

**Separation of two species standing as *Sitticus zimmermanni* (Simon, 1877) (Araneae, Salticidae), a pair of altitudinally segregated species**

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**Separation of two species standing as *Sitticus zimmermanni* (Simon, 1877) (Araneae, Salticidae), a pair of altitudinally segregated species. -**

*Sitticus zimmermanni* auctt. is found to encompass two distinct species, here recognized as *S. atricapillus* (Simon) (with *Attus alpicola* Kulczyński, *Sitticus semivittatus* Simon, and *S. appolinis* Bristowe as junior synonyms) and *S. zimmermanni* (Simon). Both species, belonging to the *floricola* species group, are redescribed. A lectotype (♀) is designated for *Attus atricapillus* Simon, 1882. *S. atricapillus* seems to be confined to mountainous habitats above 900 m asl in central and southern Europe where the spider occurs among rock debris. *S. zimmermanni* has a wide distribution from Europe to Transbaikalia (Russia). In Europe, this species has been found at altitudes up to ca 400 m asl, mostly in exposed sandy habitats. Some old European records attributed to *Attus* (or *Sitticus*) *zimmermanni* have been found to refer to *S. inexpectus* Logunov & Kronstedt.

**Key-words:** Araneae - Salticidae - *Sitticus* - taxonomy - revalidated species - Palearctic.

INTRODUCTION

*Sitticus* Simon, 1901 is one of the most speciose genera of jumping spiders in Europe. Despite a long tradition of arachnological research on salticid species in central Europe, there are still some taxa in need of a revision, partly due to unclear identity from existing descriptions, or to confusing synonymy (e.g. Braun, 1963; Harm, 1973; Prószyński, 1980). Recently, Logunov & Kronstedt (1997) separated two species up to then standing as *Sitticus rupicola* (C. L. Koch, 1837), and here we treat another species pair in the *floricola* group.

Kropf (1996) announced the presence of what he identified as *S. zimmermanni* in the Jura Mts. in western Switzerland. He noted, however, some differences between the Jura specimens and *S. zimmermanni* as described in Harm (1973), notably in the

abdominal pattern of the male and in habitat preference. Earlier Prószyński (1980) remarked that "the species [*i.e.* *S. zimmermanni*] seems to occur in two different environments: on rocks in mountains and on sand ground in lowlands" but did not pay further attention to this 'diplostenoccity' (*sensu* Duffey, 1968), which is still given as information (*e.g.* in Bellmann, 1997) when referring to *S. zimmermanni*.

At the request of Dr Christian Kropf, we have studied the material from the Jura together with conspecific material from other areas at higher elevations in central and southern Europe. It proved that the high mountain specimens differ from the material of *S. zimmermanni* examined from lowland localities in Europe. The central and southern European high mountain form unequivocally belongs to a separate species already named but placed in synonymy with *S. zimmermanni* (*cf.* Prószyński & Staręga, 1971; Prószyński, 1980). We conclude that the name *Sitticus atricapillus* (Simon) should be revalidated for this high mountain species.

Among the junior synonyms of *S. zimmermanni* given in Prószyński & Staręga (1971) are *Attus alpicola* Kulczyński, 1887 and *A. hungaricus* Kulczyński, 1891. Prószyński (1980) gave further details after examining specimens identified as either of them in the Budapest Museum. Kulczyński described *A. hungaricus* after having described *A. alpicola* and apparently he clearly distinguished the two species (see Chyzer & Kulczyński, 1891: 20-21): *A. alpicola* ♂: "oculorum area antice plus minusve albo marginata..." [applies to "*A. zimmermannii*?", *A. floricola* (C. L. Koch) and *A. rupicola* (C. L. Koch) as well] and "abdominis dorsum antice vitta brevi alba cum limbo dorsuali coniuncta ornatum"; *A. hungaricus* ♂: "oculorum area antice non albo marginata". This is in accordance with our view that two species are currently standing as *S. zimmermanni*.

Furthermore, we found that the species given as "*A. zimmermannii* Simon?" in Chyzer & Kulczyński (1891) is conspecific with *Sitticus inexpectus* Logunov & Kronstedt, 1997. In the key to males of *Attus* (p. 21) Chyzer & Kulczyński (1891) stated: "cephalothoracis limbus albus marginalis, e pube efformatus supra coxas III. in dentem triangularem magnum dilatatus...". This is a diagnostic character for the male of *S. inexpectus* (see Logunov & Kronstedt, 1997; Kronstedt, 1998) [2♂ "Coll. Chyzer" (HNHM), re-examined]. Also a later description by Simon (1937: 1192, "Ligne blanche marginale du céphalothorax émettant en arrière au niveau de la déclivité, une ligne verticale abrégée effilée au sommet mais souvent épaissie à la base") indicates that the species, which he then referred to under the name "*Sitticus zimmermanni* E. S.", is actually conspecific with *S. inexpectus*. Harm (1973) commented on *S. zimmermanni sensu* Simon (1937) without being able to place it. Simon's material from France consisted, however, of only a single ♂ stored together with *S. rupicola* in a sample collected at a high altitude in Haute-Alpes (a misplaced specimen?), which is not consistent with the present knowledge about *S. inexpectus* being a lowland species. Simon (1937) also referred to its occurrence in Britain, where *S. inexpectus* is indeed known from coastal habitats. In view of the fact that *Attus zimmermanni* had been included in two fairly recent revisions (Harm, 1973; Prószyński, 1980), we did not consider that species when describing *S. inexpectus*. In any case, the holotype of *Attus zimmermanni* is unambiguously not conspecific with *S. inexpectus* but with what we redescribe as *Sitticus zimmermanni* below.

The recognition of *S. atricapillus* being a high mountain species in central and southern Europe, with *S. zimmermanni* as the morphologically close counterpart at low to medium altitudes and with a wide Palearctic distribution, parallels the situation with the species pair *S. rupicola* and *S. inexpectus* (*cf.* Logunov & Kronstedt, 1997).

From the experience gained while studying the pairs *S. atricapillus* - *S. zimmermanni* and *S. rupicola* - *S. inexpectus* we want to stress the importance of routinely presenting scale bars along with drawings (*e.g.*, the bulbi of *S. zimmermanni* and *S. inexpectus* are considerably smaller than those of *atricapillus* and *rupicola*, respectively) as well as giving information about place of origin for the material depicted.

Females of *S. atricapillus* and of *S. zimmermanni* are difficult to distinguish (see Table I), therefore records based on single females are to be considered provisional if no additional information (habitat, altitude, *etc.*) is at hand; males are required to confirm or reject such records.

## DEPOSITORIES

BMNH	The Natural History Museum, London, UK (J. Beccaloni)
CCK	Collection of C. Komposch, Graz, Austria
CCM	Collection of C. Muster, Dresden, Germany
CJB	Collection of J. Buchar, Prague, Czech Republic
CJS	Collection of J. Svatoň, Martin, Slovakia
CMZ	Collection of M. Zabka, Siedlce, Poland
COvH	Collection of O. von Helversen, Erlangen, Germany
CRB	Collection of R. Bosmans, Ghent, Belgium
CRP	Collection of Roger Pettersson, Umeå, Sweden
CTB	Collection of T. Blick, Hummeltal, Germany
CTh	Collection of K. Thaler, Innsbruck, Austria
CVR	Collection of V. Ružička, České Budějovice, Czech Republic
DBAC	Dipartimento di Biologia Animale dell'Università di Catania, Catania, Italy (T. Cantarella)
HNHM	Hungarian Natural History Museum, Budapest, Hungary (T. Szűts)
MBCG	Museo Civico di Scienze Naturali "Enrico Gaffi", Bergamo, Italy (P. Pantini)
MMUM	Manchester Museum, University of Manchester, Manchester, UK (D. V. Logunov)
MNHN	Muséum National d'Histoire Naturelle, Paris, France (C. Rollard)
NHMB	Naturhistorisches Museum, Basel, Switzerland (A. Hänggi)
NHRS	Swedish Museum of Natural History, Stockholm, Sweden (T. Kronstedt)
NMBE	Naturhistorisches Museum, Bern, Switzerland (C. Kropf)
ZISB	Institute of Zoology, Bulgarian Academy of Sciences, Sofia, Bulgaria (C. Deltchev)
ZMHB	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (J. Dunlop)
ZMPA	Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Poland (T. Huflejt)
ZMUM	Zoological Museum of the Moscow State University, Moscow, Russia (K. G. Mikhailov)
ZMUU	Museum of Evolution, Uppsala University, Uppsala, Sweden (M. Eriksson)

## ABBREVIATIONS IN THE TEXT AND TABLE

ALE	anterior lateral eye(s)	PLE	posterior lateral eye(s)
AME	anterior median eye(s)	pr	prolateral
ap	apical	Pt	patella
d	dorsal	rt	retrolateral
Fm	femur	SRR	secondary receptacle
I, II, etc.	referring to first leg, second leg, etc.	Tb	tibia
L	length	Tr	tarsus
Mt	metatarsus	v	ventral

For leg spination the system adopted is that used by Ono (1988). Measurements are given in millimetres.

