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ON NEW CENTRAL ASIAN GENUS AND SPECIES OF WOLF SPIDERS (ARANEAE: LYCOSIDAE) EXHIBITING A PRONOUNCED SEXUAL SIZE DIMORPHISM

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ABSTRACT

A new genus *Zyuzicosa* gen. nov. is erected for eight central Asian species of the burrowing wolf spiders, of which five are described as new: *Z. baisunica* sp. nov. (both sexes from Uzbekistan), *Zyuzicosa gigantea* sp. nov. (male from Uzbekistan), *Zyuzicosa turlanica* sp. nov. (both sexes from South Kazakhstan), *Zyuzicosa uzbekistanica* sp. nov. (male from Uzbekistan), and *Zyuzicosa zerafshanica* sp. nov. (both sexes from Uzbekistan). Three new combinations are proposed: *Zyuzicosa afghana* (Roewer, 1960), comb. nov. (transferred from *Avicosa*), *Zyuzicosa fulviventrif* (Kroneberg, 1875), comb. nov. (transferred from *Tarentula*), and *Zyuzicosa laetabunda* (Spassky, 1941), comb. nov. (transferred from *Lycosa*). Identification keys to five central Asian genera of the burrowing Lycosidae and to all *Zyuzicosa* species are provided as well. Three *Zyuzicosa* gen. nov. species, for which both sexes are known, exhibit a pronounced sexual size dimorphism, having typical dwarf males that are half or less than half the size of corresponding females. This phenomenon has never previously been observed in the Lycosidae.

Key words: Araneae, burrowing wolf-spiders, Central Asia, descriptions, extreme sexual size dimorphism, identification keys, Lycosidae, taxonomy

О НОВОМ РОДЕ И ВИДАХ ПАУКОВ-ВОЛКОВ (ARANEAE: LYCOSIDAE) ИЗ ЦЕНТРАЛЬНОЙ АЗИИ, ДЕМОНИСТРИРУЮЩИХ СИЛЬНО ВЫРАЖЕННЫЙ ПОЛОВОЙ РАЗМЕРНЫЙ ДИМОРФИЗМ

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РЕЗЮМЕ

Новый род *Zyuzicosa* gen. nov. установлен для восьми центрально-азиатских видов роющих пауков-волков, из которых пять описаны как новые: *Z. baisunica* sp. nov. (самцы и самки из Узбекистана), *Zyuzicosa gigantea* sp. nov. (самец из Узбекистана), *Zyuzicosa turlanica* sp. nov. (самцы и самки из Южного Казахстана), *Zyuzicosa uzbekistanica* sp. nov. (самец из Узбекистана), и *Zyuzicosa zerafshanica* sp. nov. (самцы и самки из Узбекистана). Предложено три новые комбинации: *Zyuzicosa afghana* (Roewer, 1960), comb. nov. (перенесен из рода *Avicosa*), *Zyuzicosa fulviventrif* (Kroneberg, 1875), comb. nov. (перенесен из рода *Tarentula*), и *Zyuzicosa laetabunda* (Spassky, 1941), comb. nov. (перенесен из рода *Lycosa*). Приведены определительные ключи для пяти центрально-азиатских родов роющих ликозид и для всех видов рода *Zyuzicosa* gen. nov. Три вида *Zyuzicosa* gen. nov., для которых известны оба пола, демонстрируют сильно выраженный половой размерный диморфизм, при котором карликовые самцы в два и более раз мельче соответствующих самок. Этот феномен никогда ранее не отмечался для Lycosidae.

