microvelia reticulata Burm.	
Velia caprai Tam.	
Velia saulii Tam.	

GERRIDAE	**6**
Aquarius paludum F.	
Gerris argentatus Schum.	
Gerris gibbifer Schum.	
Gerris lacustris L.	
Gerris odontogaster Zett.	
Gerris thoracicus Schum.	
SALDIDAE	**4**
Chartoscirta cincta H.-S.	
Macrosaldula variabilis H.-S.	
**Saldula c-album* Fieb.	
Saldula saltatoria L.	
TINGIDAE	**4**
**Acalypta carinata* Pz.	
**Acalypta marginata* Wff.	
**Kalama tricornis* Schrank	
**Tingis reticulata* H.-S.	
NABIDAE	**8**
**Himacerus major* A. C.	
Himacerus mirmicoides O. C.	
**Himacerus apterus* F.	
Nabis limbatus Dhlbm.	
**Nabis brevis Sz.*	
Nabis ferus L.	
Nabis pseudoferus Rem.	
Nabis rugosus L.	
ANTHOCORIDAE	**9**
Acompocoris alpinus Reut.	
Anthocoris confusus Reut.	
Anthocoris limbatus Fieb.	
Anthocoris nemorum L	
Temnostethus pusillus H.-S.	
Orius laticollis Reut.	
Orius majusculus Reut.	
Orius minutus L.	
Orius vicinus Rib.	

CIMICIDAE	**1**
Cimex lectularius L.	
REDUVIIDAE	**1**
Reduvius personatus L.	
MIRIDAE	**100**
**Bryocoris pteridis* Fall.	
Monalocoris filicis L.	
**Campyloneura virgula* H.-S.	
Dicyphus epilobii Reut.	
Dicyphus errans Wff.	
Dicyphus hyalinipennis Burm.	
**Dicyphus pallidus* H.-S.	
Dicyphus stachydis J. Shlbg.	
Alloeotomus germanicus E. Wgn.	
Alloeotomus gothicus Fall.	
Deraeocoris ruber L.	
Deraeocoris lutescens Schill.	
Pithanus maerkelii H.-S.	
Leptopterna dolobrata L.	
Teratocoris paludum J. Shlbg.	
Stenodema calcarata Fall.	
Stenodema holsata F.	
Stenodema laevigata L.	
Stenodema virens L.	
Megaloceraea recticornis Geoffr.	
Notostira elongata Geoffr.	
Notostira erratica L.	
Trigonotylus caelestialium Kirk.	
Phytocoris dimidiatus Kb.	
Phytocoris intricatus Flor	
Phytocoris longipennis Flor	
Phytocoris tiliae tiliae F.	
Phytocoris pini Kb.	
Pantilius tunicatus F.	
**Adelphocoris lineolatus* Gz.	
Adelphocoris seticornis F.	
Calocoris affinis H.-S.	
Calocoris alpestris Mey.-D.	
Calocoris roseomaculatus De G.	
Closterotmus biclavatus H.-S.	
Closterotomus norvegicus Gm.	
Grypocoris sexguttatus F.	
Rhabdomiris striatellus F.	
Stenotus binotatus F.	
Apolygus lucorum Mey.-D.	
Lygocoris pabulinus L.	
Lygocoris rugicollis Fall.	
Lygocoris contaminatus Fall.	
Lygocoris viridis Fall.	
Lygus punctatus Zett.	
Lygus pratensis L.	
Lygus rugulipennis Popp.	
Lygus wagneri Rem.	
Orthops basalis A. C.	
**Orthops campestris* L.	
Orthops montanus Schill.	
**Pinalitus atomarius* Mey.-D.	
Pinalitus cervinus H.-S.	
Pinalitus rubricatus Fall.	
**Pinalitus visicola* Put.	
Agnocoris rubicundus Fall.	
Liocoris tripustulatus F.	
Camptozygum aequale Vill.	
Charagochilus gyllenhalii Fall.	
Polymerus holosericeus Hahn	
**Polymerus unifasciatus* F.	
Capsus ater L.	
**Halticus apterus* L.	
**Orthocephalus coriaceus* F.	
Blepharidopterus angulatus Fall.	
Blepharidopterus diaphanus Kb.	
Dryophilocoris flavoquadrimaculatus De G.	
**Globiceps flavomaculatus* F.	
**Heterotoma planicornis* Pall.	
Mecomma ambulans Fall.	
Orthotylus marginalis Reut.	
Orthotylus nassatus F.	
Orthotylus prasinus Fall.	
Pseudoloxops coccineus Mey.-D.	
Cremnocephalus alpestris E. Wgn.	
Pilophorus clavatus L.	
Pilophorus confusus Kb.	
Pilophorus perplexus Doug. & Sc.	
**Ambylytus nasutus* Kb.	
Atractotomus kolenatii Flor	
Atractotomus magnicornis Fall.	
Compsidolon salicellum H.-S.	
**Chlamydatus pulicarius* Fall.	
Harpocera thoracica Fall.	
**Megalocoleus molliculus* Fall.	
Orthonotus rufifrons Fall.	
Phoenicocoris obscurellus Fall.	
Phylus coryli L.	
Phylus melanocephalus L.	
Placochilus seladonicus Fall.	
Plagiognathus arbustorum F.	
Psallus betuleti Fall.	
Psallus ambiguus Fall.	
**Psallus perrisi* Muls. & Rey	