## REDESCRIPTIONS

*Sitticus atricapillus* (Simon, 1882) Figs 1, 3-5, 9-11, 15-17

*Attus atricapillus* Simon, 1882: 31-32 (♂♀). ♀ from Italy: Basilicata/Calabria, Massiccio del Pollino, Cima del Dolcedorme, in MNHN, here designated as lectotype in order to preserve stability of nomenclature (see remarks below).

*Attus alpicola* Kulczyński, 1887: 251, 285-289, pl. 5, figs 1-3 (♂♀). Syntypes from Italy: Trentino-Alto Adige, Mt. Schlern and Trafoi Valley, not examined. **Syn. n.**

*Sitticus alpicola*; Roewer, 1954: 1243; Bonnet, 1958: 4069.

*Sitticus appolinis* Bristowe, 1935: 784-786, figs 17-20 (♂♀). Syntypes from Greece: Mt. Parnassos in Bristowe's private collection, destroyed. Roewer, 1954: 1243; Bonnet, 1958: 4069. **Syn. n.**

*Sitticus atricapillus*; Roewer, 1954: 1243.

*Sitticus cingulatus* (Simon)? (misidentification); Braun, 1963: 125-128, figs 22-25 (♂♀).

*Sitticus semivittatus* Simon, 1937: 1192, fig. 1882 (♂). Syntypes from France: Hautes-Alpes, Lautaret, in MNHN, examined. Roewer, 1954: 1248; Bonnet, 1958: 4083. **Syn. n.**

*Sitticus zimmermanni* (Simon) (misidentification); Prószyński, 1980: 24-27 (in part), figs 72-74, 77, 78 (♂♀), 2003 (in part); Kropf, 1996: 108, fig. 2 (♂-habitus); Metzner, 1999: 84-85, pl. 49 (♂♀); Platnick, 2003 (in part).

## MATERIAL EXAMINED

**GREECE.** Central Greece: Mt. Timfristos, summit area, 1-2 Aug. 1978, 1♂ (O. v. Helversen, COvH). Epirus: Tomaros, 18-19 Aug. 1983, 1♂ 2♀ (O. v. Helversen, COvH). – **BULGARIA.** Plovdiv: Stara Planina Mts, Kozya Stena Hut, 1600 m asl, 19 July 1995, 1♀; Stara Planina Mts, Bratanets Peak, 2030 m asl, 16 June 1995, 1♀ (C. Deltshv, ZISB). Blagoevgrad: Pirin Mts, Vihren Hut, 2000 m asl, 23 July 1985, 1♂; Pirin Mts, Vasilashko Ezero Lake, 2000 m asl, 25 July 1986, 1♀; Pirin Mts, Muratovo Ezero Lake, 2400 m asl, 12 July 1989, 1♂ (C. Deltshv, ZISB). – **MACEDONIA.** Šar Planina Mts, Tri vode Hut, 1800 m asl, 22 July 1996, 2♀; Šar Planina Mts, Loboten Peak, 2000 m asl, 20 July 1996, 3♂ 2♀, 11 July 1997, 1♀ (G. Blagoev, ZISB). – **CROATIA.** Rijeka: Crni lug, 1♂ (Coll. Chyzer, HNHM); Risnjak, 1♀ (without epigyne) (Coll. Chyzer, HNHM). – **ITALY.** Basilicata/Calabria: Cima del Dolcedorme [visited 27 July 1880 (Cavanna, 1882)], 1♀ (Coll. Simon, MNHN; lectotype of *Attus atricapillus*). Friuli Venezia: Osternig, 1770 m asl, 16 August 1997, 1♂ (B. & C. Komposch, CCK). Lombardia: Bergamo, Colzate, Baite Sedernello, 1200 m asl, 2 August 2001, 1♀ (Ferrario, Pantini, Pellizzoli & Valle, MBCG). Sicily: Mt. Frumento (part of Mt. Etna), 2150 m asl, 11 July 1984, 2♂ 1♀ (P. Alicata & T. Cantarella, DBAC). Trentino-Alto Adige: Mt. Tremalzo near Bezzecca [W of Lake Garda], 14 June 1964, 4♂ 11♀ (K. Thaler, CTh). – **AUSTRIA.** Carinthia (Kärnten): Gailtaler Alpen, NW Kötschach-Mauthen, NSG Mussen, 2030 m asl, pitfall trap 1

July-26 August 2000, 2♂ (B. & C. Komposch, CCK); Oisternig, 2040 m asl, 16 August 1997, 1♀ (B. & C. Komposch, CCK). – **CZECH REPUBLIC.** Severočeský: Liberec, Mt. Ještěd, 920 m asl, scree slope, 22 August 1987, 1♂ 2♀ (V. Ružička, CVR). – **GERMANY.** Bavaria (Bayern): Spiegelau (Bayerischer Wald), exposed slope with rocks, 1370 m asl, 26 June 1999, 1♀ (G. Langer, CTB); Karwendel, Soiernspitze, dwarf pine forest with open scree, 1780 m asl, 10 August 1998, 1♂ 1♀, 30 May 1999, 1♂ 2♀ (C. Muster, CCM). – **SWITZERLAND.** Neuchâtel: Gorgier, Creux-du-Van, ca 1220 m asl, scree slope, 31 July 1996, 2♂ (C. Kropf, NMBE), 2 June 1997, 1♂ 1♀ (C. Kropf, NMBE), 7 June 1997, 1♂ (A. Rohner, NMBE). – **FRANCE.** Hautes-Alpes: Lautaret, 2♂ (Coll. Simon, MNHN; syntypes of *S. semivittatus*). Hautes-Pyrénées: Aragnouet, 2100 m asl, 28 July 1984, 3♀ (R. Bosmans, CRB).

## REMARKS

Prószyński (1980) examined what he considered to be the type of *Attus atricapillus* (deposited in MNHN). We have re-examined the same ♀ specimen [labelled *nigrocapillatus*/Baulicuta (Cav.) (i.e. a misspelling of Basilicata, see Prószyński, 1980)]. The abbreviation "(Cav.," most probably refers to G. Cavanna, who was one of the excursion participants collecting material from Basilicata which was later studied by Simon (1882). The following foot-note in Cavanna (1882: 28), regarding *A. atricapillus*, may explain the error in labelling: "Per errore *nigricornis* nei Resoconti". We are therefore convinced that this specimen belongs to the type material.

*Attus atricapillus* was originally described from both sexes. Regrettably no male from the type series seems to exist any longer. However, in the original description, Simon (1882: 32) stated: "Cephalothorax ...parte cephalica utrinque linea longitudinali pilis flavis albisque composita ornata; pilis oculorum ac clypei nigris pilis albis paucis et brevibus intermixtis." Thus, he gave no indication of a transverse white band above the first eye row as typical for males of *S. atricapillus*.

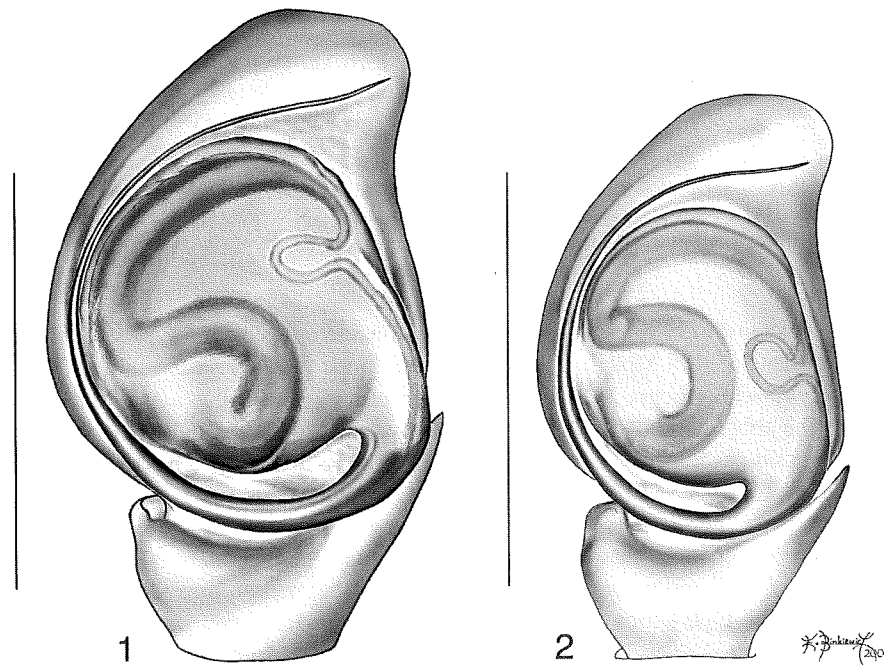
The two males from Sicily studied by us also lack this transverse white band (except for a few white hairs) above the first eye row, which is so characteristic for other males referred to this species (cf. description below). In most characters, however, the males from Sicily seem to concur with males from other parts of the distribution area (cf. also Fig. 21). Until more is known about South Italian populations of *S. atricapillus* we consider all the material here referred to this species as being conspecific and consequently use the oldest available name.