Ключевые слова: Araneae, роющие пауки-волки, Центральная Азия, описания, сильно выраженный половой диморфизм, определительные ключи, Lycosidae, таксономия

INTRODUCTION

Burrowing wolf spiders of the family Lycosidae of Central Asia are poorly known. Central Asia is here accepted as the territory of traditional Middle Asia and Kazakhstan plus neighbouring territories of western China, including Tibet, Pakistan, Afghanistan and Iran. According to Zyuzin (1990, 1993), all of the burrowing wolf spiders belong to the subfamily Lycosinae and the tribe Lycosini; but see Murphy et al. (2006), who did not support the tribes Lycosini and Trochosini *sensu* Zyuzin (1993) within the Lycosinae and also excluded the genus *Arctosa* C.L. Koch, 1847 from the Lycosinae. To date, at least 17 species of burrowing lycosids have been recorded from Central Asia (Pickard-Cambridge 1885; Schenkel 1936, 1963; Roewer 1955a, 1960; Hu and Wu 1989; Mikhailov 1997; Buchar 1997; Song et al., 1999; Hu 2001; Marusik and Buchar 2004). Uncertainty in the number of described/recorded species is because they remain poorly understood taxonomically. The majority of burrowing lycosids of Central Asia are known from a few records and/or from the type locality only, with no data on their biology (Spassky 1941; Roewer 1959, 1960). Of the recorded species, two are well known, namely: *Allohogna singoriensis* (Laxmann, 1770), studied in detail by Wagner (1868) and especially by Marikovski (1956; see also Milasowszky and Zulka 1998, for habitat preferences of this species in Europe), and *Lycosa praegrandis* C.L. Koch, 1836, a widespread east-Mediterranean species (see Zyuzin and Logunov 2000; Thaler et al. 2000). Some species, such as *Lycosa alticeps* Kroneberg, 1875, have been recorded from Central Asia several times (Kroneberg 1875; Andreeva 1976), but the species' distribution and even taxonomy remain little-known. Besides *Allohogna singoriensis*, burrowing behaviour was also described for *Lycosa asiatica* Sytshevskaya, 1980 (see Sytshevskaya 1980) but its taxonomy remains obscure. A real and yet un-described diversity of burrow-inhabiting Lycosidae of Central Asia is likely to consist of tens of species belonging to a number of undescribed genera (A. Zyuzin, pers. comm.), of which only a single monotypic genus *Oculicosa* Zyuzin, 1993 has been erected to date (see Zyuzin 1993).

It is worth mentioning that the systematic of most lycosine genera, and particularly those with larger species, is in a very poor state. Even the nominate genus of the family, *Lycosa* Latreille, 1804, has not been subject to a proper modern revision. As Murphy et al.

(2006: p. 585) put it, *Lycosa* was "used as a 'dumping ground' for wolf spiders that could not be satisfactorily placed in other genera". Other genera to which this applies include *Geolycosa* Montgomery, 1904 and *Hogna* Simon, 1885. The literature is thus full of species which were assigned by early workers to these genera in the absence of any clear generic diagnoses, let alone any understanding of their relationships. The present paper attempts to bring some clarity to a small, well defined group of central Asian species for which clear diagnostic characters and putative synapomorphies are available.

In the present work, a new genus and five new species of burrowing lycosids from Central Asia are described. This represents a tiny portion of the large unsorted collection of Central Asian Lycosidae, which became available to the author in January 2009 (courtesy of A.A. Zyuzin; Almaty, Kazakhstan). The holotypes of two earlier described species have been re-examined, both belonging to the newly erected genus.

MATERIAL AND METHODS

Specimens for this study were borrowed from or distributed among the following museums: BMNH = British Museum of Natural History, London, UK (Ms J. Beccaloni); MMUM = Manchester Museum, University of Manchester, Manchester, UK (Dr. D.V. Logunov); SZMN = Siberian Zoological Museum, Institute for Systematics and Ecology of Animals, Novosibirsk, Russia (Dr. G.N. Azarkina); ZISP = Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia (Dr. V.A. Krivokhatski); ZMUM = Zoological Museum of the Moscow University, Moscow, Russia (Dr. K.G. Mikhailov).