MIRIDAE	CONT.
**Psallus piceae* Reut.	
Psallus falleni Reut.	
Psallus haematodes Gm.	
Psallus lepidus Fieb.	
Psallus mollis Muls. & Rey	
Psallus varians varians H.-S.	
ARADIDAE	**1**
**Aradus cinnamomeus* Pz.	
BERYTIDAE	**1**
Berytinus minor H.-S.	
LYGAEIDAE	**19**
Spilostethus saxatilis Scop.	
Nysius cymoides Spin.	
**Nysius ericae* Schill.	
Kleidocerys resedae Pz.	
Cymus glandicolor Hahn	
Cymus aurescens Dist.	
Cymus melanocephalus Fieb.	
Ischnodemus sabuleti Fall.	
Gastrodes abietum Bgrth.	
Gastrodes grossipes De G.	
Scolopostethus affinis SCHILL.	
Scolopostethus thomsoni REUT.	
Stygnocoris rusticus FALL.	
Pachybrachius fracticollis SCHILL.	
Panaorus adspersus MULS. & REY	
Rhyparochromus pini L.	
Peritrechus geniculatus HAHN	
Peritrechus nubilus FALL.	
Megalonotus chiragra F.	

COREIDAE	1
Coreus marginatus L.	
RHOPALIDAE	**2**
Rhopalus subrufus Gm.	
Stictopleurus crassicornis L.	
SCUTELLERIDAE	**2**
Eurygaster maura L.	
Eurygaster testudinaria Geoffr.	
PENTATOMIDAE	**12**
Eysarcoris fabricii Kirk.	
Palomena prasina L.	
Palomena viridissima Pd.	
Carpocoris fuscispinus Boh.	
Carpocoris purpureipennis De G.	
Dolycoris baccarum L.	
Eurydema dominulum Scop.	
Rhaphigaster nebulosa Pd.	
Pentatoma rufipes L.	
Picromerus bidens L.	
Arma custos F.	
Zicrona caerulea L.	
ACANTHOSOMATIDAE	**4**
Acanthosoma haemorrhoidale L.	
Elasmostethus minor Horv.	
Elasmostethus interstinctus L.	
Elasmucha grisea L.	

from the Museum of Natural History in Paris (PÉRICART, 1998) and 35 species by an investigation near Rottal (JUDEX, 1999). Thirty species of water and semiaquatic bugs (Nepomorpha and Gerromorpha) were found in the Wauwiler Ebene and 18 in the Mösliweiher near Schötz (WIPRÄCHTIGER, 1999a, 1999b). We found 78 species for Rottal, 26 of them being new records for this Canton (see "*" in Tab. 4). Altogether 201 species have been recorded in the Canton Luzern.

In the publications of GÖLLNER-SCHEIDING (1981, 1982) *Orthops basalis* A.C. was published as *Orthops kalmii* L. The misidentification of these two species was apparently due to a mistake in the key of WAGNER (1967, 1971) which later was revised (RIEGER, 1985).

Canton Schaffhausen

The earliest records for the Canton Schaffhausen include 23 species of Miridae collected by S. SEILER (MEYER-DÜR, 1843). A list of 76 species was published by FREY-GESSNER (1864–1866), most of them also collected by S. SEILER in the mid 19th century. In his list he included a revised list of the Mirids recorded by MEYER-

DÜR (1843). Much later the occurrence of two Saldid species was reported (DETHIER & PÉRICART, 1990). Together with our results, we present here a list of 207 species of Heteroptera for the Canton Schaffhausen, 118 of them being new records for the Canton (see "*" in Tab. 5).

We were not able to check the determinations of FREY-GESSNER because the collection was destroyed by bombing of Schaffhausen during World War II (A. MÜL-

Tab. 5. Check list of Heteroptera for the Canton Schaffhausen. Nomenclature as in Tab. 2."?": doubtfull historical records. The asterisks indicate the 118 new species for the Canton.

