A new Palearctic species of the genus *Sitticus* Simon, with notes on related species in the *floricola* group (Araneae, Salticidae)

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Summary

Sitticus inexpectus sp.n. (from Britain, C. and N. Europe, Russia, Kazakhstan and Kirghizstan) is described and distribution maps provided. It is closely related to *S. caricis* (Westring) and *S. rupicola* (C. L. Koch) and has previously been misidentified as either of these. New faunistic data for *S. monstrabilis* Logunov are given. Illustrations are provided for the four species mentioned.

Introduction

The genus *Sitticus* has been the subject of considerable interest in recent years, several of its species being allocated to separate informal groups by shared characteristics in the copulatory organs (Prószyński, 1968, 1971, 1973, 1980, 1983; Harm, 1973). Even a provisional phyletic tree has been proposed (Prószyński, 1983) without, however, supporting analysis of the characters used.

In his revision of the *floricola* species group, Prószyński (1980) dealt with nine species, of which *S. gertschi* Prószyński was later synonymised with *S. cutleri* Prószyński by Nenilin (1984b). Logunov (1992) recently described two additional new species from the same group, *S. monstrabilis* and *S. pulchellus*. Also, *S. sylvestris* Emerton has been recognised by W. P. Maddison as a separate species, being closely related to *S. caricis* (Westring) (B. Cutler, pers. comm.). Thus, up to now 11 valid species have been documented from this species group. In the present contribution a new sibling species of *S. caricis* is described.

Sitticus inexpectus sp.n. has been recorded for a long time as either *S. caricis* or *S. rupicola* (C. L. Koch). Kronestedt (1983) was the first author who reported it as probably an undescribed *Sitticus* species (but did not name it). The specimens were found during a survey of the spider fauna of an extensive steppe-like area on limestone on the island of Öland in SE Sweden. Specimens (females only) identified as *S. rupicola* had previously been reported from the same habitat on Öland (Lohmander, 1942; Tullgren, 1944). Though the epigynes of the latter are now lacking (specimens preserved in the Natural History Museum, Gothenburg), it is most plausible that they belong to *S. inexpectus*. Kronestedt (1983) also mentioned the presence of this species on the island of Gotland.

Material identified as *S. rupicola* has been known from coastal areas in Estonia (Vilbaste, 1969, 1987). Estonian specimens were studied by Prószyński (1980) who listed them under the name *rupicola*. He (op. cit., p. 17) found differences in coloration between these and specimens from the Tatra Mts. but thought that the discrepancies were probably due to geographical variation "which deserves separate research, perhaps". Further study of specimens from Estonia shows that they belong to *S. inexpectus*, as suspected by Kronestedt (1983).

The presence of *S. rupicola* in Britain has for many years not been questioned despite biogeographical reasons for doing so. [In fact, Locket & Millidge (1951: 232) had a reservation regarding the identity of the British specimens.] After comparison with Central European material of *S. rupicola* as well as material of *S. inexpectus* we conclude that it is the latter species which occurs in Britain.

The occurrence of *S. inexpectus* in Poland was discovered when one of us (DVL) re-examined a specimen previously identified as *S. rupicola* (and listed under that name in Prószyński, 1961). The presence of *S. inexpectus* in Germany and Austria was revealed from material kindly placed at our disposal by German and Austrian colleagues, respectively.

Sitticus inexpectus has repeatedly been recorded from Western Asiatic areas of the former USSR as either *S. rupicola* (Charitonov, 1969; Danilov & Logunov, 1993) or *S. caricis* (Nenilin, 1984a, 1985: in part).

Finally, we provide new faunistic data for *S. monstrabilis*, hitherto known only from E. Kazakhstan (Logunov, 1992). Thus, a revised list of the *floricola* species group now includes the following twelve species:

Sitticus caricis (Westring, 1861)—Europe, Far East
S. cutleri Prószyński, 1980—C. and E. Siberia, N. America
S. floricola (C. L. Koch, 1837)—Palaearctic
S. inexpectus sp.n.—W., C. and N. Europe, Russia, SE Kazakhstan, Kirghizstan
S. magnus Chamberlin & Ivie, 1944—N. America
S. monstrabilis Logunov, 1992—SE Kazakhstan, Kirghizstan
S. palustris (Peckham & Peckham, 1883)—N. America [as *S. floricola palustris* in Prószyński (1980)]
S. pulchellus Logunov, 1992—S. Kazakhstan, Kirghizstan [not in the *saxicola* group as suggested by Logunov (1992); description of female by Logunov (1995)]
S. rupicola (C. L. Koch, 1837)—C. and S. Europe (Balkans)
S. striatus Emerton, 1911—N. America, Europe (?) (see Prószyński, 1980)
S. sylvestris Emerton, 1891—N. America
S. zimmermanni (Simon, 1877)—Europe, W. Siberia

Among these, *S. caricis, S. inexpectus, S. magnus* and *S. rupicola* (and probably *S. sylvestris*, see above) form a set of species with very similar configuration of the female copulatory organ. We may refer to them collectively as the *rupicola* complex.

As salticids are especially suitable for studying courtship behaviour, future ethotaxonomical investigations within this complex may provide support for the present

limitation or for further splitting of species based on morphological characteristics. For biogeographical reasons, it would be interesting to compare courtship in European and certain Asian populations currently assigned to *S. inexpectus*. So far we have not found any morphological characteristics which we regard as decisive for separating European from Asian specimens at the species level. We cannot, however, exclude differences at some infraspecific level.

Material and abbreviations

The specimens examined have been borrowed from/will be housed in the following museums/private collections: BMNH=Natural History Museum, London, England (P. D. Hillyard); CPH=Peter Harvey, Grays, England; CPM=Peter Merrett, Swanage, England; CTB=Theo Blick, Hummeltal, Germany; CVR=Vygandas Relys, Vilnius, Lithuania; ISE=Zoological Museum, Institute for Systematics and Ecology of Animals, Novosibirsk, Russia (D. V. Logunov); IZBE=Institute of Zoology and Botany, Estonian Academy of Sciences, Tartu, Estonia (J. Viidalepp); IZW=Museum and Institute of Zoology, Warszawa, Poland (W. Jędryczkowski); NMB=Naturhistorisches Museum, Basel, Switzerland (A. Hänggi); NMW=Naturhistorisches Museum, Wien, Austria (J. Gruber); NRS=Swedish Museum of Natural History, Stockholm, Sweden (T. Kronestedt); PSU=Zoological Department, Perm State University, Perm, Russia (S. L. Esyunin); ZIP=Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia (V. I. Ovtsharenko); ZMB=Naturhistorisches Museum, Berlin, Germany (M. Moritz); ZMMU=Zoological Museum of Moscow State University, Moscow, Russia (K. G. Mikhailov); ZMUU=Zoological Museum of Uppsala University, Uppsala, Sweden (T. Jaenson).

