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ARCTIC-ALPINE AND BOREO-MONTANE SPIDER (ARANEAE) SPECIES IN EPIGEIC SPIDER COMMUNITIES IN THE SUBALPINE ZONE OF THE EASTERN ALPS

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Abstract

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Epigeic spider communities from 57 localities situated at altitudes of 1500 m up to 2300 m were analysed with the aim of evaluating any impact of arctic-alpine and boreo-montane spider species on these communities. 27 spider species having such disjunct distribution patterns were found. In 14 subalpine localities no species from both groups were found. Proportions of these groups in the communities were remarkably lower than of the alpine- endemic species. Boreo-montane species were not numerous. In most cases they made up 1- 2%, rarely 3%, of all collected specimens. Most arctic-alpine species have a centre of distribution in the alpine zone, only few were well represented in high subalpine localities. In high subalpine communities more than 15% of species and 10% of specimens can belong to arctic-alpine species. Only two arctic-alpine species (*Meioneta gulosa* and *Oreonetides vaginatus*) and one boreo-montane species (*Micaria aenea*) regularly spread to lower zones and habitats. Ecology and Ronal distribution were rather atypical for the arctic-alpine species *Collinsia nemenziana* THALER.

Introduction

A number of spider species with disjunct distributions in northern and mountain regions of Europe occur in the Alps and in other mountain areas of central Europe (THALER, 1976, 1988, 1998; THALER, KNOFLACH, 1995). In the subalpine zone these arctic-alpine and boreo-montane species share space and resources with alpine endemics as well as with species typical for lowland areas. Faunistic and distributional data for these groups of spider species in the Alps are well documented and a lot of information was obtained during investi-

gations in high alpine and nival zones, where arctic-alpine species together with alpine endemic species are the most important components of spider communities (CHRISTANDL-PESKOLLER, JANETSCHEK, 1976; PUNTSCHER, 1980; THALER, 1981, 1984, 1988, 1992; THALER, KNOFLACH, 1997). Boreo-montane species are more common in the subalpine zone where only a few species with arcto-alpine distribution regularly occur. Traditionally the subalpine zone, dominated by coniferous forests, is considered to be the zone where most boreo-montane species occur. At present, the forests of this zone are fragmented and contain wide open areas with a high diversity of living conditions. Subalpine communities may therefore represent a mixed set of species with different life strategies, distribution and habitat preferences. In contrast to the alpine zone, the proportion of species typical for lowland communities is higher in the subalpine zone. In subalpine communities they probably occupy places which in higher zones are occupied by montane species and/or species with a northern-montane distribution. Many papers dealing with mountain spiders discuss faunistic data from boreo-montane and arctic-alpine species (THALER, 1976, 1988, 1998, THALER, KNOFLACH, 1997; ZINGERLE, 1997). Only sparse data are available about their proportions in mountain spider communities. We tried to analyse the data of spider communities in the subalpine zone and to evaluate the proportion of species with a northern-montane distribution in these communities.

Material and methods

Epigeic spider communities from 57 localities situated at altitudes from 1500 to 2300 m were analysed and proportions of both groups of spiders were evaluated. Material for comparison was collected during our own investigations in the Gastein Valley (Salzburg, Austria) in 1993-1994 (RELYS, 1996). Published data about subalpine epigeic spider communities in the Alps of Salzburg (THALER et al., 1978), Carinthia (THALER, 1989) and North and South Tyrol (PUNTSCHER, 1980; THALER, 1982, 1984; ZINGERLE, 1997, 1998) were also used. All data were collected during the long term investigations by means of pitfall traps. Communities with less than 200 caught specimens or which were investigated for less than three months were not included in the analysis.

Results

13 arctic-alpine and 14 boreo-montane spider species were present in the analysed communities. Distribution type and taxonomic status of some species depending on subspecies or allospecies in the northern regions are still under discussion (BUCHAR 1971, ESKOV, 1981; HOLM 1970, PALMGREN, 1973; THALER, 1970, 1976, 1988, 1998; THALER, KNOFLACH, 1995). The species *Pardosa giebeli* (PAVESI), *Pardosa cincta* (KULCZYŃSKI), *Diplocephalus rostratus* SCHENKEL, *Hilaira montigena* (L. KOCH) and *Scotinotylus clavatus* (SCHENKEL) were consid-

ered here as arctic-endemic species and were not included in the present analysis. Seven arctic-alpine species known from the Alps are confirmed as living in nival (*Erigone tirolensis* L. KOCH, *Lepthyphantes complicatus* (EMERTON)) and/or alpine zones (*Entelecara media* KULCZYŃSKI, *Scotinotylus evansi* (O. P.-CAMBRIDGE), *Meioneta nigripes* (SIMON), *Mecynargus paetulus* (O. P.-CAMBRIDGE) and *Pellenes lapponicus* (SUNDEVALL)) (THALER, 1988). They do not occur in the investigated subalpine communities. 27 species with a northern-montane distribution found in subalpine communities are shown in Table 1.