CHECK LIST OF HETEROPTERA FOR THE CANTON SCHAFFHAUSEN	**207**

CERATOCOMBIDAE	**1**
**Ceratocombus coleoptratus* Zett.	
NEPIDAE	**1**
Ranatra linearis L.	
CORIXIDAE	**4**
Hesperocorixa moesta Fieb.	
Sigara striata L.	
Sigara falleni Fieb.	
Sigara fossarum Lch.	
VELIIDAE	**2**
Microvelia reticulata Burm.	
?Velia caprai caprai Tam. ?	
GERRIDAE	**1**
Gerris argentatus Schum.	
SALDIDAE	**3**
Saldula c-album Fieb.	
**Saldula orthochila* Fieb.	
Saldula saltatoria L.	
TINGIDAE	**10**
**Acalypta carinata* Pz.	
**Acalypta marginata* Wff.	
Acalypta parvula Fall.	
Agramma laetum Fall.	
**Campylosteira verna* Fall.	
**Catoplatus fabricii* Stål	
Dictyla echii Schrank	
Dictyla lupuli H.-S.	
**Kalama tricornis* Schrank	
**Physatocheila harwoodi* China	
NABIDAE	**8**
Prostemma guttula F.	
**Himacerus mirmicoides* O.C.	
**Nabis flavomarginatus* Sz.	
**Nabis brevis* Sz.	
**Nabis ferus* L	
**Nabis pseudoferus* Rem.	
**Nabis punctatus* A. C.	
**Nabis rugosus* L.	
ANTHOCORIDAE	**7**
**Acompocoris alpinus* Reut.	
?Acompocoris pygmaeus Fall. ?	
**Anthocoris nemorum* L.	
**Temnostethus pusillus* H.-S.	
**Orius majusculus* Reut.	
**Orius minutus* L.	
Lyctocoris campestris F.	
REDUVIIDAE	**5**
Empicoris culiciformis De G.	
Empicoris vagabundus L.	
Phymata crassipes F.	
Pygolampis bidentata Gz.	
Rhynocoris iracundus Pd.	
MIRIDAE	**76**
**Campyloneura virgula* H.-S.	
**Dicyphus annulatus* Wff.	
**Dicyphus globulifer* Fall.	
**Deraeocoris morio* Boh.	
**Deraeocoris ruber* L.	
Deraeocoris lutescens Schill.	
Leptopterna dolobrata L.	
Stenodema holsata F.	
**Stenodema laevigata* L.	
**Megaloceraea recticornis* Geoffr.	
**Notostira elongata* Geoffr.	
**Notostira erratica* L.	
**Trigonotylus caelestialium* Kirk	
**Phytocoris longipennis* Flor	
**Adelphocoris lineolatus* Gz.	
**Adelphocoris seticornis* F.	
**Brachycoleus pilicornis* Pz.	
**Calocoris affinis* H.-S.	
Calocoris roseomaculatus De G.	
**Closterotomus biclavatus* H.-S.	
Closterotomus fulvomaculatus De G.	
Closterotomus norvegicus Gm.	

MIRIDAE	**cont.**
Grypocoris sexguttatus F.	
Rhabdomiris striatellus F.	
**Hadrodemus m-flavum* Gz.	
Stenotus binotatus F.	
**Dichrooscytus intermedius* Reut.	
Apolygus lucorum Mey.-D.	
**Apolygus spinolae* Mey.-D.	
**Lygocoris pabulinus* L.	
**Lygus pratensis* L.	
**Lygus rugulipennis* Popp.	
**Lygus wagneri* Rem.	
**Orthops basalis* A. C.	
**Orthops campestris* L.	
**Orthops kalmii* L.	
Pinalitus rubricatus Fall.	
Charagochilus gyllenhalii Fall.	
Polymerus holosericeus Hahn	
**Polymerus nigrita* Fall.	
**Polymerus unifasciatus* F.	
**Polymerus microphtalmus* E. Wgn.	
**Capsodes gothicus gothicus* L.	
**Capsus ater* L.	
**Halticus apterus apterus* L.	
**Orthocephalus coriaceus* F.	
**Orthocephalus saltator* Hahn	
Strongylocoris luridus Fall.	
**Strongylocoris steganoides* J. Shlbg.	
Cyllecoris histrionius L.	
Globiceps sphaegiformis Rossi	
**Globiceps flavomaculatus* F.	
**Globiceps fulvicollis* Jak.	
Heterocordylus tumidicornis H.-S.	
**Malacocoris chlorizans* Pz.	
Orthotylus nassatus F.	
Orthotylus viridinervis Kb.	
**Hallodapus rufescens* Burm.	
**Ambylytus nasutus* Kb.	
**Atractotomus magnicornis* Fall.	
**Atractotomus parvulus* Reut.	
Campylomma verbasci Mey.-D.	
**Chlamydatus pulicarius* Fall.	
**Chlamydatus pullus* Reut.	
Criocoris crassicornis Hahn	
Hoplomachus thunbergii Fall.	
**Macrotylus herrichi* Reut.	
**Megalocoleus molliculus* Fall.	
Monosynamma bohemanni Fall.	
Oncotylus viridiflavus Gz.	
**Phoenicocoris obscurellus* Fall.	
**Plagiognathus arbustorum* F.	
**Plagiognathus chrysanthemi* Wff.	
**Plesiodema pinetella* Zett.	
Psallus ambiguus Fall.	
Psallus variabilis Fall.	
ARADIDAE	**3**
**Aradus cinnamomeus* Pz.	
Aradus conspicuus H.-S.	
Aradus depressus F.	
PIESMATIDAE	**2**
Piesma capitatum Wff.	
**Piesma maculatum* Lap.	
BERYTIDAE	**7**
Berytinus clavipes F.	
Berytinus minor H.-S.	
**Berytinus crassipes* H.-S.	
**Berytinus montivagus* Mey.-D.	
**Berytinus signoreti* Fieb.	
**Gampsocoris punctipes* Germ.	
Neides tipularius L.	
LYGAEIDAE	**25**
**Nysius ericae* Schill.	
**Ischnodemus sabuleti* Fall.	
Macroplax preyssleri Fieb.	
Heterogaster urticae F.	
**Platyplax salviae* Schill.	
Plinthisus brevipennis Latr.	
Tropistethus holosericeus Sz.	
**Drymus latus* Doug. & Sc.	
**Drymus ryeii* Doug. & Sc.	
**Drymus sylvaticus* F.	
**Gastrodes abietum* Bgrth.	
**Scolopostethus affinis* Schill.	
**Scolopostethus thomsoni* Reut.	
?Taphropeltus contractus H.-S. ?	
**Stygnocoris rusticus* Fall.	
Stygnocoris sabulosus Schill.	
Pachybrachius fracticollis Schill.	
Aellopus atratus Gz.	
**Graptopeltus lynceus* F.	
**Rhyparochromus pini* L.	
Xanthochilus quadratus F.	
**Peritrechus gracilicornis* Put.	
**Megalonotus chiragra* F.	
Emblethis verbasci F.	
Pterotmetus staphiliniformis Schill.	
PYRRHOCORIDAE	**1**
**Pyrrhocoris apterus* L.	