DIAGNOSIS. See Table I.

## DESCRIPTION

**MALE** (from Italy, Trentino). *Measurements.* Carapace 2.15 long, 1.65 wide, 0.83 high at PLE. Ocular area 0.98 long, 1.30 wide anteriorly and 1.29 posteriorly. Diameter of AME 0.39. Abdomen 1.98 long, 1.50 wide. Cheliceral length 0.85. Clypeal height 0.09. Length of leg segments:

	Fm	Pt	Tb	Mt	Tr	Total
I	1.30	0.81	0.93	0.85	0.53	4.42
II	1.10	0.66	0.65	0.63	0.41	3.45
III	1.03	0.50	0.55	0.64	0.45	3.17
IV	1.61	0.68	1.08	0.90	0.55	4.82



Figs 1, 2

Left male palp, ventral view. – 1. *Sitticus atricapillus* (Croatia). – 2. *S. zimmermanni* (Sweden: Dalarna). Scale line: 0.5 mm.

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

**Coloration.** Carapace: brown, shining, covered with a dark appressed pubescence. A longitudinal streak of white hairs on each side, running from ALE below PLE to posterior slope of carapace (Figs 5, 15). A transverse band of white hairs present between ALE and above AME. A median streak of white hairs from fovea forwards to level of PME. Eye brows (outside upper part of AME) with longer white scale-like hairs. AME and ALE surrounded by scattered short white scale-like hairs. Clypeus brown with light (greyish) hairs. Sternum greyish brown. Abdomen: dorsally blackish brown. Dorsum bordered with white hairs forming a white band around anterior part. A distinct median white lanceolate spot in anterior part (often confluent with white band at anterior margin) and a pair of large distinct white spots just behind the middle of dorsum. A few small median chevron-like marks of white hairs present towards the rear end of the abdomen. Sides and venter light greyish brown with whitish pubescence. Spinnerets light greyish brown. Legs: brown to yellowish brown, with very slightly darker markings. Fm+Tb+Mt I sometimes uniformly dark brown. Palp: brown;

Pt more or less yellowish throughout; Fm (dorso-distally), Pt and Tb furnished with white hairs, longest laterally on Tb, cymbium dorso-basally with a spot of a few white hairs, otherwise with dark hairs.

**Palp.** Structure as in Figs 1, 3, 4.

**FEMALE** (from Italy, Trentino). **Measurements.** Carapace 2.33 long, 1.78 wide, 0.88 high at PLE. Ocular area 1.03 long, 1.39 wide anteriorly and 1.43 posteriorly. Diameter of AME 0.40. Abdomen 2.28 long, 1.80 wide. Cheliceral length 0.70. Clypeal height 0.14. Length of leg segments:

	Fm	Pt	Tb	Mt	Tr	Total
I	1.13	0.66	0.73	0.60	0.48	3.60
II	1.05	0.58	0.63	0.55	0.43	3.24
III	1.08	0.51	0.58	0.63	0.45	3.25
IV	1.93	0.78	1.21	1.00	0.54	5.46

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

**Coloration.** Carapace dusky brown, with appressed light hairs. Clypeus light brown, with dense pubescence of long white hairs. Abdomen dorsally greyish, with two pairs of dark irregular blotches (with dark hairs), one pair just anterior to the middle and the other in the posterior part; anterior pair often immediately followed by a pair of lighter spots. A few lighter chevron-like marks at the midline posteriorly (Figs 16, 17). Legs light brownish with slightly darker annulation. Palp mostly yellowish brown, tip of tarsus blackened, and densely equipped with long white hairs, especially laterally.

**Epigyne and spermathecae** as in Figs 9-11.

#### HABITAT

*Sitticus atricapillus* appears to be a high mountain species (up to 2600 m asl in the Alps: Thaler, 1997) found among accumulations of rocks (Kropf, 1996: sub *S. zimmermanni*), gravel with dwarf pines and *Erica*, as well as in grassy heaths with stones (Thaler, 1997: sub *S. zimmermanni*).

#### DISTRIBUTION

The species seems to have a central and southern European range and is virtually restricted to mountainous regions (Fig. 22). It has been recorded from Greece (Bristowe, 1935: sub *S. appolinis*; Metzner, 1999: sub *S. zimmermanni*), Bulgaria (Deltshev & Blagoev, 1997 and Deltshev, 1998: sub *S. zimmermanni*), Croatia (Chyzer & Kulczyński, 1891: sub *Attus alpicola*), Italy (Basilicata/Calabria: Simon, 1882; Trentino-Alto Adige: Kulczyński, 1887: sub *Attus alpicola* and Komposch, 2000: sub *S. zimmermanni*; Sicily: Alicata & Cantarella, 2000: sub *S. zimmermanni*), Austria (Thaler, 1997 and Komposch, 2000: sub *S. zimmermanni*), Czech Republic (Buchar & Ružička, 2002: sub *S. zimmermanni* in part: material listed above), Germany (Muster,

2001: sub *S. zimmermanni*), Switzerland (Kropf, 1996: sub *S. zimmermanni*), France (Hautes-Alpes: Simon, 1937 and Hautes-Pyrénées: Denis, 1953 (♂): sub *S. semivittatus*; Bosmans *et al.*, 1986: sub *S. zimmermanni*).

*Sitticus zimmermanni* (Simon, 1877)

Figs 2, 6-8, 12-14, 18-20

*Attus Zimmermanni* Simon, 1877: 74-75 (♂). Holotype from Germany or Poland: River Neisse, in ZMHB, examined.

*A. Zimmermannii*; Bösenberg, 1903: 433, pl. 41 fig. 637 (♂).

*A. hungaricus* Kulczyński in Chyzer & Kulczyński, 1891: 23-26, pl. 1 fig. 37a, b (♂♀). Syntypes from Hungary: Pécel (Pécel) and Kecskemét, and Romania: Érmihályfalva (Valea lui Mihai), not examined.