Abbreviations used: AME=anterior median eyes, ALE=anterior lateral eyes, PME=posterior median eyes, PLE=posterior lateral eyes, d=dorsal, v=ventral, pr=prolateral, rt=retrolateral, ap=apical, Fe=femur, Pt=patella, Ti=tibia, Mt=metatarsus, Ta=tarsus. For leg spination, the system adopted by Ono (1988) is used. Measurements are given in millimetres.

Sitticus inexpectus, sp.n. (Figs. 1–6, 10, 13–17, 21–26, 30, 31, 36–40, 42–44)

Sitticus rupicola (misidentification): Tullgren, 1944: 28–29 (in part: at least illustrations of male palp and vulva were apparently made from foreign material of *S. rupicola*); Locket & Millidge, 1951: 232, figs. 112C, 113D (♂♀); Vilbaste, 1969: 183–185, figs. 152, 153 (♂♀); Jones, 1983: 152, fig. on p. 153 (♀ habitus); Roberts, 1985: 126, fig. 52d, g (♂♀).

Sitticus sp.: Kronestedt, 1983: 196–198, fig. 9 (♀ habitus).

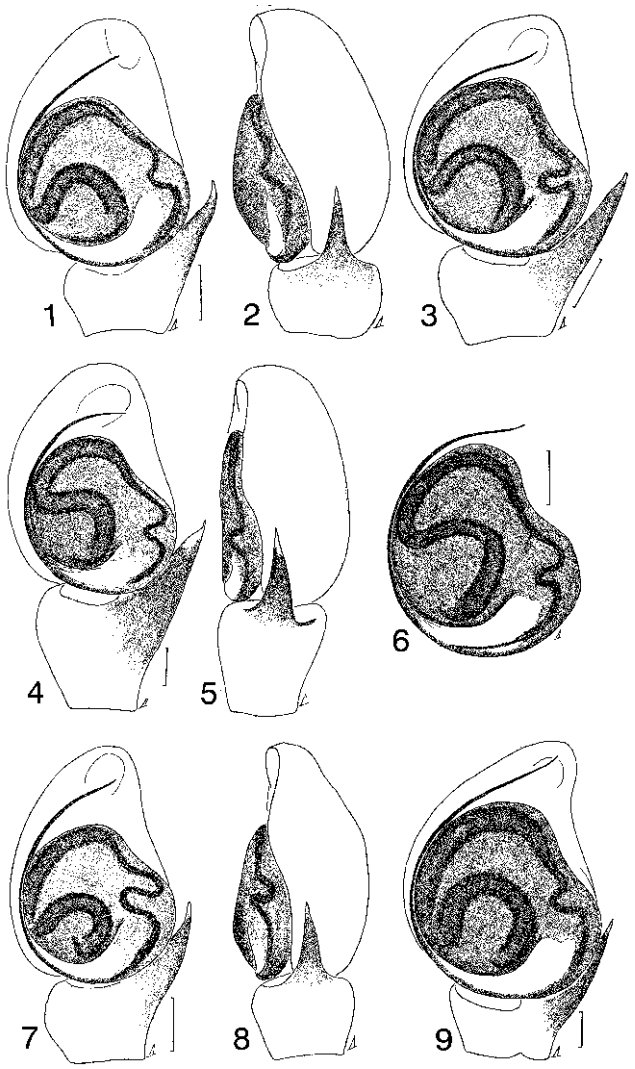
Type: Holotype ♂ (NRS) from Sweden: Öland, Resmo, W of Lake Möckelmossen, pitfall trap, 8–20 June 1978 (T. Kronestedt).

Etymology: The species name is derived from a Latin word meaning unexpected.

Diagnosis (cf. also Table 1). *Sitticus inexpectus* is closely related to *S. caricis* and *S. rupicola*. From *S. caricis* it can be distinguished by body coloration (*S. caricis* usually has no specific colour markings, cf. Fig. 47), male palp with more conspicuous white pilosity, and size of epigynal pocket (cf. Figs. 21–26 with 28). For habitus, see also Jones [1983: p. 153, *S. inexpectus* (sub *S. rupicola*, specimen from Britain, D. Jones pers. comm.) and *S. caricis*]. From *S. rupicola* the new species differs by the pattern of white hairs on male carapace (cf. Fig. 40 with 41), proportions of the male palp (cf. Fig. 10 with 12), and configuration of the internal female genitalia (cf. Figs. 21–26, 30 with 27, 29).

Description: Male holotype: Measurements: Carapace 1.85 long, 1.38 wide, 0.80 high at PLE. Ocular area 0.83 long, 1.10 wide anteriorly and 1.13 wide posteriorly. Diameter of AME 0.33. Abdomen 1.75 long, 1.48 wide. Cheliceral length 0.63. Clypeal height 0.14. Length of leg segments:

	Fe	Pt	Ti	Mt	Ta	Total
I	1.08	0.55	0.75	0.65	0.40	3.43
II	0.85	0.50	0.55	0.45	0.38	2.73
III	0.83	0.45	0.48	0.53	0.35	2.64
IV	1.33	0.60	0.83	0.70	0.48	3.94



Figs. 1–9: Left male palp (2, 5, 8 in retrolateral view, others in ventral view). **1–6** *Sitticus inexpectus* sp.n. (1,2 holotype from Sweden, 3 from England, 4-6 from Kirghizstan); **7, 8** *S. caricis* (Sweden); **9** *S. rupicola* (Austria). Scale lines=0.1 mm.

Leg spination: Leg I: Fe d 0-1-1-2; Pt pr 0-1-0; Ti pr 1-1, v 2-2-2ap; Mt v 2-2ap. Leg II: Fe d 0-1-1-3; Ti pr and v 1-1; Mt v 2-2ap. Leg III: Fe d 0-1-1-3; Pt pr and rt 0-1-0; Ti pr and rt 1-1, v 2ap; Mt pr 1-2ap, rt 1-1-2ap, v 2ap. Leg IV: Fe d 0-1-1-3; Pt pr and rt 0-1-0; Ti d 1-0, pr and rt 1-1-1, v 1-2ap; Mt pr and rt 1-1-2ap, v 2ap.

Coloration: Carapace brown to dark brown, bordered by a line of white hairs which on each side widens at level of coxae III and from there gives off a stripe of white hairs projecting upwards on lateral slope (Fig. 40, *arrow*). Eye field black; a transverse stripe of white hairs between and above ALEs (passing above AMEs). Carapace with three longitudinal stripes composed of white hairs: one along midline of carapace (often distinct as a median spot between PLEs and as a median longitudinal stripe just before and at beginning of posterior carapacal slope), one at each side, starting above PME, continuing below PLE and becoming more diffuse with rather scattered hairs behind PLE. Sternum, maxillae, labium and chelicerae brownish. Abdomen: dorsum as in Fig. 37 or 39, venter yellowish to brownish grey. Book-lung covers and spinnerets yellowish to brownish grey. Legs mottled (yellowish and brownish), Fe distally darker (most of Fe I may be dark, Fe IV usually dark only distally), Ti and Mt with traces of annulation. Palp: Fe dark brownish (dorsoapically lighter), Pt dorsally yellowish to light brown, Ti and cymbium brownish; dorsodistal part of Fe and dorsal part of Pt densely covered with white hairs; Ti with long white hairs pro- and retrolaterally; cymbium with some scattered white hairs dorsally.