COREIDAE	**5**
Gonocerus acuteangulatus Gz.	
Syromastus rhombeus L.	
Enoplops scapha F.	
**Coreus marginatus* L.	
**Coriomeris denticulatus* Scop.	
ALYDIDAE	**1**
Alydus calcaratus L.	
RHOPALIDAE	**5**
**Corizus hyoscyami* L.	
**Rhopalus parumpunctatus* Schill.	
**Rhopalus subrufus* Gm.	
**Stictopleurus abutilon* Rossi	
**Stictopleurus punctatonervosus* Gz.	
PLATASPIDAE	**1**
Coptosoma scutellatum Geoffr.	
CYDNIDAE	**5**
Sehirus luctuosus Muls. & Rey	
Tritomegas bicolor L.	
**Canthophorus impressus* Horv.	
**Adomerus biguttatus* L.	
**Legnotus picipes* Fall.	
THYREOCORIDAE	**1**
**Thyreocoris scarabaeoides* L.	
SCUTELLERIDAE	**3**
Odontoscelis fuliginosa L.	
**Eurygaster maura* L.	
**Eurygaster testudinaria* Geoffr.	
PENTATOMIDAE	**18**
**Sciocoris macrocephalus* Fieb.	
**Sciocoris microphthalmus* Flor	
Sciocoris umbrinus Wff.	
**Aelia acuminata* L.	
**Neottiglossa pusilla* Gm.	
**Rubiconia intermedium* Wff.	
**Palomena prasina* L.	
**Palomena viridissima* Pd.	
Dryocoris vernalis Wff.	
Chlorochroa juniperina L.	
**Carpocoris fuscispinus* Boh.	
**Carpocoris purpureipennis* De G.	
**Dolycoris baccarum* L.	
**Eurydema oleraceum* L.	
**Pentatoma rufipes* L.	
**Troilus luridus* F.	
Arma custos F.	
**Zicrona caerulea* L.	

ACANTHOSOMATIDAE	**2**
Elasmucha ferrugata F.	
Cyphostethus tristriatus F.	

LER, ETH collection, pers. comm.). Therefore, we have only updated the name (STICHEL, 1955–1962; HEISS & PÉRICART, 1983; PÉRICART, 1984, 1998; AUKEMA & RIEGER, 1995, 1996, 1999). However, the following four records are problematic:

1. *Velia currens* F. was published in the lists for the Canton of FREY-GESSNER (1864–1866). Much later, *Velia caprai* TAM. and *Velia saulii* TAM. were separated from that species as distinct species (TAMANINI, 1947). It is therefore not clear which of the three species had actually been found. Probably it was *Velia caprai* TAM., which is also very common in the southern part of Baden-Württemberg, while *Velia currens* F. occurs only in Ticino (DETHIER & MATTHEY, 1977).

2. *Acompocoris alpinus* REUT. was described in 1875 and separated from *Acompocoris pygmaeus* FALL., so we do not know which of the two species had been found.

3. *Taphropeltus hamulatus* THOMS. was described in 1870. After being considered as a synonym of *Taphropeltus contractus* H.-S. it was later separated again; we do not know which of the two species was really collected.

4. *Sehirus morio* L. was published in the lists for the Canton of FREY-GESSNER (1864–1866). At that time *Sehirus luctuosus* MULSANT & REY had not been described as a separate species from *S. morio*. We assume that the record probably deals with *S. luctuosus* MULS. & REY which is found frequently, while *S. morio* L. is seldom found in Central Europe.

Biogeography of rare species

In the following, we discuss our own findings in detail with a critical focus on species on the Red List and those rarely found in Switzerland. Some species on the Red Lists of Germany are very common and widespread in both Baden-Württemberg and Switzerland and will not be discussed here. These are *Saldula c-album* FIEB., *Saldula orthochila* FIEB., *Acalypta marginata* WFF., *Catoplatus fabricii* STAL, *Kalama tricornis* SCHR., *Acompocoris alpinus* REUT., *Calocoris alpestris* MEY.-D., *Grypocoris sexguttatus* F., *Macrotylus herrichi* REUT., *Berytinus signoreti* FIEB., *Ischnodemus sabuleti* FALL., *Adomerus biguttatus* L., *Legnotus picipes* FALL., *Rubiconia intermedium* WFF. and *Zicrona caerulea* L.

Canton Schaffhausen – We compared our results for Schaffhausen (Tab. 5) with those of Baden-Württemberg and the dry habitats of the Hegau (Landkreis Konstanz). For the Landkreis Konstanz 411 bug species have been recorded (HECKMANN, 1989, 1990, 1993, 1996, 1999; HECKMANN & RIEGER, in prep.; HECKMANN, unpublished data). In total 21 species of the Schaffhausen bug fauna have not been found in the Landkreis Konstanz so far.