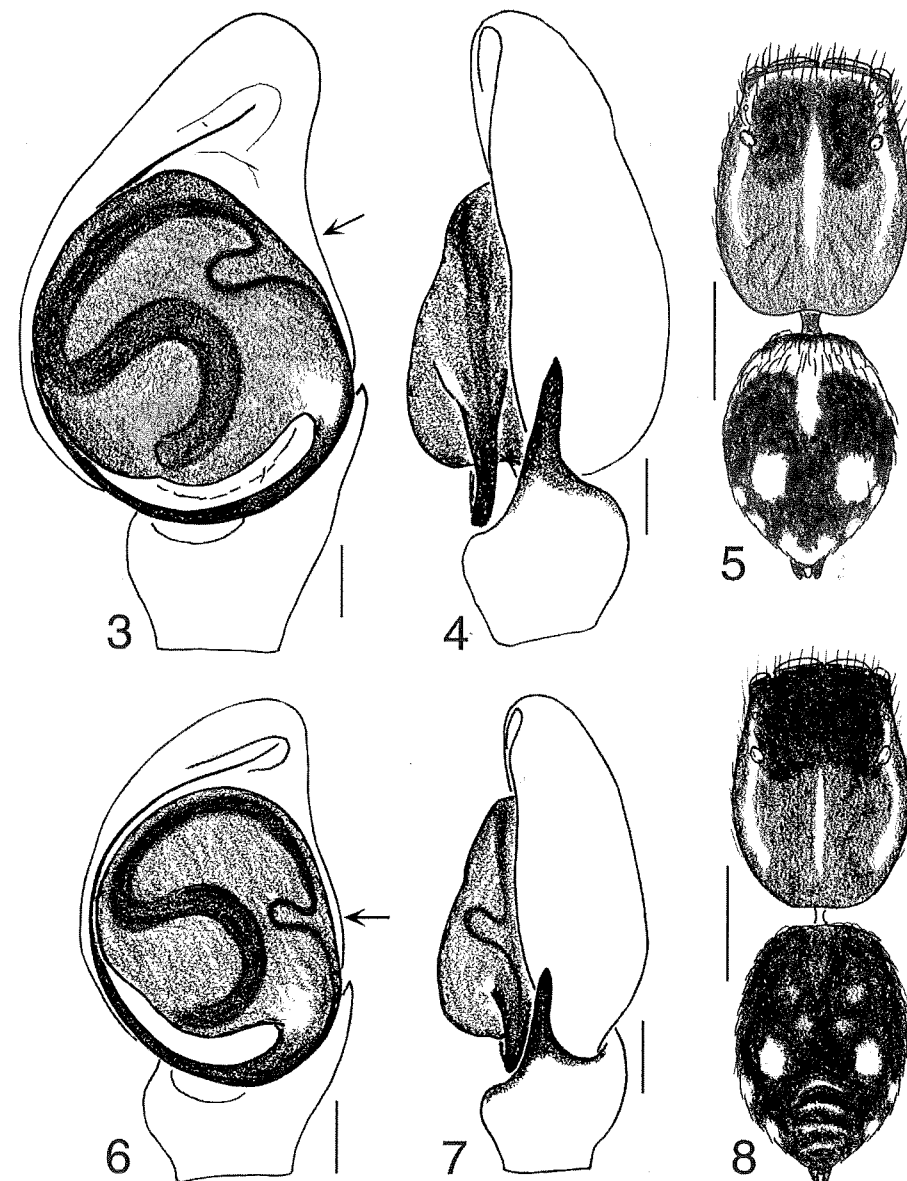
*Sitticus hungaricus*; Roewer, 1954: 1245; Bonnet, 1958: 4076.

*Sitticus tullgreni* Holm, 1944: 3-4, figs 4-7 (♀) [printed 4 July 1944, not in 1945 as given in Platnick, 2003]. Holotype from Sweden: Uppland, Hagede, Vargholmen, in ZMUU, examined. Tullgren, 1944: 29-30, fig. 21B, pl. 2 fig. 32 (♀); Roewer, 1954: 1248; Kleemola, 1969: 47, figs 2-3 (♂♀).

*Sitticus zimmermanni*; Roewer, 1954: 1249 (in part); Bonnet, 1958: 4085 (in part); Prószyński & Staręga, 1971: 289 (in part); Harm, 1973: 386-388 (in part, description and figures apparently based on *S. zimmermanni*), figs 5, 10, 31, 32, 39, 40, 46-50 (♂♀); Prószyński, 1980: 24-27 (in part), figs 69-71, 75, 76, 79-81 (♂♀), 1991: 518-521 (in part), figs 1384.1, 1384.3-4 (♂♀), 2003 (in part); Wesołowska, 1996: 42, fig. 34 a-c (♂♀); Zabka 1997: 97-98, figs 376-381 (♂♀); Logunov & Marusik, 2000: 225-226; Platnick, 2003 (in part). A complete set of references for Siberian records is given in Logunov & Marusik (2000).

MATERIAL EXAMINED

**SWEDEN.** Dalarna: Ore, Lake Skattungen, 20 June 1982, 1♀, 25 June 1982, 1♂, 17 July 1982, 2♂ 1♀, 3 Sept. 1982, 2♂, 22 July 1983, 2♂, 3 June 2001, 1♀, 15 August 2002, 1♂; Ore, Lake Oresjön, 22 July 1983, 2♂, 30 July 1999, 2♂, 30 July 2000, 2♂, 10 August 2000, 1♂, 27 August 2000, 1♂, 6 July 2001, 3♂, 20 July, 2♂ 1♀ (T. Kronestedt, NHRS). Norrbotten: Haparanda Sandskär, 21-23 June 1996, 1♂ 2♀ (R. Pettersson, CRP). Östergötland: Gryt, Långskär, 25 July 1980, 1♂ 1♀ (T. Kronestedt, NHRS). Uppland: Hagede, Vargholmen, 28 July 1941, 1♀ (H. O. Backlund, ZMUU; holotype of *S. tullgreni*). – **GERMANY.** Bavaria (Bayern): ca 10 km S of Augsburg, near Königsbrunn, at River Lech, 15-31 August 2001, 1♂ (K. Gees, CTB). Sachsen: Lausitz, Neisse, 1870, 1♂ (H. Zimmermann, ZMHB 5972; holotype: frons, palps and legs mounted on a microscopic slide); Niesky, 1♂ (Coll. Koch, BMNH); Halbendorf, sandy grassland, 5 June 1995, 1♀ (Gerlach, NMBE). Sachsen-Anhalt: E of Bitterfeld, Goitzsche, restored former brown coal opencast mine, 18 July -1 August 1997, 2♂ (I. Al Hussein, CTB); E of Halle (on the Saale), Lochau, restored former brown coal opencast mine, 28 June - 12 July 1996, 1♀ (I. Al Hussein, CTB). – **POLAND.** Swietokrzyskie: Puszcza Sandomierska, leśn. Krawce, *Leucobryo-Pinetum* (pitfall traps), 13 July 1998, 2♂ (T. Huflejt, ZMPA); same locality, nadl. Kotowa (clearing, pitfall trap), 14 May 1998, 1♂ (T. Huflejt, ZMPA). Mazowieckie: near Siedlce (Białki), 29 May 2000, 2♀ (J. Janowska, CMZ). – **CZECH REPUBLIC.** Středočeský: Tišice-Kozly, sandy locality, 25 May 1961, 2♂ (J. Buchar, CJB). – **SLOVAKIA.** Nitra: Chotínske piesky, 19 October 1973, 1♂ (J. Svatoň, CJS); Čenkov near Šturovo, sandy locality, 12 May 1964, 1♂ (J. Buchar, CJB). – **SWITZERLAND.** Vaud: Buchillon (at the border of Lake Geneva), 1♂ 1♀ (R. de Lessert, NHMB; identified as *S. hungaricus* by W. Kulczyński). – **AUSTRIA.** Carinthia (Kärnten): Völkermarkter Stausee, Neudenstein-Insel (Komposch, 1996), 391 m asl, 10 July-10 August 1993, 1♀ (W. Graf, CCK), 14 September 1993, 1♀ (C. Komposch, CCK). – **HUNGARY.** Pest: Vasad, 1♂ (HNHM). – **RUSSIA.** Orenburg Area: Kuvandyk District, near Aituar, birch-poplar stand (in litter), 14 May 1997, 1♀ (S. L. Eshyunin, MMUM). Volgograd Area: near Frolovo, June 1993, 1♂ 1♀ (Y. M. Marusik, MMUM). – **UKRAINE.** Crimea: Saki District, Pribrezhnaya railway station, dry meadow on yellow porous limestone



FIGS 3-8

Left male palp, ventral (3, 6) and retrolateral view (4, 7); male habitus, dorsal view (5, 8). – 3-5. *Sitticus atricapillus* (Italy: Trentino). – 6-8. *S. zimmermanni* [Sweden: Östergötland (6, 7), Dalarna (8)]. Scale lines: 0.1 mm (3, 4, 6, 7), 1 mm (5, 8).

(pitfall traps), 3-19 July 2000, 1♀ (N. M. Kovblyuk, MMUM). – **AZERBAIJAN.** Leninavan, S of Mir Bashir, 4 June 1987, 1♂ (S. I. Golovatch & K. Y. Eskov, ZMUM). – For additional material previously examined by one of us (DVL), see Wesołowska (1996), Logunov & Marusik (2000), and Logunov & Guseinov (2002).

## REMARK

The holotype was redescribed and illustrated by Bösenberg (1903) and examined by Harm (1973) and Prószyński (1980).

DIAGNOSIS. See Table I.