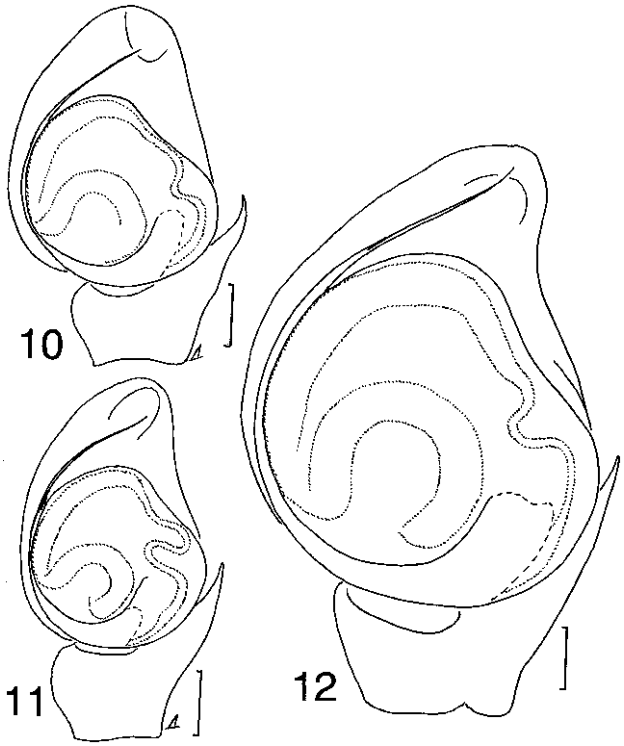
Palp: Structure as in Figs. 1–6, 10.

Female (England): Measurements: Carapace 2.33 long, 1.88 wide, 1.15 high at PLE. Ocular area 0.98 long, 1.38 wide anteriorly and 1.48 wide posteriorly. Diameter of AME 0.40. Abdomen 2.83 long, 2.15 wide. Cheliceral length 0.68. Clypeal height 0.15. Length of leg segments:

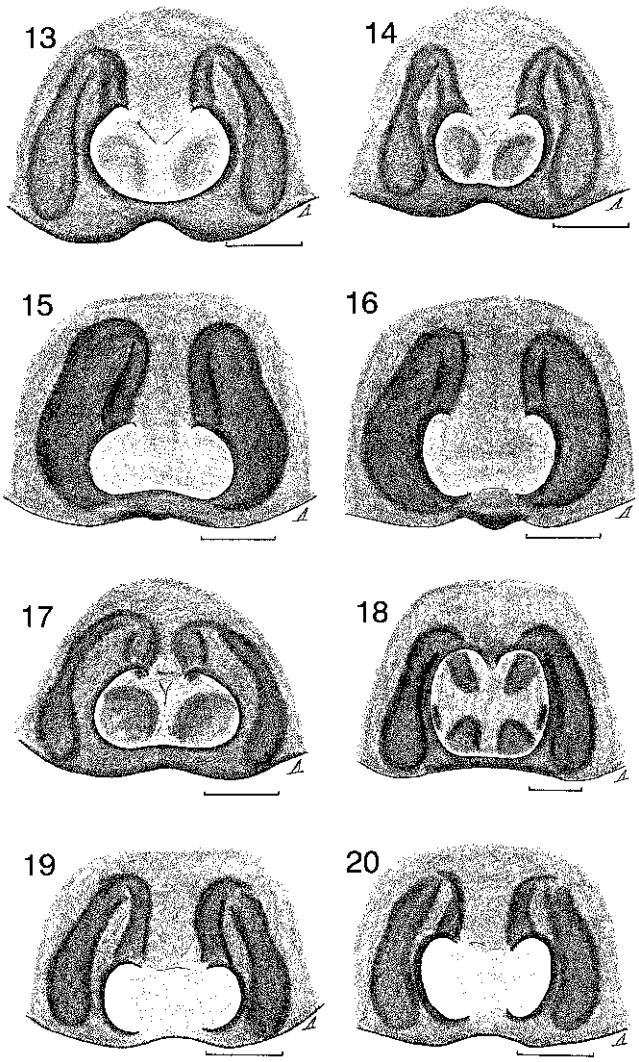
	Fe	Pt	Ti	Mt	Ta	Total
I	1.18	0.73	0.78	0.59	0.43	3.71
II	1.08	0.70	0.63	0.58	0.40	3.39
III	1.05	0.55	0.60	0.68	0.40	3.28
IV	1.83	0.83	1.20	1.05	0.53	5.44

Leg spination: Leg I: Fe d 0-1-1-2; Ti v 2-2-2ap; Mt v 2-2ap. Leg II: Fe d 0-1-1-2; Ti v 1-1-2ap; Mt v 2-2ap. Leg III: Fe d 0-0-1-3; Pt pr and rt 0-1-0; Ti pr and rt 1-1-1, v 1-2ap; Mt pr 2-2ap, rt 1-1-2ap, v 2ap. Leg IV: Fe d 0-1-1-2; Pt pr and rt 0-1-0; Ti pr and rt 1-1-1, v 1-2ap; Mt pr 2-1-2ap, rt 1-1-2ap, v 2ap.

Coloration: Lighter than male. Carapace with white hairs in thoracic part forming a very indistinct pattern of oblique, curved streaks from midline towards sides (cf. Figs. 43, 44). Clypeus densely covered with white hairs. Abdomen: dorsum as in Figs. 36, 38. Legs yellowish brown with more contrasting dark annulation/pseudoannulation. Fe may be yellowish brown except



Figs. 10–12: Left male palp (ventral view) drawn to same scale for size comparison. **10** *Sitticus inexpectus* sp.n.; **11** *S. caricis;* **12** *S. rupicola.* Scale lines=0.1 mm.