Eight of our recently recorded species have not been found in the Landkreis Konstanz, though it is a well investigated region. All species except *Campylosteira verna* FALL., *Physatocheila harwoodi* CHINA and *Sciocoris microphthalmus* FLOR. are xero-thermophilic species and most are on the Red List of Germany: *Saldula orthochila* FIEB., *Campylosteira verna* FALL., *Physatocheila harwoodi* CHINA, *Brachycoleus pilicornis* PZ., *Hallodapus rufescens* BURM., *Syromastus rhombeus* L., *Sciocoris macrocephalus* FIEB. and *Sciocoris microphthalmus* FLOR.

Thirteen species are mentioned in the early records but were neither found by us nor in the Landkreis Konstanz: *Hesperocorixa moesta* FIEB., *Sigara fossarum* LCH., *Dictyla lupuli* H.-S., *Calocoris roseomaculatus* DE G., *Strongylocoris luridus* FALL., *Globiceps sphaegiformis* ROSSI, *Neides tipularius* L., *Aellopus atratus* F., *Xanthochilus quadratus* F., *Syromastus rhombeus* L., *Sciocoris umbrinus* WFF.,

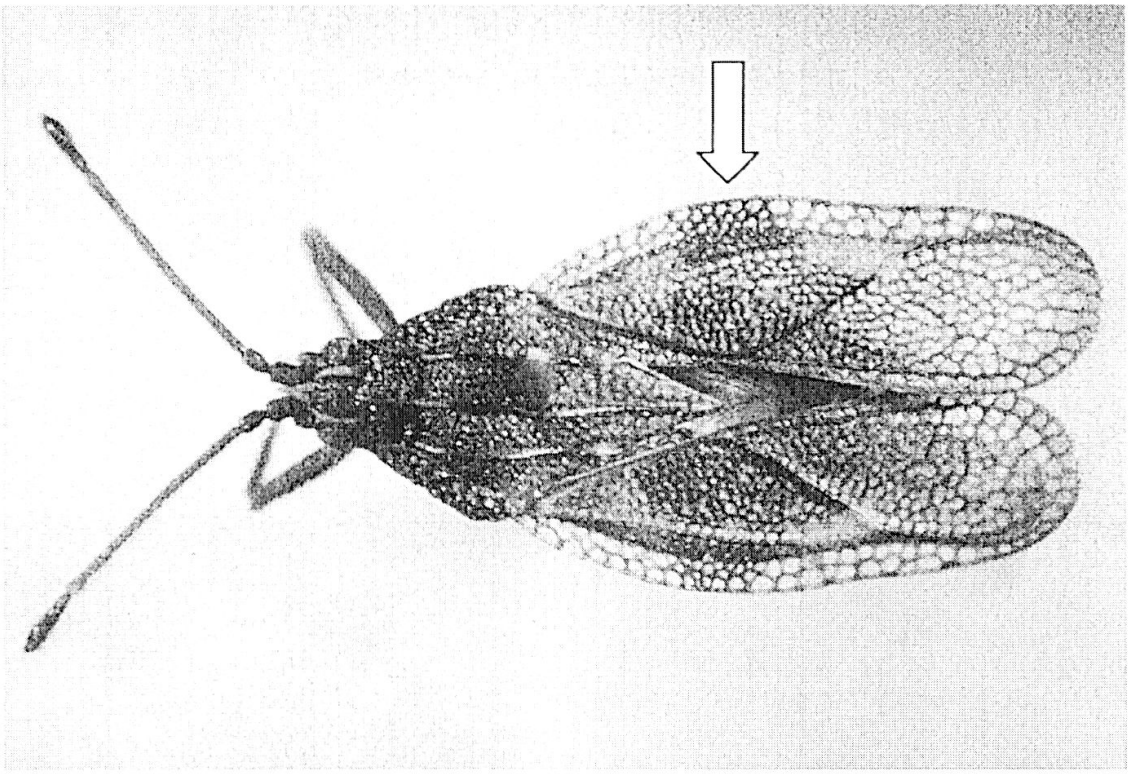

Fig. 2. *Physatocheila harwoodi*. The arrow shows the narrow black area of the elytra which is much wider in the other species of the genus. The body length is about 3.5 mm. (Photo: M. DI GIULIO).

Chlorochroa juniperina L. and *Elasmucha ferrugata* F. Also *Neides tipularius* L., *Aellopus atratus* F., *Xanthochilus quadratus* F., *Syromastus rhombeus* L., and *Chlorochroa juniperina* L. are xero-thermophilic and are mostly Red List species in Germany. *Strongylocoris luridus* FALL. is found in the Black Forest (RIEGER & STRAUSS, 1992) and lives on *Jasione montana*. *Elasmucha ferrugata* F. also is known from the nearby Wutachschlucht in the Black Forest (KLESS, 1961) and lives on *Vaccinium myrtillus*. The distribution of the other eleven species in Baden-Württemberg corresponds with hot and dry habitats along the Rhine Valley north of Basel (HECKMANN, 1996).