Arctic-alpine species

13 arctic-alpine species were discovered in the 35 communities investigated. The lowest subalpine locality where an arctic-alpine species occurred was at 1618 m (*Meioneta gulosa* (L. KOCH)) (RELYS, 1996). Arctic-alpine species are more common at altitudes above 1850 m and are mostly found over 2100 m. More than 10% of all specimens in a community usually belong to arctic-alpine species at altitudes above 2100 m.

As mentioned above, arctic-alpine species in the Alps are rarely present in high subalpine localities. Nevertheless, these species may become dominant in some cases: *Tiso aestivus* (L. KOCH) (23%) at 2150 m or *Arctosa alpigena* (DOLESCHALL) (7.7%) at 2175m (RELYS, 1996; THALER, 1982). Such communities with a high proportion of arctic-alpine species were found only at altitudes above 2100 m. Only two arcto-alpine species, *Erigone remota* L. KOCH and *Acantholycosa norvegica* (THORELL), were present in large numbers at two localities at lower altitudes (1800-1900 m) (RELYS, 1996). In most cases *E. remota* was a highly dominant species making up 30.2% or 26.2% of all individuals in the community. Such a community structure is typical for the northern regions where communities are built up from low numbers of very abundant species. *A. norvegica* is a stenotopic species living in stony debris. If a suitable habitat is available, this species occurs in the middle subalpine zone and could become a dominant (RELYS, 1996). In the upper subalpine zone only two arctic-alpine species belonging to the family Gnaphosidae were found (*Micaria alpina* L. KOCH and *Gnaphosa leporina* (L. KOCH)). These species are not very abundant and at best they make up 1.1% (*M. alpina*) and 3.7% (*G. leporina*) of a community (PUNTSCHER, 1980). They were found in investigated subalpine communities only in Obergurgl and in two high subalpine communities in the Gastein valley (PUNTSCHER, 1980; RELYS, 1996). Another single record of *M. alpina* comes from South Tyrol (ZINGERLE, 1997). In the other 47 subalpine communities these species were not recorded. *Mecynargus morulus* (O.P.-CAMBRIDGE) is a typical species for the alpine zone but in some communities of the transitional zone between subalpine and alpine zones (2175-2260 m) up to 4.7% specimens belong to this species (PUNTSCHER, 1980; RELYS, 1996; THALER 1989). *Panamomops tauricornis* (SIMON) seems to be one of the arcto-alpine species preferring light coniferous forests in the high subalpine zone close to the timberline (THALER, 1982; ZINGERLE, 1997).

The most common arcto-alpine species in the subalpine zone are *M. gulosa* and *Oreonetides vaginatus* THORELL. They often occur in various habitats of the high subalpine

T a b l e 1. Acrtic-alpine and boreo-montane species with a northern-montane distribution. The highest value of dominance (%) and the number of communities in which the species were found is shown for each species.

arctic-alpine species	%	No.
Erigone remota L. K.	30.2	4
Latithorax faustus (O.P.-C.)	3.5	1
Mecynargus morulus (O.P.-C.)	4.7	5
Panamomops tauricornis (SIMON)	0.5	3
Tiso aestivus (L. K.)	23	2
Walckenaeria clavicornis (EMER.)	0.4	1
Meioneta gulosa (L. K.)	3.6	14
Oreonetides vaginatus TH.	2	16
Acantholycosa norvegica (TH.)	11.5	2
Arctosa alpigena (DOLE.)	7.7	8
Gnaphosa leporina (L. K.)	3.7	9
Micaria alpina L. K.	1.1	11
Xysticus obscurus COLL.	0.3	1

boreo-montane species	%	No.
Diplocentria bidentata (EMER.)	11.5	5
Microcentria rectangulata (EMER.)	0.5	1
Panamomops palmgreni THAL.	3	7
Scotinotylus alpigenus (L. K.)	2.6	7
Sisicus apertus (HOLM)	0.3	1
Bolyphantes index (TH.)	0.4	2
Hilaira tatrica KULC.	6.2	10
Lepthyphantes antroniensis SCHE.	0.8	5
Lepthyphantes cornutus SCHE.	2	4
Stemonyphantes conspersus (L. K.)	0.1	2
Robertus scoticus JACK.	1.2	4
Alopecosa pinetorum TH.	11.2	3
Micaria aenea TH.	1.6	18
Sitticus saxicola (C.L. K.)	0.3	1

zone but are seldom abundant. At best, *O. vaginatus* makes up 2% and *M. gulosa* 3.6% of all specimens in a community (RELYS, 1996; THALER, 1989). Despite some individuals reaching lower subalpine altitudes (1618 m, *M. gulosa*), most of the communities where these species appear are situated above 1850-1900 m.