## DESCRIPTION

MALE (from Sweden, Östergötland). *Measurements*. Carapace 1.76 long, 1.33 wide, 0.76 high at PLE. Ocular area 0.79 long, 1.05 wide anteriorly and 1.08 posteriorly. Diameter of AME 0.30. Abdomen 1.68 long, 1.33 wide. Cheliceral length 0.68. Clypeal height 0.10. Length of leg segments:

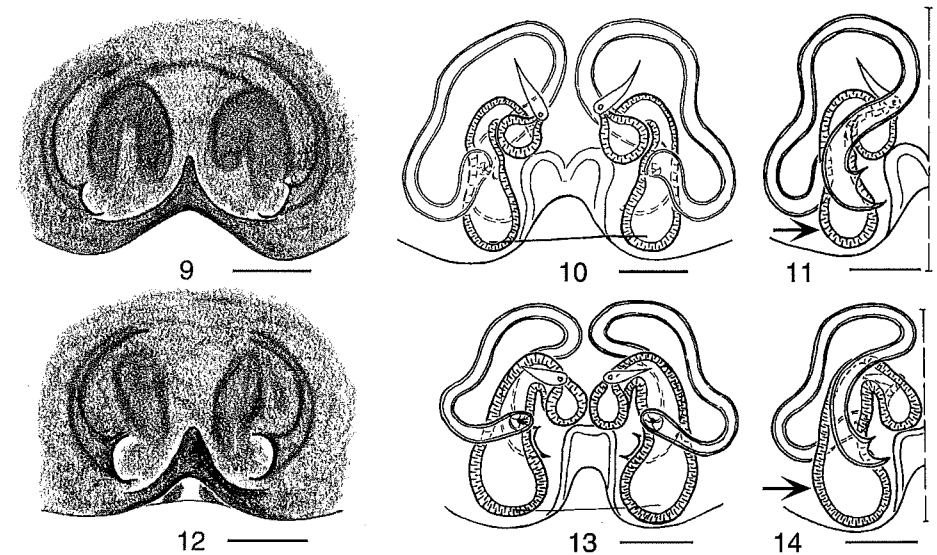
	Fm	Pt	Tb	Mt	Tr	Total
I	1.07	0.61	0.74	0.65	0.39	3.46
II	0.81	0.49	0.48	0.46	0.31	2.55
III	0.76	0.43	0.41	0.49	0.32	2.41
IV	1.21	0.54	0.74	0.67	0.37	3.53

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

*Coloration*. Carapace: brownish, eye field blackish, covered with dark appressed hairs. Sides of thoracic part with white appressed hairs. Narrow median band of white hairs from level of PLE to beginning of rear slope of carapace. Each side with a lateral band of white hairs from ALE, passing PME and PLE, to rear slope of carapace (not reaching margin). A transversal row of stout black hairs pointing forwards above AME; "eyebrows" composed of shorter black hairs mixed with short whitish hairs surrounding AME. Sides of carapace with mixed black and white appressed hairs. Clypeus brownish, with thin light hairs. Chelicerae yellowish to light brown. Sternum greyish brown. Abdomen: dorsally blackish brown, at about its middle with a pair of white spots (smaller than in *S. atricapillus*). Dorsum bordered with band of white hairs, in anterior part interrupted medially; white lanceolate spot in anterior part lacking (cf. *S. atricapillus*). White lateral bands broken into a few white spots (mainly posteriorly). (Dorsal pattern on abdomen may vary, cf. illustration in Kleemola, 1969, fig. 4a.) Legs: yellowish brown with dark blotches/annulation; Fm I dorsally and laterally and entire Tb I in some specimens dark brown. Palp: femur and patella yellowish brown and more or less sooty, tibia and cymbium dark brown. Femur dorsally and patella covered with white hairs of moderate length, tibia dorso-retrolaterally with longer white hairs and dorso-prolaterally with longer black hairs. Cymbium with black hairs (a few whitish hairs may be present basally).

*Palp*. Structure as in Figs 2, 6, 7.

FEMALE (from Sweden, Dalarna). *Measurements*. Carapace 2.18 long, 1.61 wide, 1.01 high at PLE. Ocular area 0.84 long, 1.26 wide anteriorly and 1.33 posteri-



FIGS 9-14

Epigyne, ventral view (9, 12) and spermathecae, dorsal view (10, 13) and ventral view of right side (11, 14). - 9-11. *Sitticus atricapillus* (Italy: Trentino). - 12-14. *S. zimmermanni* (Sweden: Dalarna). Scale lines: 0.1 mm.

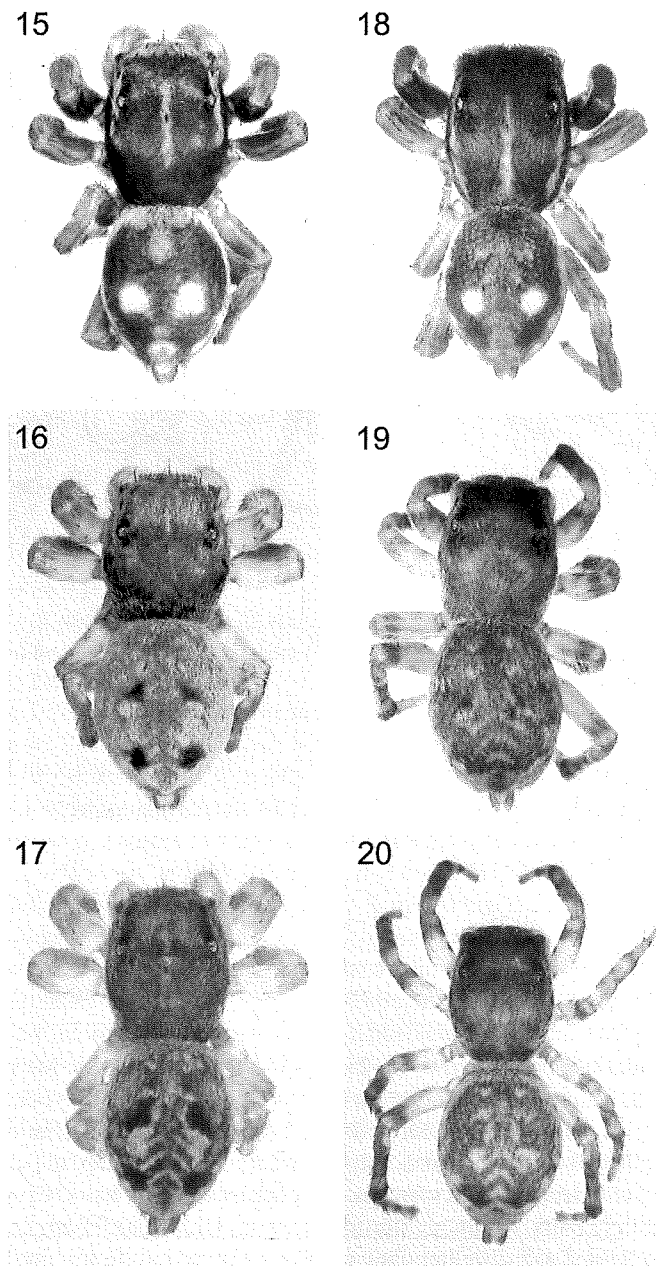
only. Diameter of AME 0.40. Abdomen 2.35 long, 1.80 wide. Cheliceral length 0.68. Clypeal height 0.10. Length of leg segments:

	Fm	Pt	Tb	Mt	Tr	Total
I	1.00	0.61	0.64	0.52	0.37	3.14
II	0.91	0.54	0.52	0.50	0.36	2.83
III	0.93	0.50	0.50	0.57	0.36	2.86
IV	1.56	0.69	1.06	0.83	0.51	4.65

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

*Coloration*. Carapace dusky brown, with appressed light hairs. Clypeus brown, with appressed light hairs. Abdomen dorsally greyish, with a pair of larger white spots behind the middle and a few lighter chevron-like markings along midline posteriorly; a pair of diffuse dark spots close to rear end. Live females may be uniformly greyish in appearance. Palp yellowish, with more or less dark greyish markings, most of Tr dark. Palp with light and (fewer) dark hairs. Legs yellowish, with distinct greyish annulation.

*Epigyne* and spermathecae as in Figs 12-14.



FIGS 15-20

Habitus, dorsal view. – 15-17. *Sitticus atricapillus* (15 male from Greece: Timfristos, 16 female from Greece: Tomaros, 17 female from Czech Republic). – 18-20. *S. zimmermanni* (18 male, 19 female, both from Sweden: Dalarna; 20 female from Austria).