Terminology of sclerites of the copulatory organs follows Griswold (1993) and Zyuzin (1993). In a few cases, when differing terms have been used to describe the same sclerites, the term 'synembolus' by Zyuzin (1993: fig. 6, sem) is adopted instead of the 'process of the basal lobe of embolus' by Griswold (1993: fig. 57, 59, EPL) and the 'terminal apophysis' by Dondale and Redner (1990) and by Langlands and Framenau (2010). The term 'hyaline conductor' (Griswold 1993: fig. 59) is used instead the 'tegular depression' by Zyuzin (1993), the 'tegular apophysis' by Russell-Smith et al. (2009: fig. 7) and the 'tegular lobe' by Langlands and Framenau (2010: figs 13a, 15a, etc.). Finally, the term 'palea' (*sensu* Zyuzin 1993: fig.

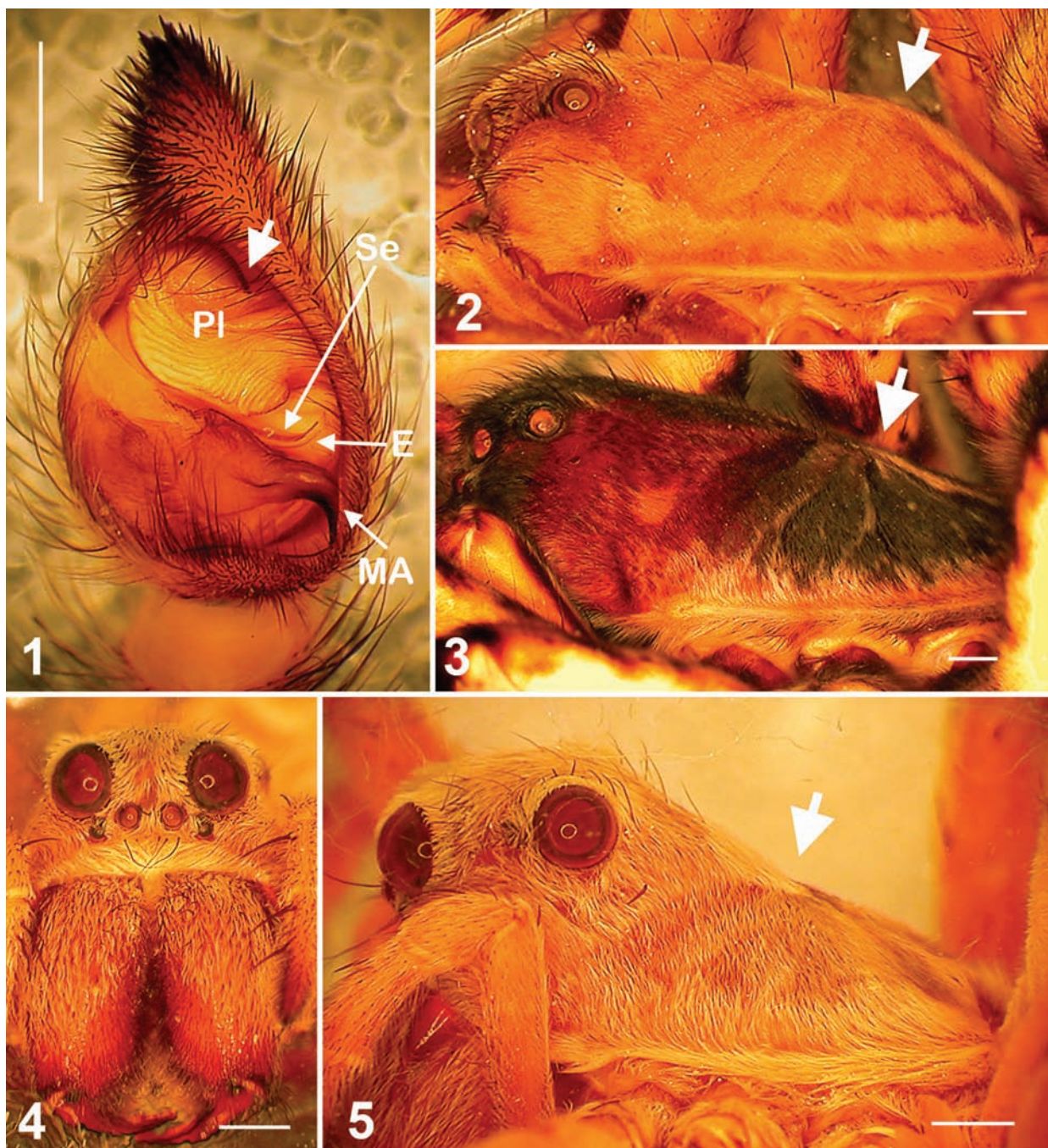
Table 1. Comparative material on the other burrowing Lycosidae used in the present paper.