The species of special interest found by us are:

1. *Ceratocombus coleoptratus* (ZETTERSTEDT, 1819): In Switzerland this species has been found only recently in the Canton Ticino (OTTO, 1994). It was found several times in Baden-Württemberg and is common in the Landkreis Konstanz (HECKMANN & RIEGER, in prep.). It is rarely collected because of its small size and the fact that it occurs hidden in moss. Mostly it is recorded by pitfall traps. In Bayern it has been put on the Red List.

2. *Acalypta carinata* (PANZER, 1806) is often found in the same habitats as *Ceratocombus coleoptratus* ZETT. and can be caught easily with pitfall-traps. Records are known for Vaud, Bern, Zürich and Wallis (PÉRICART, 1983). It is on the Red List for Baden-Württemberg and Bayern but seems to be common in the south of Baden-Württemberg (RIEGER, 1981) and the Landkreis Konstanz (HECKMANN, 1990).

3. *Campylosteira verna* (FALLÉN, 1826) lives hidden between mosses and lichens. In Switzerland it is known from Bern and Graubünden (PÉRICART, 1983)

but few records are known for Baden-Württemberg (HÜEBER, 1891; MEESS, 1907; FISCHER, 1961; RIEGER, 1981). It is on the Red List of Bayern and Germany.

4. *Physatocheila harwoodi* CHINA, 1936 (Fig. 2): New record for Switzerland! The species lives on *Acer pseudoplatanus* and is recorded very rarely. It is known from several places (HEISS, 1978) in Tyrol (Austria), from Baden-Württemberg (RIEGER, 1981; VOIGT, 1983) and from Bayern (SINGER, 1952). This new record corresponds to the known distribution area.

5. *Deraeocoris morio* (BOHEMAN, 1852): This xero-thermophilic species lives on *Thymus* and is known only from the Ticino (GÖLLNER-SCHEIDING & REZBANYAI-RESER, 1992) and several places in Baden-Württemberg and in the Landkreis Konstanz (HECKMANN & RIEGER, in prep.).

6. *Brachycoleus pilicornis pilicornis* (PANZER, 1805): This thermophilic species lives on *Euphorbia verrucosa*. It is known from the Cantons of Basel, Zürich, Aargau (FREY-GESSNER, 1864–1866) and Thurgau (BLÖCHLINGER, pers. comm.). In Baden-Württemberg it is known from several places and also from warm places in the nearby Wutachschlucht in the Black Forest (KLESS, 1961).

7. *Polymerus microphthalmus* (WAGNER, 1951): New record for Switzerland! This species lives on *Galium*, often together with *P. unifasciatus* F., and is common in the Hegau and rarely found in other parts of Baden-Württemberg. Probably there is no Swiss record because it has been confused with *P. unifasciatus* F.

8. *Strongylocoris steganoides* (J. SAHLBERG, 1875) was synonymised with *S. leucocephalus* by REUTER (1888). KIRITSHENKO (1951) revised the genus and separated these two species. WAGNER (1973) treats it as a subspecies, and it might therefore have been misidentified (RIEGER, 1997). In Baden-Württemberg *S. steganoides* is widespread and very common whereas *S. leucocephalus* is a rare species. In the Landkreis Konstanz only *S. steganoides* has been found (HECKMANN & RIEGER, in prep.).We assume that the same is true for Switzerland and the records of *S. leucocephalus* should be checked.

9. *Hallodapus rufescens* (BURMEISTER, 1835) is known in Switzerland only from the Cantons Vaud, Bern (FREY-GESSNER, 1864–1866), Wallis (CERUTTI, 1937a) and Graubünden (Valbella; DI GIULIO, unpublished data). In Baden-Württemberg it is only known from the Suebian Alb (RIEGER, 1976) and from the Kniebis in the northern Black Forest (RIEGER, pers. comm.).

10. *Berytinus crassipes* (HERRICH-SCHÄFFER, 1835) lives on *Cerastium*. Records are known from Aargau and Vaud in Switzerland (PÉRICART, 1984), the Wollmatinger Ried in the Landkreis Konstanz (HECKMANN, 1990) and a few other places in Baden-Württemberg (KLESS, 1961; RIEGER, 1976; HECKMANN, 1996).

11. *Berytinus montivagus* (MEYER-DÜR, 1841): This xero-thermophilic species is known in Switzerland only from Graubünden (FREY-GESSNER, 1871), Aargau (PÉRICART, 1984) and Neuchâtel (BARBALAT, 1991) but is probably more widespread. It is known from the Hohentwiel in the Landkreis Konstanz and from other places in Baden-Württemberg (SCHMID, 1967; HECKMANN & RIEGER, in prep.).

12. *Drymus latus* DOUGLAS & SCOTT, 1871: This is the second record for Switzerland. The species has only been recorded in the Canton Basel (PÉRICART, 1998). There are few records in the Landkreis Konstanz (HECKMANN, 1990; HECKMANN & RIEGER, in prep.) and from few other places in Baden-Württemberg (RIEGER & STRAUSS, 1992).