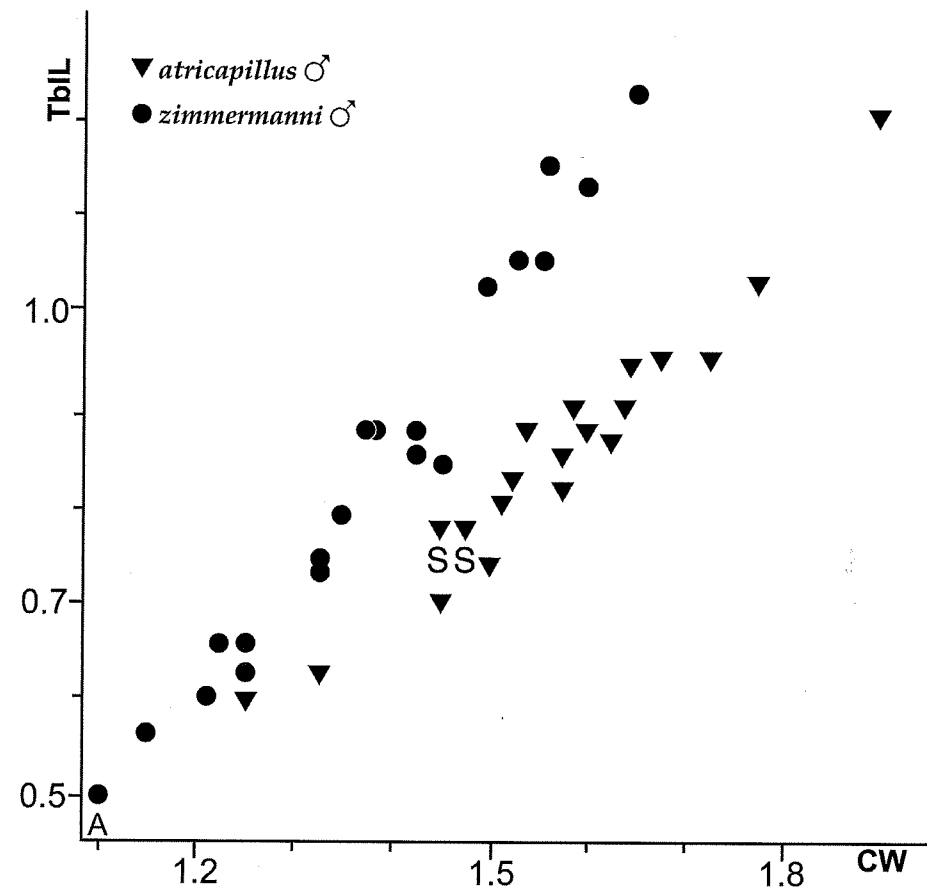


FIG. 21

Tibia I length (TbIL)/carapace width (CW) ratios in males of *Sitticus atricapillus* (▼) and of *S. zimmermanni* (●). A = male from Azerbaijan, S = non-characteristic males from Sicily: Etna.

## COMMENTS

Due to its presumed rarity, *S. zimmermanni* is included in the Red Lists of Threatened Species in Germany (Platen *et al.*, 1998), in Slovakia (Gajdoš *et al.*, 1999) and in Austria: Carinthia (Komposch & Steinberger, 1999). In the light of two species being encompassed under the name *Sitticus zimmermanni*, a re-evaluation of these species is necessary.

The specimens listed above from Russia, Ukraine and Azerbaijan differ somewhat from the rest of the material examined. The females from Russia and Ukraine were caught without males and have a more yellowish appearance and a more pronounced abdominal pattern than females from western Europe. The male from Azerbaijan is unusually small (cf. Fig. 21: A). Until further comparison between north-western and central European material on the one hand and Ukrainian, Russian, and Asiatic material on the other has been undertaken, we regard it all as conspecific.

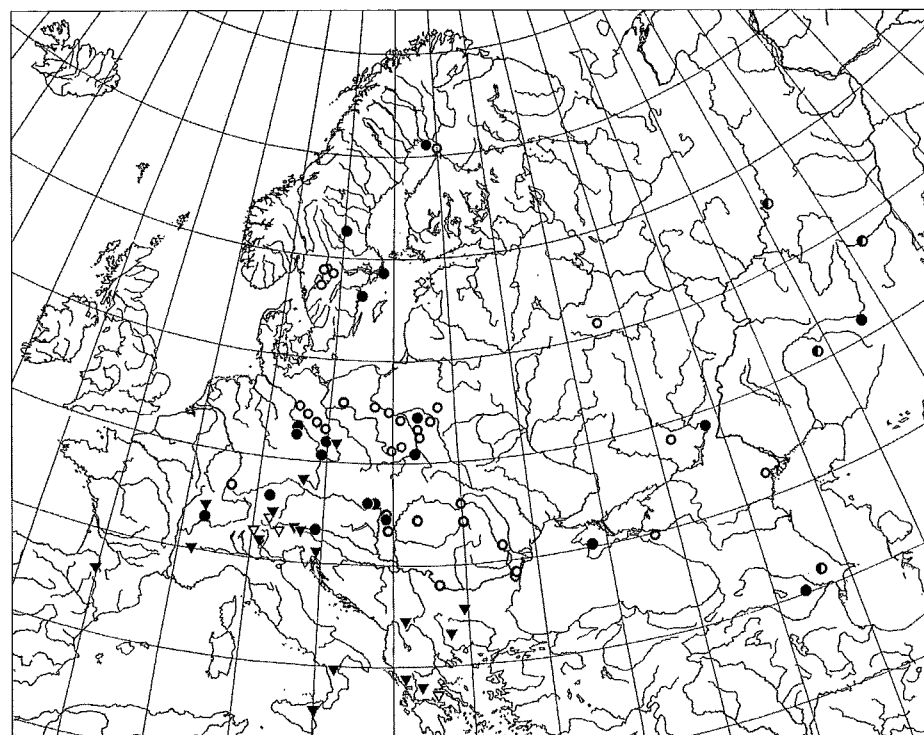


FIG. 22

Localities of *Sitticus atricapillus* (triangles) and of *S. zimmermanni* (circles). For additional records of *S. zimmermanni* in northern Asia see Logunov & Marusik (2000: map 50). Filled symbols refer to material seen by the authors, open symbols refer to records in the literature; half-filled circles refer to records in the literature based on material previously examined by DVL. One symbol may represent more than one close locality.

#### HABITAT AND NOTE ON BIOLOGY

*Sitticus zimmermanni* appears to be a species confined to lower altitudes; the highest localities where it has so far been found are situated at about 400 m asl. This species has been characterized as a xerobiont (Harm, 1973), though it would be more appropriate to regard it as an inhabitant of certain xerothermic habitats (cf. Bauchhenss, 1990). In Sweden, it has been found on shores with sand and sparse vegetation and also on rocky shores at the Baltic Sea, northwards as far as the innermost part of the Bothnian Gulf, as well as at similar localities at some inland lakes in the south and central parts of the country (Kronestedt *et al.*, 1997); the sandy shores of the lakes in Dalarna with adjacent dry pine forests on sandy ground. In Germany, the species has been found in various xerothermic inland habitats, also on river banks. In Poland, it has mainly been met with on sandy ground (Próchniewicz, 1991). The finds from newly restored habitats in Germany and from an artificial island in Austria (Komposch, 1996) suggest a potential in this species to colonize suitable habitats in early succession stages. In Russia (the southern Urals, western and central Siberia), *S. zimmermanni* has

TABLE I. Morphological differences between *Sitticus atricapillus* and *S. zimmermanni*

	<i>S. atricapillus</i>	<i>S. zimmermanni</i>
<b>Males</b>		
Carapace pattern	Transverse dorsal band of white hairs above first eye row distinct*, backwards continuing into a longitudinal band of white hairs on each side (Figs 5, 15).	Without transverse band in front; each side with a longitudinal band of white hairs (Figs 8, 18)
Chelicerae	Stouter than in <i>S. zimmermanni</i>	Less stout than in <i>S. atricapillus</i>
Abdomen	Dorsum anteriorly with a white transverse band, often confluent with white lanceolate median spot (Figs 5, 15)	Dorsum lacking white transverse anterior band and white lanceolate median spot (Figs 8, 18)
Leg I length	Tb shorter in relation to carapace width compared with <i>S. zimmermanni</i> (Fig. 21)	Tb longer in relation to carapace width compared with <i>S. atricapillus</i> (Fig. 21)
Palpal pubescence	Entire Tb with numerous white hairs	Tb with white hairs mostly situated retrolaterally
Tegulum (in ventral view)	More rounded (Figs 1 & 3) compared with <i>S. zimmermanni</i>	More elongated (Figs 2 & 6) compared with <i>S. atricapillus</i>
Position of small loop of seminal duct (bulbus in resting position)**	At 1-2 o'clock (Figs 1 & 3, arrow)	At 2-3 o'clock (Figs 2 & 6, arrow)
<b>Females</b>		
Palp	Yellow, except for darkened tip of Tr	Yellow, with brown annulations on all segments
Epigyne**	Copulatory openings relatively wider apart from each other (Fig. 9)	Copulatory openings relatively closer to each other (Fig. 12)
Spermathecae**	SRR relatively small, not swollen (Fig. 11, arrow)	SRR relatively large, swollen (Fig. 14, arrow)

\* For South Italian males see comments above

\*\* The differences in this character are not always distinct.



been recorded from sandy stands, birch and pine forests and forest plantations in the steppe zone (see Logunov & Marusik, 2000),

A pregnant female captured in Sweden (Dalarna) produced 15 eggs in a thin sac attached to the wall inside a silk chamber.