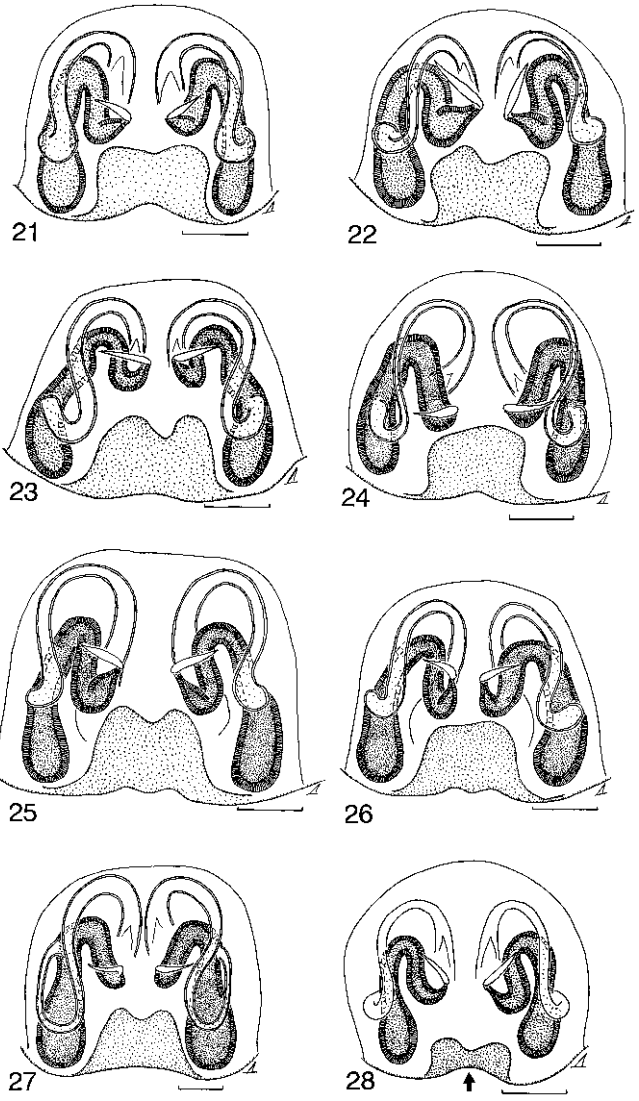
Figs. 13–20: Epigynes. **13–17** *Sitticus inexpectus* sp.n. (13, 14 from Sweden, 15, 16 from Kirghizstan, 17 from England); **18** *S. rupicola* (Austria); **19, 20** *S. caricis* (Sweden). Scale lines=0.1 mm.

for dark distal part, and sometimes have an indistinct, somewhat darker, more or less complete ring in proximal half.

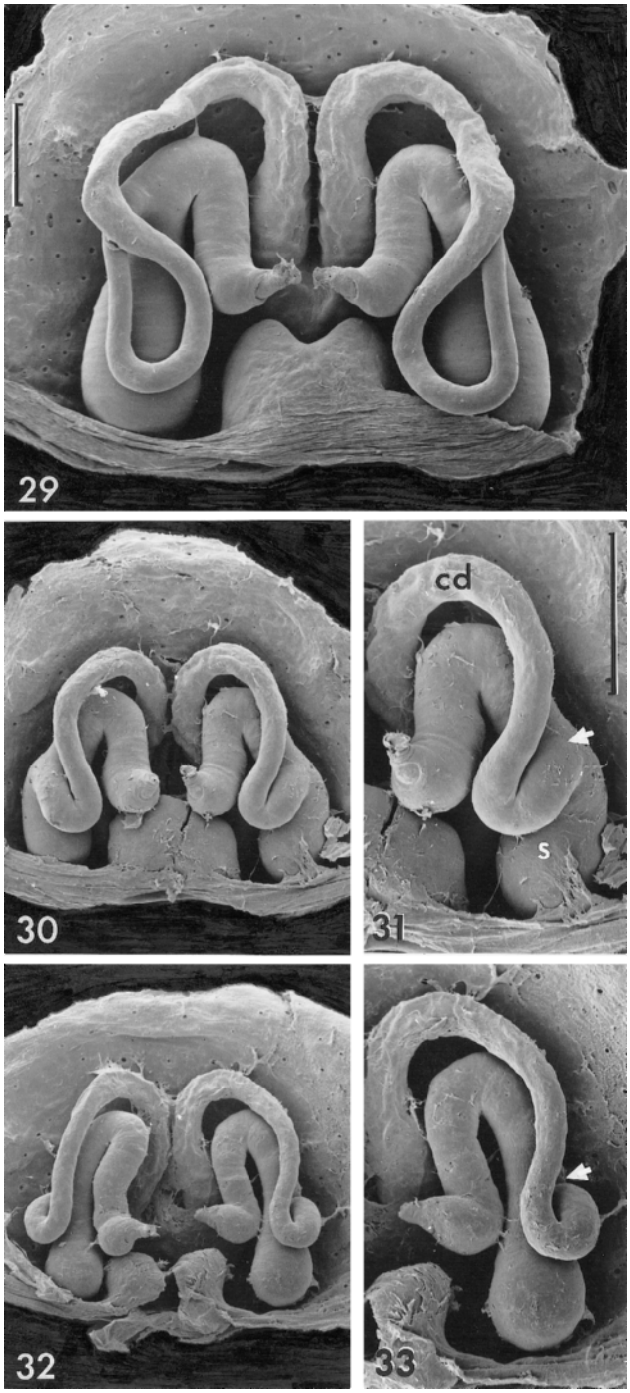
Epigyne: As in Figs. 13–17, internal parts as in Figs. 21–26, 30, 31 (see Table 1).

Variation: We are aware of variability in characters such as the small loop of the sperm duct in the bulbus (cf. Figs. 1–6, 10) and the loop of the copulatory ducts in the female (cf. Figs. 21–26). We regard these as intraspecific variations. Most males that we have seen from Britain have a sperm duct loop in the bulbus like Fig. 3, but in one (from Bridgwater Bay), the loop is similar to that illustrated in Fig. 4.