The occurrence of two arctic-alpine species in low and middle subalpine communities (1600-1720 m) in South Tyrol (ZINGERLE, 1997) was remarkable. In this region *O. vaginatus* was found at an altitude of 1720 m, and *Latithorax faustus* (O. P.-CAMBRIDGE) at 1590 m. *L. faustus* made up 3.5% of all individuals in the spider community of subalpine pasture. This species was not found in the other subalpine communities.

Boreo-montane species

14 boreo-montane spider species were found in 36 communities. Only a small number of these species made up a remarkable part of the spider communities. It is thought that most boreo-montane species are found in subalpine coniferous forests. Actually these species reach their highest level of dominance in open and forest habitats in the high subalpine zone close to the timberline. Only 4 of all the investigated communities had more than 5% of all specimens belonging to boreo-montane species (RELYS, 1996; THALER, 1982, 1984). All these communities (with the exception of one dominated by *Alopecosa pinetorum* (THORELL) were located at altitudes above 1900 m and were found in light coniferous habitats on the timberline ecotone. Usually 0.4-2% of specimens found in subalpine communities belonged to boreo-montane species.

The community with the highest number of boreo-montane species and specimens was found at 1900 m, at a site with stony debris covered by mosses, *Pinus mugo*, *Vaccinium* and *Rhododendron* (THALER, 1989). In this community 13% of all species and 15% of all specimens belonged to boreo-montane species. A similar community of *P. mugo* with an important component of boreo-montane spider species was investigated in South Tyrol at 1930 m by ZINGERLE (1997). No communities where more than 4% of specimens belonged to boreo-montane species were found at altitudes lower than 1800 m. As mentioned, many of the boreo-montane species occurred in light coniferous forests near the timberline but in most cases they were not numerous. Only four boreo-montane spider species (*Hilaira tatrica* KULCZYŃSKI, *Lepthyphantes cornutus* SCHENKEL, *Stemonyphantes conspersus* (L. KOCH) and *Robertus scoticus* JACKSON) were found in subalpine spruce forests. Some boreo-montane species (*H. tatrica, Micaria aenea* THORELL and *Panamomops palmgreni* THALER) were typical components of the communities of dwarf-shrub heaths situated in a low subalpine zone, making up 2-3% of specimens (RELYS, 1996).

In high subalpine dwarf-shrub heaths 11.5% of all specimens belonged to *Diplocentria bidentata* (EMERTON) (THALER, 1982). *A. pinetorum* is a rare species and it has a very local distribution (THALER, BUCHAR, 1994), but in some habitats more than 11% of all specimens belong to this species (RELYS, 1996). *H. tatrica* was a common boreo-montane species making up to 6.2% of individuals in light coniferous forests at altitudes of 1800 m (THALER, 1984). This species was less numerous in dwarf-shrub heaths at different altitudes. *Scotinotylus alpigenus* (L. KOCH) was best represented in a similar habitat in North Tyrol (THALER, 1984). This species occurred in low numbers in subalpine forest habitats in South Tyrol. *Lepthyphantes antroniensis* SCHENKEL also occurred in low numbers in communities in the high subalpine zone at altitudes over 1800 m. In most cases this species was found in light coniferous forests at altitudes of 1900-2000 m (THALER, 1984; ZINGERLE, 1997). One of the most common boreo-montane species is *M. aenea* occurring in 18 communities and preferring light habitats, but never reaching high levels of dominance. This species seems to be the boreo-montane species with the highest ability to inhabit different localities in mountainous areas and often reaches lower altitudes (RELYS, 1996). *L. cornutus* is probably a typical boreo-montane woodland species. It was found in low subalpine spruce forests (THALER, 1982) and reached its highest dominance of 2% in high subalpine larch forests (ZINGERLE, 1997). *R. scoticus* does not show high dominance in communities or special habitat preference. It probably has a tendency to inhabit light coniferous forests. *P. palmgreni* is more numerous in habitats with a well developed shrub layer. The most numerous occurrence of this species was found in a stand of *P. mugo* at an altitude of 1930 m in South Tyrol (ZINGERLE, 1997). This species usually prefers altitudes of 1900-2050 m. In the dwarf-shrub communities of the Gastein valley (at altitudes of 1600-1650 m) up to 2% of specimens belong to this species (RELYS, 1996).