#### DISTRIBUTION

*Sitticus zimmermanni* has a Euro-Siberian subboreal range; it has been recorded from Sweden (Kronstedt *et al.*, 1997), Finland (Palmgren, 1977: sub *S. tullgreni*), Poland (map with localities given in Próchniewicz, 1991), Germany (map with references given in Staudt, 2003), Austria (Komposch, 1996), Switzerland (Prószyński, 1980 in part: sub *S. hungaricus* from Lac Buchillon), Czech Republic (Buchar & Ružička, 2002 in part: material listed above), Slovakia (at least some of the finds reported in Gajdoš *et al.*, 1999), Hungary (Samu & Szinetár, 1999), Romania (Fuhn & Gherasim, 1995), Russia (from Moscow: Grese, 1911: sub *Attus Zimmermannii*; eastwards to Transbaikalia: Logunov & Marusik, 2000), Azerbaijan (Logunov & Guseinov, 2002), Turkmenistan (Fet, 1983; Wesołowska, 1996), and China (Xinjiang: Hu & Wu, 1989) (Fig. 22; for additional eastern records not shown on this map, see Logunov & Marusik, 2000: map 50).

Some records attributed to *S. zimmermanni* from Slovakia (Gajdos *et al.* 1999) need confirmation. One male from Vel'ká Fatra (Selenec, Vel'ká Skalná, 7 August 1974, leg. P. Hroznár, det. F. Miller) turned out to be a misidentified *S. rupicola*. Also Roșca's records from northern Romania (see Fuhn & Gherasim, 1995) and Ukraine (Bucovina) (Roșca, 1930, 1936), as well as other records from Ukraine (Polesye and Chernomorski Reserve: Polchaninova, 1988, 1990, 1997; Evtushenko, 1991) and from the southern part of European Russia (Rostov Areas and Kalmykiya: Minoranskiy, 1995; Minoranskiy & Ponomarev, 1984; Mikhailov, 1997; Ponomarev, 2002), need to be confirmed.

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Mikhailov kindly helped us gathering Ukrainian and some Russian records for *S. zimmermanni*. We are also obliged to Ms Elizabeth Binkiewicz for making some of the drawings. We thank Mr Blick for providing us with some information on literature; he, Prof. Thaler and Dr Peter Schwendinger (Muséum d'histoire naturelle, Geneva, Switzerland) kindly commented on the manuscript of this paper.

#### REFERENCES

- ALICATA, P. & CANTARELLA, T. 2000. I Salticidi di Sicilia: stato della conoscenza e descrizione di due nuove specie (Araneae Salticidae). *Memorie della Società entomologica italiana* 78: 485-498.
- BAUCHHENSS, E. 1990. Mitteleuropäische Xerotherm-Standorte und ihre epigäische Spinnenfauna – eine autökologische Betrachtung. *Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg* (NF) 31/32: 153-162.
- BELLMANN, H. 1997. Kosmos-Atlas Spinnentiere Europas. *Franckh-Kosmos Verlag, Stuttgart*, 304 pp.
- BONNET, P. 1958. Bibliographia araneorum. Vol. 2. *Douladoure, Toulouse*, pp. 3027-4230 (N-S).
- BÖSENBERG, W. 1903. Die Spinnen Deutschlands 5-6. *Zoologica, Stuttgart* 14: 385-465.
- BOSMANS, R., MAELFAIT, J.-P. & DE KIMPE, A. 1986. Analysis of the spider communities in an altitudinal gradient in the French and Spanish Pyrénées. *Bulletin of the British arachnological Society* 7: 69-76.
- BRAUN, R. 1963. Einige neue und einige zweifelhafte Spinnenarten aus Österreich (Arach., Araneae). *Senckenbergiana biologica* 44: 111-128.
- BRISTOWE, W. S. 1935. The spiders of Greece and the adjacent islands. *Proceedings of the Zoological Society of London* 1934: 733-788.
- BUCHAR, J. & RUŽIČKA, V. 2002. Catalogue of spiders of the Czech Republic. *Peres Publishers, Praha*, 351 pp.
- CAVANNA, G. 1882. Narrazione della escursione fatta al Vulture ed al Pollino nel luglio del 1880 da Biondi, C. Caroti e G. Cavanna. *Bolletino della Società entomologica italiana* 14: 3-30.
- CHYZER, C. & KULCZYŃSKI, W. 1891. Araneae Hungariae. Vol. 1. *Ed. Academiae Scientiarum Hungaricae, Budapest*, 171 pp. + 6 pls.
- DELTSHEV, C. 1998. Spiders from high altitude zone of Central Stara Planina Mountain (Bulgaria). *Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck* 85: 213-221.
- DELTSHEV, C. & BLAGOEV, G. 1997. The spiders of Pirin Mountain (Bulgaria). Taxonomic, faunistic and zoogeographical analysis. *Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck* 84: 269-286.
- DENIS, J. 1953. Araignées des environs du Marcadau et du Vignemale (Hautes-Pyrénées). *Bulletin de la Société d'Histoire naturelle de Toulouse* 88: 83-112.
- DUFFEY, E. 1968. An ecological analysis of the spider fauna of sand dunes. *Journal of Animal Ecology* 37: 641-674.
- EVTUSHENKO, K. V. 1991. Faunistic complexes of spiders (Aranei) of some biotopes of the Chernigov Polesye. *Vestnik Zoologii* 1: 74-76. (In Russian).
- FET, V. Y. 1983. The fauna of Aranei of the south-western Kopetdagh. *Entomologicheskoye Obozrenie* 62: 835-845.
- FUHN, I. E. & GHERASIM, V. F. 1995. Fauna României. Arachnida. Vol. 5, fasc. 5. Familia Salticidae. *Editura Academiei Române, Bucuresti*, 301 pp.
- GAJDOŠ, P., SVATOŇ, J. & SLOBODA, K. 1999. Katalóg pavúkov Slovenska/Catalogue of Slovakian Spiders. *Ústav krajinskej ekológie SAV, Bratislava*, 339 pp.
- GRESE, N. S. 1911. Additions to the list of spiders of the Moscow Gouvernement. *Dnevnik zoologicheskago Otdeleniya* 3(10): 55-61. (In Russian).