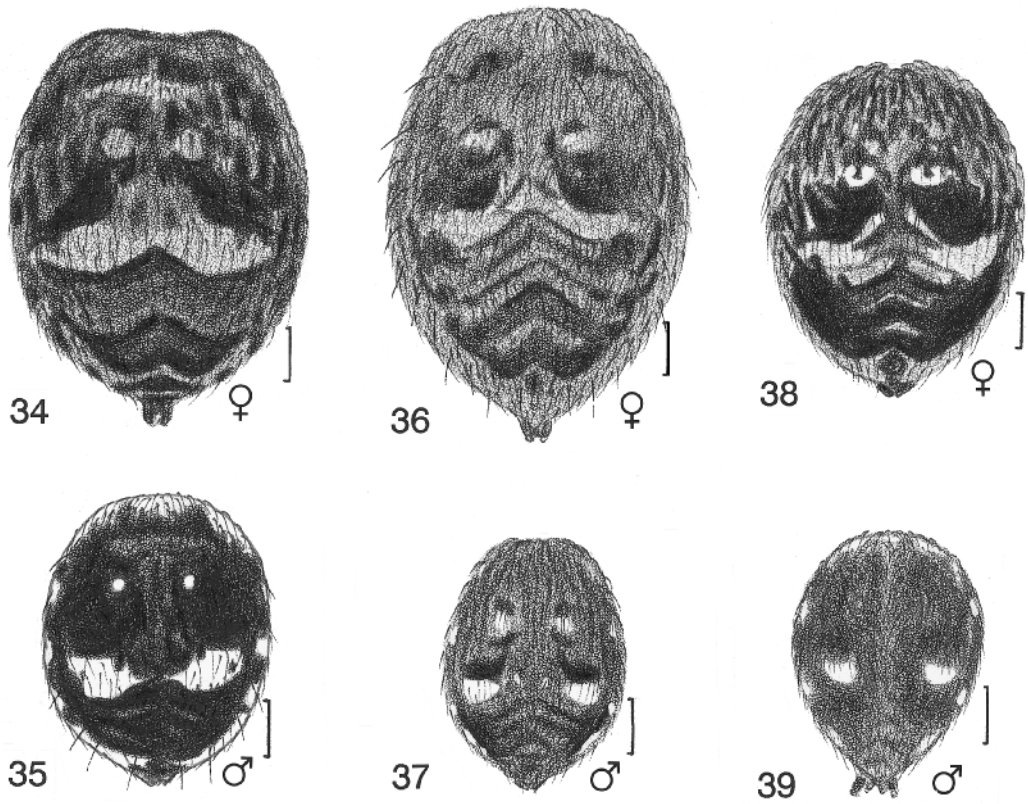
Material examined: Paratypes: AUSTRIA: 4♂ 2♀ (NMW, NRS), Burgenland, Neusiedler See–Seewinkel National Park, Illmitzer Zicksee, salt meadow (grazed), pitfall traps, 18 July–27 Aug. 1990 (C. Lethmayer). ENGLAND: 1♀ (CPM), East Sussex, E of Eastbourne, 6 July 1961 (P. Merrett);1♀ (CPM), Essex, Colne Point, 3 June 1962 (P. Merrett); 6♂ 2♀ (BMNH), same locality and date (D. J. Clark); 3♂ 3♀ (CPH), same locality, pitfall traps, 21 Apr.–27 May 1991 (P. R. Harvey); 2♂ 4♀ (CPH), same locality, pitfall traps, 22 Aug.–7 Oct. 1990 (P. R. Harvey); 1♂ (BMNH), Hampshire, near Portsmouth (D. J. Clark); 2♀ (CPM), Norfolk, Blakeney Point, Sept. 1960 (J. J. Rowe); 2♂ 1♀ (CPM), Somerset, Bridgwater Bay, 18 Sept. 1963 (P. Merrett). ESTONIA: 1♂ 2♀ (IZBE), Puhtu peninsula, 4 July 1959 (A. Vilbaste); 1♀ (IZBE), Väinameri, Nootamaa island, 26 Aug. 1960 (A. Vilbaste). GERMANY: 1♂ 2♀ (ZMB), Brandenburg, E. of Stolpe, sandy shore of R. Oder, pitfall traps, 10–17 May 1994 (W. Beyer); 1♀ (ZMB), Brandenburg, NE of Lunow, grassy vegetation near stand of willows on dike *c.* 300 m W of R. Oder, pitfall trap, 20–28 June 1994 (W. Beyer); 1♂ (CTB), Sachsen-Anhalt, Teutschenthal, pitfall trap, 12 Aug.–3 Sept. 1991 (T. Kreuter), 1♀ (CTB), Sachsen-Anhalt, Röblingen am See, pitfall trap, about 15 July–10 Aug. 1992 (T. Kreuter).



Figs. 21–28: Internal female genitalia (dorsal view). **21–26** *Sitticus inexpectus* sp.n. (21, 22 from Sweden, 23 from England, 24 from Novosibirsk area, 25, 26 from Kirghizstan); **27** *S. rupicola* (Austria); **28** *S. caricis* (Sweden); *arrow* points at epigynal pocket. Scale lines=0.1 mm.



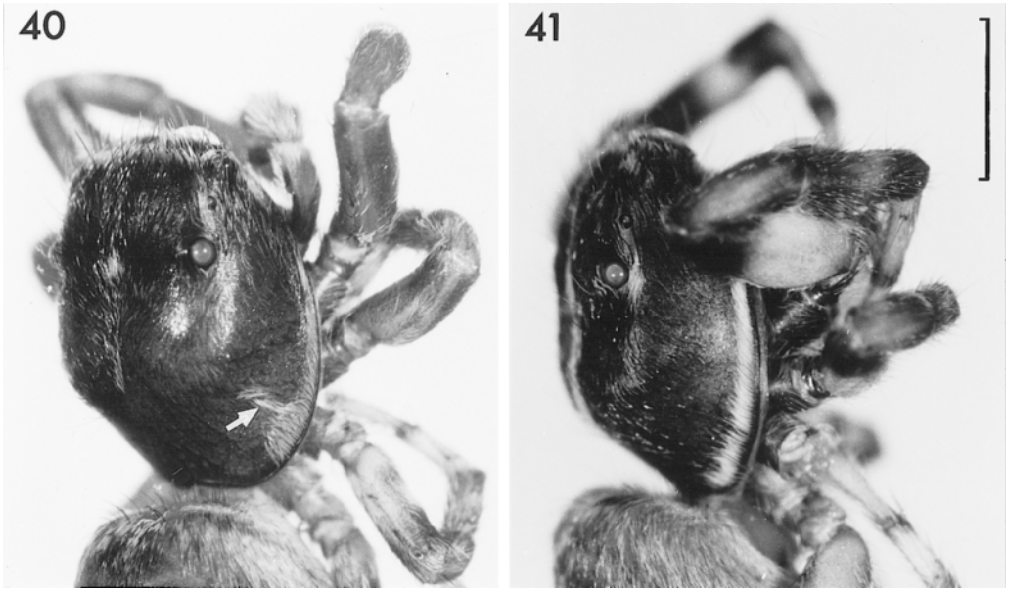
Figs. 29–33: Internal female genitalia (dorsal view). **29** *Sitticus rupicola* (France); **30, 31** *S. inexpectus* sp.n. (Austria); **32, 33** *S. caricis* (Sweden); epigynal pocket broken medially as a result of drying. *Arrows* point at site of copulatory duct joining spermatheca; *cd*=copulatory duct, *s*=spermatheca. Scale lines=0.1 mm (29, 30, 32 same magnification, 31, 33 same magnification).



Figs. 34–39: Dorsal abdominal pattern. **34, 35** *Sitticus rupicola* (Austria) (34 ♀, 35 ♂); **36–39** *S. inexpectus* sp.n. (36, 38 ♀; 37, 39 ♂; 36, 37 from England; 38, 39 from Kirghizstan). Scale lines = 0.5 mm.