13. *Peritrechus gracilicornis* PUTON, 1877: This xerophilic species is known in Switzerland from Wallis and Ticino (PÉRICART, 1998). In Baden-Württemberg it

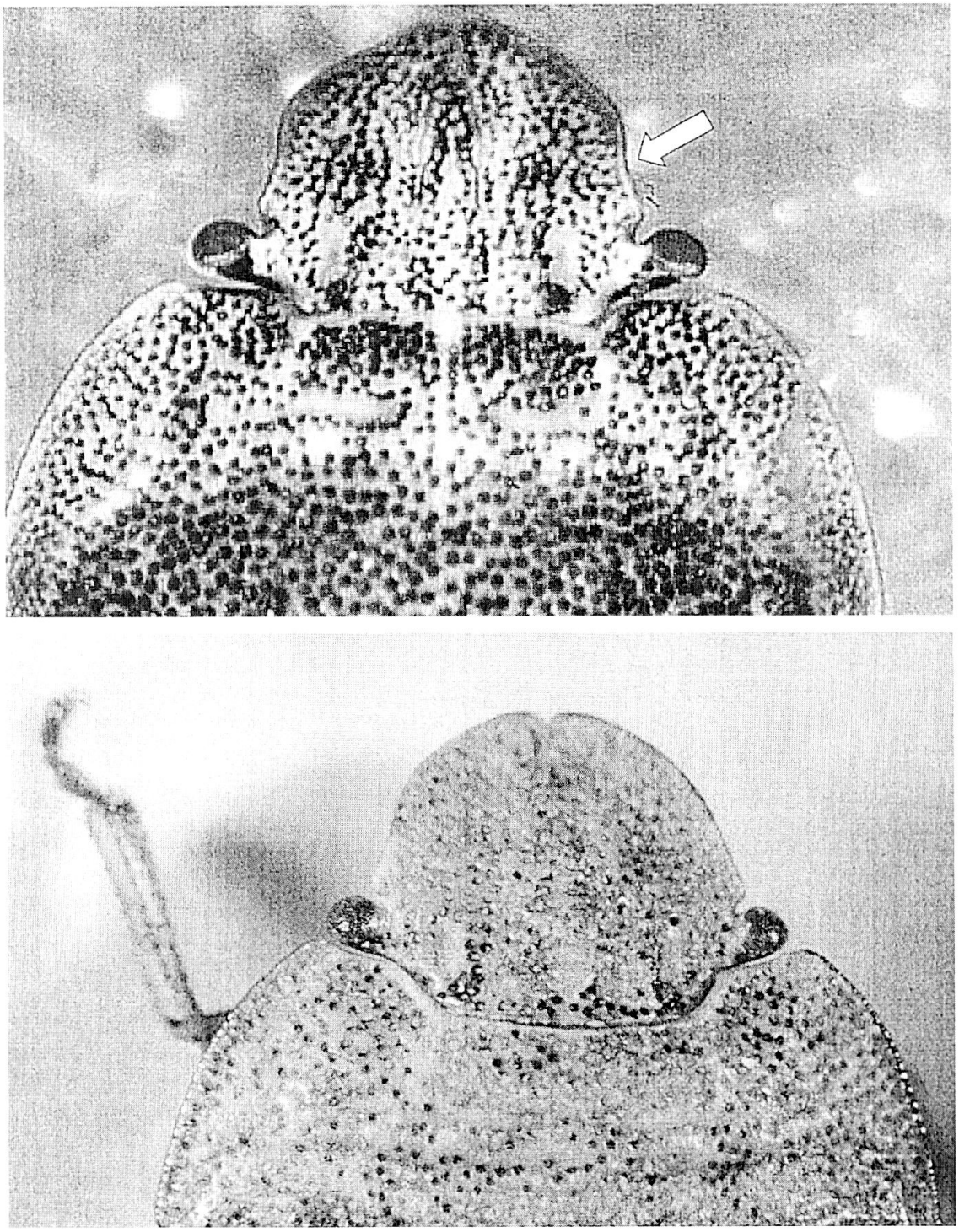

Fig. 3. *Sciocoris macrocephalus* FIEB. (upper part) can be distinguished from *Sciocoris microphthalmus* FLOR (lower part) by the sinuated lateral margins of the head (arrows) and by the longer eyestalks. The body length is about 6 mm. (Photo: R. HECKMANN and M. DI GIULIO).

is mostly found along the valleys of the Rhine and the Neckar and also in the Hegau (HECKMANN, 1996).

14. *Canthophorus impressus* HORVATH, 1881: This is the third reliable record of this species for Switzerland. It has been found previously in the Cantons Obwalden (GÖLLNER-SCHEIDING, 1989b) and Ticino (GÖLLNER-SCHEIDING & REZBANYAI-

RESER, 1992). The species lives on *Thesium* and is widespread in Baden-Württemberg (RIEGER & STRAUSS, 1992) and has been found in the Wollmatinger Ried in the Landkreis Konstanz (HECKMANN, 1999). Before RIEGER (1997) the determination of the females was unsure and therefore the records of *C. dubius* SCOP. in FREY-GESSNER (1864–1866) were probably *C. impressus* as this is the more common species in Baden-Württemberg.

15. *Sciocoris microphthalmus* FLOR, 1860 (Fig. 3): This species is known from Ticino (RAMPAZZI & DETHIER, 1997) and Tyrol (HEISS, 1977); however, in Baden-Württemberg it is common (RIEGER, pers. comm)

16. *Sciocoris macrocephalus* FIEBER, 1851 (Fig. 3): Reliable records exist only from Wallis (VOELLMY & SAUTER, 1983), Neuchâtel (BARBALAT, 1991), Ticino (GÖLLNER-SCHEIDING & REZBANYAI-RESER, 1992) and Thurgau (Coll. BLÖCHLINGER, Müllheim). There are no checked records from Baden-Württemberg (RIEGER, 1996) and the Fürstentum Liechtenstein (BERNHARDT, 1992), but the species is found frequently in Tyrol (HEISS, 1977). Reports also exist from Vaud, Wallis, Aargau, Zürich and Graubünden (FREY-GESSNER, 1864–1866). However, it remains uncertain whether these reports differentiate between *S. macrocephalus* and *S. microphthalmus*.