Five boreo-montane species were rare and they were found only as a few specimens: *Sisicus apertus* (HOLM), *Microcentria rectangulata* (EMERTON), *Bolyphantes index* (THORELL), *S. conspersus, Sitticus saxicola* (C. L. KOCH). The species *S. apertus, M. rectangulata* and *S. saxicola* were recorded only from communities in South Tyrol. 10 out of 14 recorded

boreo-montane species were found in 9 communities in this region (ZINGERLE, 1997). In comparison to South Tyrol, only 5 boreo-montane species were found in 18 subalpine communities investigated in the Gastein valley (RELYS, 1996).

Collinsia nemenziana THALER, 1980

Considering arcto-alpine and boreo-montane species, some unusual data on the ecology and distribution of *Collinsia nemenziana* THALER may be mentioned. *C. nemenziana* (Linyphiidae, Erigoninae) was described in 1980 and was considered to be an alpine-endemic species which may be distributed in open subalpine habitats up to 1900 m (THALER, 1980). ESKOV (1990) proposed that *C. nemenziana* was a junior synonym of *C. caliginosa* (L. KOCH, 1879) which was found in arctic regions. This species should therefore be considered as arctic-alpine. In the Alps *C. nemenziana* shows a pattern of distribution and habitat selection atypical for an arctic-alpine species. Most individuals were caught in the middle subalpine zone where no other arctic-alpine species occur. At open sites even 8-9% of all individuals in some subalpine communities belong to this species (RELYS, 1996). In this respect *C. nemenziana* resembles typical alpine-endemic Erigoninae species like *Silometopus rosemariae* WUNDERLICH and *Erigone cristatipalpis* SIMON and shows similar levels of dominance in some communities. If *C. nemenziana* = *C. caliginosa* and therefore really is an arctic-alpine species, it may be that it is an arctic-alpine species inhabiting low altitudes. Its preferred altitude is situated about 500-800 m lower than that of other arctic-alpine species. According to ecological data *C. nemenziana* is more like an alpine-endemic species. Further taxonomic investigations may help to solve this problem.

Conclusions

Despite high species richness neither boreo-montane nor arctic-alpine spiders, nor both groups together, can make up such a significant part of subalpine spider communities as do alpine-endemic species. In most communities this is caused by the high dominance of alpine-endemic Lycosidae species like *Pardosa oreophila* SIMON. Some arctic-alpine species may inhabit suitable habitats in high subalpine zones and represent an important part of these communities. The role of arctic-alpine species in epigeic spider communities can be recognised only in communities at altitudes over 1800 m. There are no arctic-alpine species occurring only in subalpine communities. All arctic-alpine species recorded in subalpine zones are better represented in the alpine zone. *A. norvegica* occurring in communities of stony debris habitats may be an exception. Some boreo-montane species seem to prefer habitats in the subalpine zone (*H. tatrica, P. palmgreni* and *A. pinetorum*). Only a few boreo-montane species could become numerous and therefore reach high levels of dominance in the subalpine communities (*D. bidentata* and *A.*

pinetorum). More often arctic-alpine species (*E. remota, A. alpigena* and *T. aestivus*) are highly dominant. The boreo-montane species were best represented in the communities on the localities situated near the timberline at altitudes from 1800 m up to 2000 m. The small proportion of these species in lower woodland communities is due to the presence of abundant species typical of lowland habitats. Lowland species decrease with increasing altitude and boreo-montane species become more predominant at higher altitudes with more extreme living conditions.

References

Christandl-Peskoller, H., Janetschek, H., 1976: Zur Faunistik und Zoozönotik der südlichen Zillertaler Hochalpen. Veröffentlichungen der Universität Innsbruck, *101*, Alpin-biologische Studien, 7, p. 1-134.

Buchar, J., 1971: Die Verwandschaftsbeziehungen der Art *Pardosa cincta* (Kulczyński) (Araneae, Lycosidae). Acta Universitatis Carolinae Biologica, *15*, p. 121-129.

Eskov, K.Y., 1981: Taxonomy of spiders of the genus *Hilaira* (Aranei, Linyphiidae). Zoologicheskij Zhurnal, *60*, p. 1480-1486.