KAZAKHSTAN: 2♂ 2♀ (NRS), Almaty Area, Balkhanskiy Distr., Bakanas, bank of Ili River, 11–13 May 1986 (A. A. Zyuzin); 1♀ (ZMMU), Temirlik River valley, 25 June 1993 (D. A. Milko). KIRGHIZSTAN: 2♂ 4♀ (ISE), Baubashata Mt. Range, Yarodar natural limits, 8 June 1981 (S. L. Zonshtein); 1♂ 1♀ (ZIP), Osh Area, Arslanbob, 20 Sept. 1982 (S. L. Zonshtein); 1♂ 5♀ (ZIP), Issyk-Kul Lake, Kuturga, 2 July 1977 (S. L. Zonshtein); 1♀ (ZIP), Ferganskiy Mt. Range, Kirova Sovkhoz, 2 June 1981 (S. L. Zonshtein); 1♂ (ZMMU), Kirgizskiy Mt. Range, 20 km S of Bishkek (= Frunze), Malinovoye Canyon, 28 July 1984 (S. V. Ovtchinnikov); 1♀ (ZMMU), same locality, Dolinka, 26 June 1980 (S. L. Zonshtein); 1♀ (ZMMU), same range, Tchon-Aryk, Bozbultas, 1200 m asl, 29 May 1983 (S. V. Ovtchinnokov); 3♀ (ZIP), Narynskiy Mt. Range, Irisu River valley, 19 July 1987 (S. V. Ovtchinnikov). POLAND: 1♂ (IZW), Puszcza Kampinoska, Nartowa Mts., 28 Apr. 1956 (J. Prószyński; sub *rupicola* in Prószyński, 1961). RUSSIA: 6♂ 1♀ (PSU), Chelyabinsk Area, Troitskiy District, Troitskiy Reserve, Kukai Lake, on shore, 28 June 1989 (S. L. Esyunin); 1♂ (ISE), Novosibirsk Area, Lake Tchany, Kazanskiy peninsula, 15 Aug. 1992 (V. V. Dubatolov); 1♀ (ISE), Novosibirsk Area, environs of Novosibirsk, Vaskhnil, June 1991 (D. Stundiuk; sub *rupicola* in Danilov & Logunov, 1993). SWEDEN: 1♀ (NRS), same locality as holotype, 17 June 1977 (T. Kronestedt); 3♀ (NRS), same locality, 15 June 1983 (T. Kronestedt); 1♂ 1♀ (ZMUU), Gotland, Lau, 6 Aug. 1942 (G. Wängsjö).

Comparative material: Sitticus rupicola: AUSTRIA: 1♂ 1♀ (CVR), Salzburg, Badgastein, Weissenbachtal canyon, 1770 m asl, stony xeric



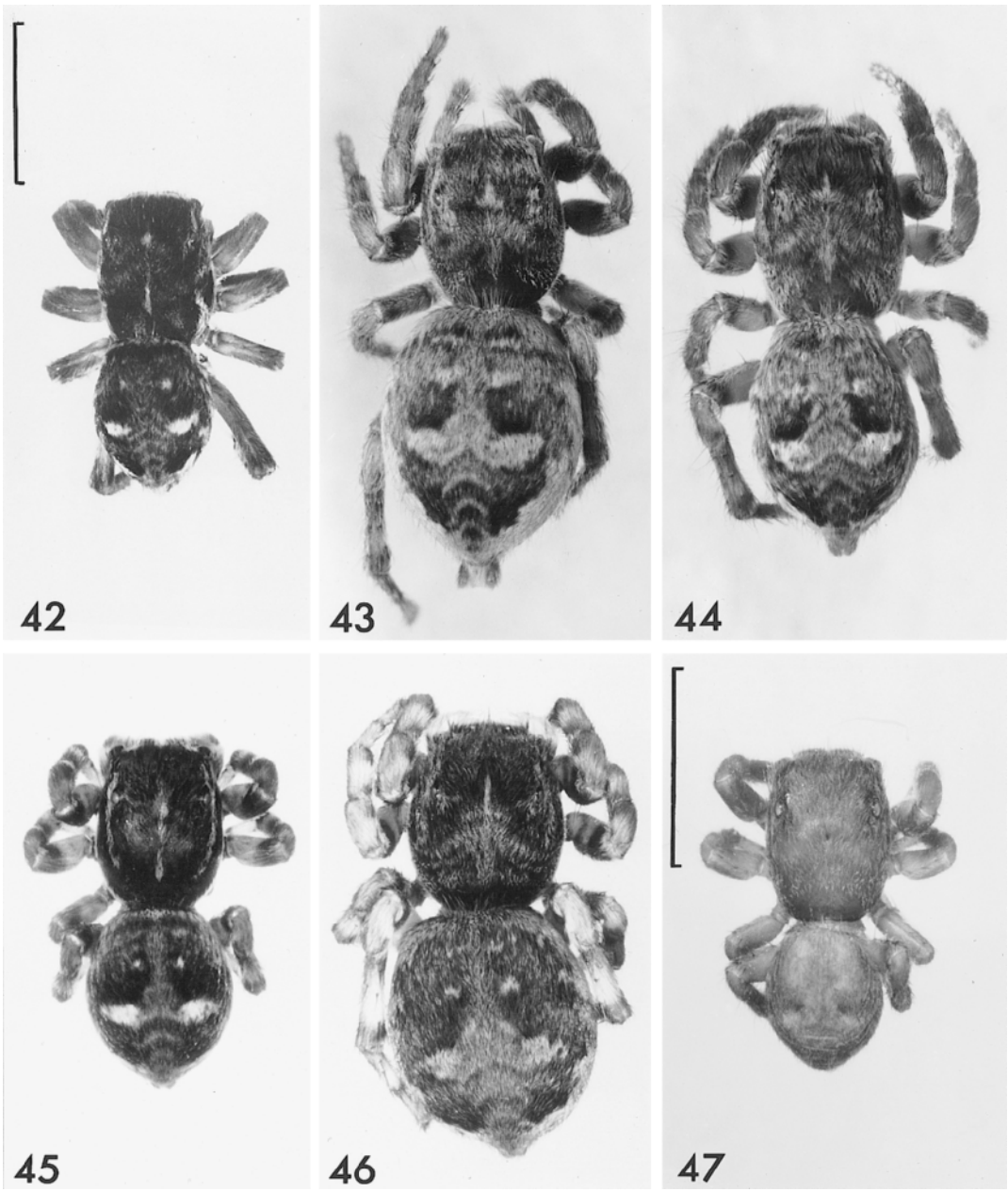
Figs. 40, 41: Male prosoma, lateral view. **40** *Sitticus inexpectus* sp.n. (Germany, Sachsen-Anhalt), note short white stripe (*arrow*) on posterior part of carapacal slope; **41** *S. rupicola* (Austria, topotypic specimen). Scale line = 1 mm.

meadow, 30 July–22 Aug. 1993 (V. Relys) [*topotypes*: the type locality is "Gastein" (Koch, 1837)]; 3♂ 7♀ (IZW), (Coll.?). FRANCE: 4♂ 3♀ (NRS), Haute Savoie, Montenvers, *c.* 1900 m asl, from nest complexes under flat stones, 9 Sept. 1995 (M. S. Harvey & T. Kronestedt). GERMANY: 1♂ 1♀ (NRS), no locality (L. Koch, in Collectio Thorell). POLAND: 2♂ 2♀ (IZW), Bieszczady, 16 June 1967 (W. Staręga). (Country?): 14♂ 30♀ (IZW), Tatry (Coll.?); 2♂ 5♀ (NRS), "Tatra" (Kulczyński, in Collectio Thorell). SWITZERLAND: 4♂ 14♀ (NMB), Berner Oberland, Gadmental (E. Schenkel); 2♀ (NRS), Tessin (Pavesi, in Collectio Thorell); 6♂ 13♀ (NMB), Tessin, Bedretto (E. Schenkel); 4♂ 11♀ (IZW), Kanton Uri, Urseren Tal, 1538 m asl, 26 July 1966 (J. Prószyński); 8♂ 12♀ (NMB), Wallis, Fiesch (E. Schenkel).