- HARM, M. 1973. Zur Spinnenfauna Deutschlands, XIV. Revision der Gattung *Sitticus* Simon (Arachnida: Araneae: Salticidae). *Senckenbergiana biologica* 54: 369-403.
- HOLM, Å. 1944. Ein Beitrag zur Salticiden-Fauna Schwedens. *Arkiv för Zoologi* 35B (4): 1-4.
- HU, J. L. & WU, W. G. 1989. Spiders from agricultural regions of Xinjiang Uygur Autonomous Region, China. *Jinan: Shandong Univ. Publ. House*, 435 pp. (In Chinese).
- KLEEMOLA, A. 1969. On the spiders of the island group of Krunnit (PP) with some notes on the species *Sitticus tullgreni* Holm. *Aquilo, Ser. Zoologica* 8: 44-49.
- KOMPOSCH, C. 1996. Arachnological investigations on primary succession of an artificial island in southern Austria (Arachnida: Opiliones, Araneae). Proceedings of the XIIIth International Congress of Arachnology, Geneva, 3-8 September 1995 (ed. V. MAHNERT). *Revue suisse de Zoologie* vol. hors série: 327-334.
- KOMPOSCH, C. 2000. Bemerkenswerte Spinnen aus Südost-Österreich I. *Carinthia II* 190/110: 343-380.
- KOMPOSCH, C. & STEINBERGER, K.-H. 1999. Rote Liste der Spinnen Kärntens (Arachnida: Araneae). In: ROTTENBURG, T. et al. (eds). Rote Listen gefährdeter Tiere Kärntens. *Naturschutz in Kärnten* 15: 567-618.
- KRONESTEDT, T. 1998. *Sitticus inexpectus* (Araneae, Salticidae) new to Italy. *Arachnologische Mitteilungen* 15: 81-83.
- KRONESTEDT, T., PETTERSSON, R. & COULIANOS, C.-C. 1997. Arachnids on the island of Haparanda Sandskär, Sweden. *Natur i Norr* 16: 38-42. (In Swedish, with English abstract).
- KROPP, C. 1996. Erstnachweis von *Acantholycosa norvegica* (Thorell, 1872) für die Schweiz und weitere bemerkenswerte Spinnenfunde (Arachnida, Araneae). *Jahrbuch des Naturhistorischen Museums Bern* 12: 101-112.
- KULCZYŃSKI, W. 1887. Przyczynek do tyrolskiej fauny pajęczaków. *Rozprawy i sprawozdania z posiedzeń wydziału matematyczno-przyrodniczego Akademii Umiejętności* 16: 245-356.
- LOGUNOV, D. V. & GUSEINOV, E. F. 2002 (2001). Faunistic review of the jumping spiders of Azerbaijan (Aranei: Salticidae), with additional faunistic records from neighbouring Caucasian countries. *Arthropoda Selecta* 10: 243-260.
- LOGUNOV, D. V. & KRONESTEDT, T. 1997. A new Palearctic species of the genus *Sitticus* Simon, with notes on related species in the *floricola* group (Araneae, Salticidae). *Bulletin of the British arachnological Society* 10: 225-233.
- LOGUNOV, D. V. & MARUSIK, Y. M. 2000. Catalogue of the jumping spiders of northern Asia (Arachnida, Araneae, Salticidae). *KMK Scientific Press, Moscow*, 299 pp.
- METZNER, H. 1999. Die Springspinnen (Araneae, Salticidae) Griechenlands. *Andrias* 14: 1-279.
- MIKHAILOV, K. G. 1997. Catalogue of the spiders of the territories of the former Soviet Union (Arachnida, Aranei). *Zoological Museum of the Moscow State University, Moscow*, 416 pp.
- MINORANSKIY, V. A. 1995 (for 1994). On the spider fauna of agrocoenoses of the Lower Don (pp. 48-56). In: UTOCHKIN, A. S. et al. (eds). Fauna i ekologiya paukoobraznykh. *Perm'skiy Gosudarstvennyy Universitet, Perm*. (In Russian).
- MINORANSKIY, V. A. & PONOMAREV, A. V. 1984. Materials on the spider fauna of Kalmykia (pp. 82-92). In: UTOCHKIN, A. S. et al. (eds). Fauna i ekologiya paukoobraznykh. *Perm'skiy Gosudarstvennyy Universitet, Perm*. (In Russian).
- MUSTER, C. 2001. Biogeographie von Spinnentieren der mittleren Nordalpen (Arachnida: Araneae, Opiliones, Pseudoscorpiones). *Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg (NF)* 39: 5-196.
- ONO, H. 1988. A revisional study of the spider family Thomisidae (Arachnida, Araneae) of Japan. *National Science Museum, Tokyo*, 252 pp.
- PALMGREN, P. 1977. Die Spinnenfauna Finnlands und Ostfennoskandiens VIII. Anhang: Bestimmungstabelle der in Finnland repräsentierten Spinnenfamilien und kommentiertes Register der Teile I-VIII der Spinnenfauna. *Fauna fennica* 30: 35-50.
- PLATEN, R., BLICK, T., SACHER, P. & MALTEN, A. 1998. Rote Liste der Webspinnen (Arachnida: Araneae). In: BINOT, M. et al. (eds). Rote Liste gefährdeter Tiere Deutschlands. *Schriftenreihe für Landschaftspflege und Naturschutz* 55: 268-275.

- PLATNICK, N. I. 2003. The world spider catalog, version 3.5. *American Museum of Natural History*, online at <http://research.amnh.org/entomology/spiders/catalog81-87/index.html>
- POLCHANINOVA, N. Y. 1988. Spiders of the Chernomorski State Reserve (pp. 42-51). In: UTOCHKIN, A. S. et al. (eds). Fauna i ekologiya paukoobraznykh. *Perm'skiy Gosudarstvennyy Universitet, Perm*. (In Russian).
- POLCHANINOVA, N. Y. 1990. Comparative characteristics of the spider fauna of steppes of the Levoberezhnaya Ukraine. *Novosti faunistiki i sistematiki, Kiev (AN USSR)*: 163-167. (In Russian).
- POLCHANINOVA, N. Y. 1997. Herpetobiont spiders of the Ivan-Rybal'chanski Division of Chernomorski Reserve. *Izvestia Khar'kov entomologicheskogo Obshchestva* 5(1): 131-139. (In Russian with English summary).
- PONOMAREV, A. V. 2002. The jumping spiders (Aranei, Salticidae) of the South-East part of the European part of the ex-USSR (pp. 203-206). In: NAGALEVSKII, V. Y. (ed.). Actual problems of ecology and conservation of the ecosystems of the southern regions of Russia and neighboring territories. Materials on the XV inter-republican scientific-practical conference, Kubansky State University. *Krasnodar*. (In Russian).
- PRÓCHNIEWICZ, M. 1991. Zur Verbreitung von fünf Spinnenarten (Arachnida: Araneae). *Bulletin of the Polish Academy of Sciences, Biological Sciences* 39: 181-183.
- PRÓSZYŃSKI, J. 1980. Revision of the spider genus *Sitticus* Simon, 1901 (Aranei, Salticidae), IV. *Sitticus floricola* (C. L. Koch) group. *Annales zoologici, Warszawa* 36: 1-35.
- PRÓSZYŃSKI, J. 1991. Salticidae (pp. 488-523). In: HEIMER, S. & NENTWIG, W. (eds). Spinnen Mitteleuropas. *Paul Parey, Berlin & Hamburg*, 543 pp.
- PRÓSZYŃSKI, J. 2003. Salticidae (Araneae) of the World. Part II. Catalogue of Salticidae (Araneae) – synthesis of quotations in the world literature since 1940, with basic taxonomic data since 1758. Online at <http://www.salticidae.org/salticid/catalog/0-tit-pg.htm>
- PRÓSZYŃSKI, J. & STAREGA, W. 1971. Pajaki - Aranei. *Katalog Fauny polski* 16: 1-382.
- ROEWER, C. F. 1954. Katalog der Araneae von 1758-1940, bzw. 1954. Vol. 2, fasc. b, pp. 927-1751. *Institut royal des Sciences naturelles de Belgique, Bruxelles*.
- ROȘCA, A. 1930. Contribuțiuni la cunoșterea Arachnoidelor din Bucovina. *Buletinul Facultății de Științe din Cernăuți* 4(2): 201-219.
- ROȘCA, A. 1936. Fauna Araneelor din Bucovina (sistematica, ecologia și răspândirea geografică). *Buletinul Facultății de Științe din Cernăuți* 10: 123-216.
- SAMU, F. & SZINETÁR, C. 1999. Bibliographic check list of the Hungarian spider fauna. *Bulletin of the British arachnological Society* 11: 161-184.
- SIMON, E. 1877. Description de deux Salticides d'Europe. *Annales de la Société entomologique de France* (5) 7 (Bulletin): 74-76.
- SIMON, E. 1882. Aracnidi raccolti da G. Cavanna al Vulture, al Pollino ed in altri luoghi dell'Italia meridionale e centrale. *Bolletino della Società entomologica italiana* 14: 31-48.
- SIMON, E. 1937. Les Arachnides de France 6(5). *Roret, Paris*, pp. 979-1298.
- STAUDT, A. 2003. Nachweiskarten der Spinnentiere Deutschlands. *Arachnologische Gesellschaft*, online at <http://www.spiderling.de/vu>
- THALER, K. 1997. Beiträge zur Spinnenfauna von Nordtirol – 4, Dionycha (Anyphaenidae, Clubionidae, Heteropodidae, Liocranidae, Philodromidae, Salticidae, Thomisidae, Zoridae). *Veröffentlichungen des Tiroler Landesmuseums Ferdinandeum* 77: 233-285.
- TULLGREN, A. 1944. Svensk Spindelfauna 3. Egentliga spindlar. Araneae. Fam. 1-4. Salticidae, Thomisidae, Philodromidae och Eusparrassidae. *Entomologiska Föreningen, Stockholm*, 138 pp + 18 pls.
- WESOŁOWSKA, W. 1996. New data on the jumping spiders of Turkmenistan (Aranei Salticidae). *Arthropoda Selecta* 5(1-2): 17-53.
- ZABKA, M. 1997. Fauna Polski. Vol. 19. Salticidae. Pajaki skaczace (Arachnida: Araneae). *Muzeum i Instytut Zoologii PAN, Warszawa*, 189 pp.