Eskov, K.Y., 1990: The spider genus *Collinsia* O. Pickard-Cambridge 1913 in the fauna of Siberia and the Soviet Far East (Arachnida, Araneae: Linyphiidae). Senckerbergiana biologica, *70*, p. 287-298.

Holm, A., 1970: Notes on spiders collected by the 'Vega' expedition 1878 – 1880. Entomologica Scandinavica, *1*, p. 188-208.

Palmgren, P., 1973: Beiträge zur Kenntnis der Spinnenfauna der Ostalpen. Commentationes biologici, *71*, p. 1-52.

Puntscher, S., 1980: Ökologische Untersuchungen an Wirbellosen des zentralalpinen Hochgebirges (Obergurgl, Tirol) 5. Verteilung und Jahresrythmik von Spinnen. Veröffentlichungen der Universität Innsbruck, *129*, Alpin-biologische Studien, 14, p. 1-106.

Relys, V., 1996: Eine vergleichende Untersuchung der Struktur und der Lebensraumbindung epigäischer Spinnengemeinschaften (Arachnida, Araneae) des Gasteinertals (Hohe Tauern, Salzburg, Österreich). Dissertation, Universität Salzburg.

Thaler, K., 1970: Über einige wenig bekannte Zwergspinnen aus den Alpen (Arach., Araneae, Erigonidae). Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *58*, p. 255-276.

Thaler, K., 1976: Endemiten und arktoalpine Arten in der Spinnenfauna der Ostalpen (Arachnida: Araneae). Entomologica Germanica, *3*, p.135-141.

Thaler, K., 1980: Über wenig bekannte Zwergspinnen aus den Alpen – VI (Arachnida: Aranei, Erigoninae). Revue Suisse de Zoolgie, *87*, p.: 579-603.

Thaler, K., 1981: Neue Arachniden-Funde in der nivalen Stufe der Zentralalpen Nordtirols (Österreich) (Aranei, Opiliones, Pseudoscorpiones). Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *68*, p. 99-105.

Thaler, K., 1982: Fragmenta Faunistica Tirolensia – V. (Arachnida...Saltatoria) – V. Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *69*, p. 53-78.

Thaler, K., 1984: Fragmenta Faunistica Tirolensia – VI. (Arachnida...Carabidae). Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, 71, p. 97 -118.

Thaler, K., 1988: Arealformen in der nivalen Spinnenfauna der Ostalpen (Arachnida, Aranei). Zoologischer Anzeiger, *220*, p. 233-244.

Thaler, K., 1989: Epigäische Spinnen und Weberknechte (Arachnida: Aranei, Opiliones) im Bereich des Höhentransektes Glocknerstraße – Südabschnitt (Kärnten, Österreich). Veröffentlichungen des österreichischen MaB-Programms, *13*, p. 201-216.

Thaler, K., 1992: Weitere Funde nivaler Spinnen (Aranei) in Nordtirol und Beifänge. Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *79*, p. 153-159

Thaler, K., 1998: Die Spinnen von Nordtirol (Arachnida, Araneae): Faunistische Synopsis. Veröffentlichungen des Tiroler Landesmuseums Ferdinandeum, *78*, p. 37-58.

Thaler, K., Buchar, J., 1994: Die Wolfspinnen von Österreich 1: Gattungen *Acantholycosa, Alopecosa, Lycosa* (Arachnida, Araneida: Lycosidae). Faunistisch-tiergeographische Übersicht. Carinthia II, *184*, p. 357-375.

Thaler, K., Knoflach, B.,1995: *Xysticus obscurus* Collett – eine arktoalpine Krabbenspinne neu für Österreich. Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *82*, p. 145-152.

Thaler, K., Knoflach, B.,1997: Funde hochalpiner Spinnen in Tirol 1992 – 1996 und Beifänge. Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *84*, p. 159-170.

Thaler, K., De Zordo, I., Meyer, E., Schatz, H., Troger, H., 1978: Arthropoden auf Almflächen im Raum von Badgastein (Zentralalpen, Salzburg, Österreich). In Cernusca, A. (ed.): Ökologische Analysen von Almflächen im Gasteiner Tal. Veröffentlichungen des österreichischen MaB-Programms Hohe Tauern, *2*, p. 195-233.

Zingerle, V., 1997: Epigäische Spinnen und Weberknechte im Naturpark Puez-Geisler (Dolomiten, Südtirol). Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck, *84*, p. 171-226.

Zingerle, V., 1998. Ragni e opilioni del Monte Grappa, Dolomiti, Italia (Araneae, Opiliones). Convegno „Aspetti naturalistici della provincia di Belluno“, p. 227-245.