Sitticus caricis: 4♂ 1♀ (IZW), "752, ex coll. W. Kulczyński". RUSSIA: 1♂ 10♀ (PSU), Perm Area, Gornozavodsk District, Basegi Reserve, *Sphagnum* bog, 24 July 1985, 5 Aug. 1986, 5 Aug. 1990 (S. L. Esyunin); 3♂ 1♀ (PSU) S. Urals, Ilmenskiy Reserve, *Carex*-moss bog, 20 July 1986 (A. B. Polyanin). SWEDEN: 1♂ (NRS), Dalarna, By, 11 May 1941 (T. Palm); 1♂ (NRS), Halland, Enslöv, 5 May 1951 (H. Andersson; 1♂ 1♀ (NRS), male labelled "Hlm"=Holmia (i.e. Stockholm), both pinned in Westring's dry collection (at least male specimen a *syntype*), now transferred to alcohol; 3♀ (NRS), Jämtland, Häggenås, Storflon, 2 July 1944 (R. Krogerus); 1♀ (NRS) Skåne, Knäbäck, 10 Aug. 1941 (T. Palm); 3♀ (NRS), Skåne, Näsum, 3 June 1941 (T. Palm); 1♀ (NRS), Uppland, Lidingö, Ekholmsnässjön, 18 April 1943 (O. Ågren); 1♂ 2♀ (NRS), Uppland, Vänge, Fibysjön, 28 May 1942 (O. Lundblad); 1♀ (NRS), same locality, 1 Sept. 1945 (O. Lundblad); 2♀ (NRS), Öland, Halltorp, 17 May 1949 (N. Bruce).

Distribution: England, Germany, Austria, Poland, Sweden, Estonia (Fig. 48), Russia, Kazakhstan, Kirghizstan (Fig. 49).

Remarks: It is very likely that a female identified as *S. rupicola* from Transbaikalia (Izmailova, 1989) belongs either to *S. inexpectus* or to *S. caricis*. An early record of *S. rupicola* from Norway (Collett, 1876) was based on a female of *S. floricola*, preserved in Zoological Museum, Oslo (det. A. Tullgren). Certain lowland finds attributed to *S. rupicola* from Germany (Harm, 1973; Fründ *et al.*, 1994) should be re-evaluated concerning their species assignment as they may turn out to be *S. inexpectus*.



Figs. 42–47: **42–44** *Sitticus inexpectus* sp.n. (42 ♂ from Austria, Burgenland; 43 ♀ from England, Essex; 44 ♀ from Sweden, Öland); **45, 46** *S. rupicola* (45 ♂, 46 ♀ from France, Haute Savoie); **47** *S. caricis* (♂ from Sweden, Uppland). Scale lines=2 mm (42–46 same magnification).

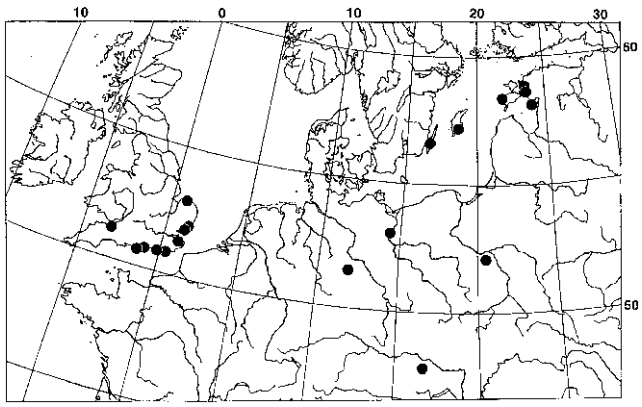


Fig. 48: Collection localities of *Sitticus inexpectus* sp.n. in Europe. Occurrence in Britain taken from Locket *et al.* (1974: map 165), in Estonia from Vilbaste (1987: map 146). One dot may represent more than one close locality.

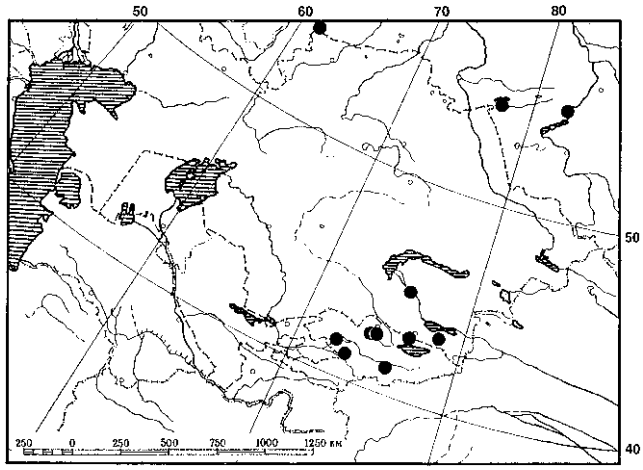


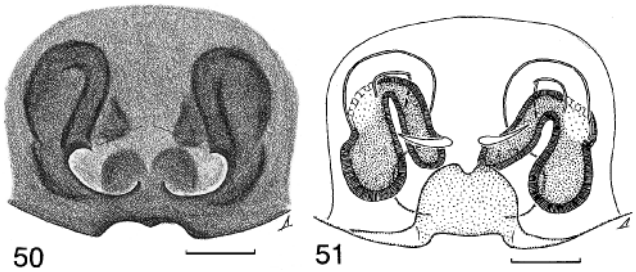
Fig. 49: Collection localities of *Sitticus inexpectus* sp.n. in Russia, Kazakhstan and Kirghizstan.

Habitat: In Sweden *S. inexpectus* was found under flat stones in an exposed area on limestone bedrock, close to a shallow lake (island of Öland locality), and by sifting wrack bed material (island of Gotland locality); in Estonia among shingle and wrack beds as well as among plants on shore meadow in various western localities on the Baltic coast (on islands and the mainland); in Germany in a sandy spot by a river (Oder) and in grassy vegetation at some distance from the same river, as well as at two rather close pools in Sachsen-Anhalt (one of them in a salty area) influenced by human activities; in Poland among grass by a canal (Prószyński, 1961, sub *rupicola*); in Austria in a meadow close to a salty lake; in England in various sea shore localities (shingle, sand). At least some of the W. Siberian, Kazakhstan and Kirghizstan localities are also close to lakes or rivers.