Canton Luzern – Four interesting species were found in the Canton Luzern:

1. *Acalypta carinata* (PANZER, 1806): see discussion of Canton Schaffhausen.

2. *Himacerus major* (A. COSTA, 1842): In Switzerland there are only two records of this species, from the Cantons Wallis and Basel. A further record (PÉRICART, 1987; DETHIER & PÉRICART, 1988) is attributed to a mistake of the name Kaiserstuhl. The species was actually found in Baden-Württemberg (Kaiserstuhl in Baden) and not in the Canton Aargau. Several records come from Baden-Württemberg along the Rhine Valley (HECKMANN, 1996) and from the Landkreis Konstanz. This is the first record for Central Switzerland.

3. *Pinalitus atomarius* (MEYER-DÜR, 1843): In Switzerland this alpine-boreal species which lives on *Picea* is known from Bern, Basel and Aargau (FREY-GESSNER, 1864–1866) and recently from Ticino (RAMPAZZI & DETHIER, 1997). The distribution in Baden-Württemberg is restricted to the Black Forest (RIEGER & STRAUSS, 1992; HECKMANN, 1996) and to the Suebian Alb (RIEGER, pers. comm.).

4. *Pinalitus visicola* (PUTON, 1888): This species lives on *Viscum album* and has been recorded in Switzerland only in the Canton Wallis (CERUTTI, 1937b). In the Landkreis Konstanz, the distribution corresponds with that of *Viscum*. Its distribution for Baden-Württemberg has been described in HECKMANN & RIEGER (in prep.). The sparse records reflect the dependence of the species on *Viscum* and the fact that its habitat mostly in the canopy, is rarely sampled.

CONCLUSIONS

The Red List of Baden-Württemberg is very helpful in interpreting the rare species of Switzerland. Some xero-thermophilic species recorded more or less frequently in the south of Baden-Württemberg especially in the valley of the Rhine and Hegau also occur in the Canton Schaffhausen. The same species are recorded in the southern part of Switzerland and in the Cantons Basel and Aargau, but not in the Innerschweiz and Mittelland. These species, which are good candidates for a Red List of Switzerland, include: *Deraeocoris morio* BOH., *Hallodapus rufescens* BURM., *Berytinus crassipes* H.-S., *Berytinus montivagus* MEY.-D., *Berytinus signoreti* FIEB., *Drymus latus* DOUG. & SC., *Peritrechus gracilicornis* PUT., *Emblethis ver-*

basci F., *Sciocoris macrocephalus* Fieb,. and *Sciocoris microphthalmus* FLOR. From our findings in Luzern *Himacerus major* A. C. and *Pinalitus visicola* PUT. should be added to the list.

Many species found in the ancient records of MEESS (1900, 1907) and FREY-GESSNER (1864–1866) appear to have decreased in abundance during the last century, e.g. *Neides tipularius* L., *Aellopus atratus* F., *Xanthochilus quadratus* F., *Sciocoris umbrinus* WFF., *Chlorochroa juniperina* L. and *Elasmucha ferrugata* F. However, the sparse data available on the distribution of heteropteran bugs do not allow a thorough analysis of the situation in Switzerland. The data of Baden-Württemberg, however, support the conclusion that these species decreased in the last century (HECKMANN, 1996). We assume that this decline was a consequence of increasing intensification of agricultural production in both Germany and Switzerland.

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ZUSAMMENFASSUNG

Im Schaffhauser Randen (Kanton Schaffhausen) wurden zwischen 1997 und 1999 drei verschiedene Wiesentypen untersucht. Dabei wurden verschiedene Sammelmethoden angewendet, wie Kescherfang, Bodenfallen und ein Sauggerät. Insgesamt wurden 45 Wiesen untersucht und 140 Wanzenarten gefunden. Auf dem Gemeindegebiet Ruswil/Buttisholz (Kanton Luzern) wurden 31 extensiv bewirtschaftete Wiesen untersucht und dabei 78 Arten festgestellt. In unseren Untersuchungen fanden wir 118 neue Arten für den Kanton Schaffhausen und 26 für den Kanton Luzern. Anhand der Literatur und aufgrund eigener Funde stellten wir für beide Kantone Artenlisten zusammen. Aus dem Kanton Schaffhausen sind bisher 207 Wanzenarten bekannt, aus dem Kanton Luzern 201 Arten. Die Biogeographie ausgewählter Arten wird diskutiert.
Drei Arten aus dem Schaffhauser Randen sind Neunachweise für die Schweiz: *Physatocheila harwoodi* CHINA, 1936, *Strongylocoris steganoides* (J. SAHLBERG, 1875) und *Polymerus microphthalmus* (WAGNER, 1951). Die bisherigen Funde von *Strongylocoris leucocephalus* sollten überarbeitet werden.

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