Sitticus inexpectus is a lowland species (compared with *S. rupicola* which occurs at higher altitudes), mostly found in the proximity of water (sea, rivers, lakes). Its presence in salty inland habitats in Germany and Austria is noteworthy. One may speculate that the scattered localities of *S. inexpectus* in Europe represent a relict distribution of a currently regressive species that managed to disperse during some earlier period with more suitable conditions. Maybe the species has previously been overlooked, or it should be questioned whether it is endangered at least in Central Europe.

S. rupicola	*S. inexpectus*	*S. caricis*
Males and females		
Carapace and abdomen distinctly patterned.	Carapace and abdomen distinctly patterned.	Carapace and abdomen without, or abdomen with faint pattern. Ground colour brownish.
Males		
Carapace with three distinct longitudinal stripes of white hairs, one median and one at each side, continuing behind PLE (Fig. 45).	Carapace with longitudinal median stripe of white hairs (often distinct as one median spot between PLEs and one stripe just before and at beginning of posterior carapacal slope). Longitudinal stripe of white hairs at each side indistinct behind PLE. Marginal bands of white hairs widen at level of coxae III and from there give off a stripe of white hairs on carapacal slope (Fig. 40, *arrow*).	No pattern (Fig. 47).
Palp with conspicuous white pilosity (Fe distally, Pt).	Palp with conspicuous white pilosity (Fe distally, Pt, Ti laterally).	Palp with no conspicuous white pilosity.
Cymbium and bulbus comparatively large (Fig. 12, note scale line).	Cymbium and bulbus comparatively small (Fig. 10, note scale line).	Cymbium and bulbus comparatively small (Fig. 11, note scale line).
Females		
Epigyne (Fig. 18) and internal genitalia (Fig. 27) comparatively large (note scale lines). Copulatory ducts with comparatively wide drooping loop before opening into anterior part of spermathecae (Fig. 29).	Epigyne (Figs. 13–17) and internal genitalia (Figs. 21–26) comparatively small (note scale lines). Copulatory ducts with comparatively small loop before opening into median part of spermathecae on dorsal side (Fig. 31, *arrow*).	Epigyne (Figs. 19, 20) and internal genitalia (Fig. 28) comparatively small (note scale lines). Copulatory ducts with comparatively small loop before opening into median part of spermathecae on outer side (Fig. 33, *arrow*).
Epigynal pocket relatively large.	Epigynal pocket relatively large.	Epigynal pocket relatively small (Fig. 28, *arrow*).

Table 1: Differences between *Sitticus rupicola, S. inexpectus* and *S. caricis*.



Figs. 50, 51: *Sitticus monstrabilis* (from Kirghizstan). **50** Epigyne; **51** Internal female genitalia (dorsal view). Scale lines = 0.1 mm.

Sitticus monstrabilis Logunov, 1992 (Figs. 50, 51)

Material examined: KAZAKHSTAN: 1♀ (ISE), Almaty Area, Almaatinskiy Reserve, Talgar River, 25 July 1984 (S. I. Deryugin). KIRGHIZSTAN: 1♀ (ISE), Issyk-Kul Lake, Kuturga, July 1977 (S. L. Zonshtein); 1♀ (ISE), Issyk-Kul Area, upper reaches of Tyup River, fir forest, 18 July 1984 (S. V. Ovtchinnikov).

Notes: The species has previously been described (♂♀) from SE Kazakhstan (Logunov, 1992), thus Issyk-Kul Area in Kirghizstan represents its southernmost known occurrence. Improved illustrations of the female copulatory organ (Figs. 50, 51) are given here. The arrangement of the copulatory ducts and the spermathecae is essentially as in the *rupicola* complex. The palpal organ (Logunov, 1992: fig. 9a), however, indicates affinity to *S. pulchellus*.

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Niche partitioning in three sympatric web-building spiders (Araneae: Linyphiidae)

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Summary

Three sympatric species of linyphiid spiders, *Frontinellina frutetorum*, *Neriene radiata* and *Linyphia triangularis* were observed in eastern Austria. Their phenology, web height, prey capture and web structure were measured and compared. The adults of *F. frutetorum* and *N. radiata* were active in early summer, while adults of *L. triangularis* were seasonally isolated, being active in autumn. The spiders were also observed to utilise different web heights and to capture different types of prey. In contrast, aspects of web size, prey size and prey capture rates were similar. It is postulated that differences in the spiders' spatial and temporal distribution resulted in further prey capture differences.

Introduction

The utilisation of distinct niches in terms of temporal segregation, web structure, web placement and prey capture has been reported for many different web-building spiders (Brown, 1981; Enders, 1974; Herberstein & Elgar, 1994; Malt *et al.*, 1990; Olive, 1980; Pasquet, 1984; Uetz *et al.*, 1978; Ward & Lubin, 1992; Wise & Barata, 1983). The suggested mechanism responsible for the observed patterns is the competitive exclusion principle, stating that no two species can occupy the same niche as a result of competition, leading to some form of displacement (Begon *et al.*, 1990).

Niche theory has, however, recently come under attack. Studies have found extensive prey and niche overlap (Kajak, 1965; Nyffeler & Benz, 1979, 1989), providing strong arguments against competition theory and questioning the importance of niche partitioning (Wise, 1993).

Investigating niche parameters brings with it some practical difficulties, as the niche occupied by any organism has an infinite number of dimensions which cannot be completely assessed (Krebs, 1970). Measuring a vast array of niche parameters for the purpose of comparing two or more organisms will, however, probably find a number of differences, though some of these may not be of great importance to the ecology of the animals studied (Toft, 1987).

Nevertheless, while these arguments may deter further investigations into niche partitioning, a careful selection of niche parameters can provide important and conclusive results, which in turn are a necessary basis for the design of further studies into the forces driving the observed patterns.

Herein, I report on a number of niche parameters, such as prey capture, web structure, web placement and seasonality, utilised by three linyphiid spiders, *Frontinellina frutetorum* (C. L. Koch), *Neriene radiata* (Walckenaer) and *Linyphia triangularis* (Clerck). The spiders construct typical linyphiid webs with a centrally located sheet beneath which the spider hangs. Entangling threads are spun above the sheet to intercept prey which tumbles down on to the sheet, where it is attacked by the spider.

Material and methods

The spiders were studied from March to October (1993 and 1994) in a mixed deciduous forest in eastern Austria near the town of Hartberg (Herberstein, 1995). The study site consisted of an area of forest regrowth planted with fir trees (mostly Douglas fir, *Pseudotsuga menziesii*). The trees were surrounded by a dense understorey, composed of grasses, ferns, raspberry and blackberry bushes.

Phenology

The species-specific phenologies were estimated using density measures (individuals per square metre). Ten transects (10 × 1 m) were randomly chosen each month and the number of spiders found along the transects counted. The average monthly densities sampled from March to October 1994 were plotted to show the emergence and disappearance of the spiders. A more precise measure of the phenologies of the spiders could have been achieved by regular samples of their size. However, this would have been a very disruptive method, causing the destruction of webs and probably an exodus of spiders and was therefore not used.

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