Species name	Material examined	Locality
<i>Allohogna singoriensis</i> (Laxmann, 1770)	1 male (ZMUM)	Kazakhstan, East Kazakhstan Region, nr. Ust'-Kamenogorsk, 10.06.1911, E.N. Zorin [this is the type locality of <i>A. singoriensis</i>].
	1 female (ZMUM)	"Narynskaya Volost', Zaisan l. / Semipalatinsk Region / 20.07.1911 / E.N. Zorin" [Kazakhstan, East Kazakhstan Region, nr. Lake Zaisan].
	1 female (MMUM)	Russia, Chelyabinsk Region, Troitsky Reserve (c. 54°00'N, 61°10'E), steppe, 07.2009, S.L. Esyunin.
<i>Allohogna shansia</i> (Hogg, 1912)	1 female (ZMUM)	Russia, Buryatia, c. 40 km NE of Ulan-Ude (c. 51°43'N, 108°15'E), grassland, 9.06.1990, S.N. Danilov.
	1 male (ZMUM)	Russia, Buryatia, Tarbagatai Distr., nr. Kuytun (c. 54°20'N, 101°30'E), grassland, 15.10.1997, S.N. Danilov.
	1 female imm. (MMUM)	Russia, Buryatia, Kyakhta Distr., 4-5 km N of Ust'-Kiran (50°28'N, 106°49'E), sandy steppe with <i>Salix</i> sp. And pines, 580-590 m a.s.l., 25-26.06.2001, D.V. Logunov.
<i>Geolycosa dunini</i> Zyuzin & Logunov, 2000	2 females (MMUM)	Azerbaijan, 20-25 km NE of Shemakha, Pirkuli Reserve (c. 40°43'N, 48°33'E), 1000 m a.s.l., 9/09/1984, D.V. Logunov.
<i>Lycosa praegrandis</i> C. L. Koch, 1836	1 female (ZMUM)	Kazakhstan, South Kazakhstan Region, Suzak Distr., c. 2 km N of Taikonyr, Betpak-Dala desert (45°13'N, 67°32'E), 9.07.2001, R.K. Kadyrbekov.
<i>Lycosa tarantula</i> (Linnaeus, 1758)	1 male, 1 female (ZMUM)	Spain, Calahonda, Siera Nevada, nr. Motril (c. 36°45'N, 3°31'W), 07.2001/04, D. Penney.
<i>Oculicosa supermirabilis</i> Zyuzin, 1993	3 males, 7 females (SZMN)	Kazakhstan, South Kazakhstan Region, Otrar Distr., near Tabakbulak, Kyzylkum desert, clayey parts, 23-25.05.1993, A.A. Zyuzin.
	9 males, 3 females (ZMUM)	Kazakhstan, South Kazakhstan Region, Arys' Distr., Kyzylkum desert, Karatau plateau, Karamola Mt. (top) (c. 47°58'N, 66°35'E), 29-31.05.1993, A.A. Zyuzin.
	1 male (MMUM)	Kazakhstan, Ustyurt Plateau, Ustyurt State Reserve, nr. El'chibek well, 19.05.1989, A.A. Zyuzin.

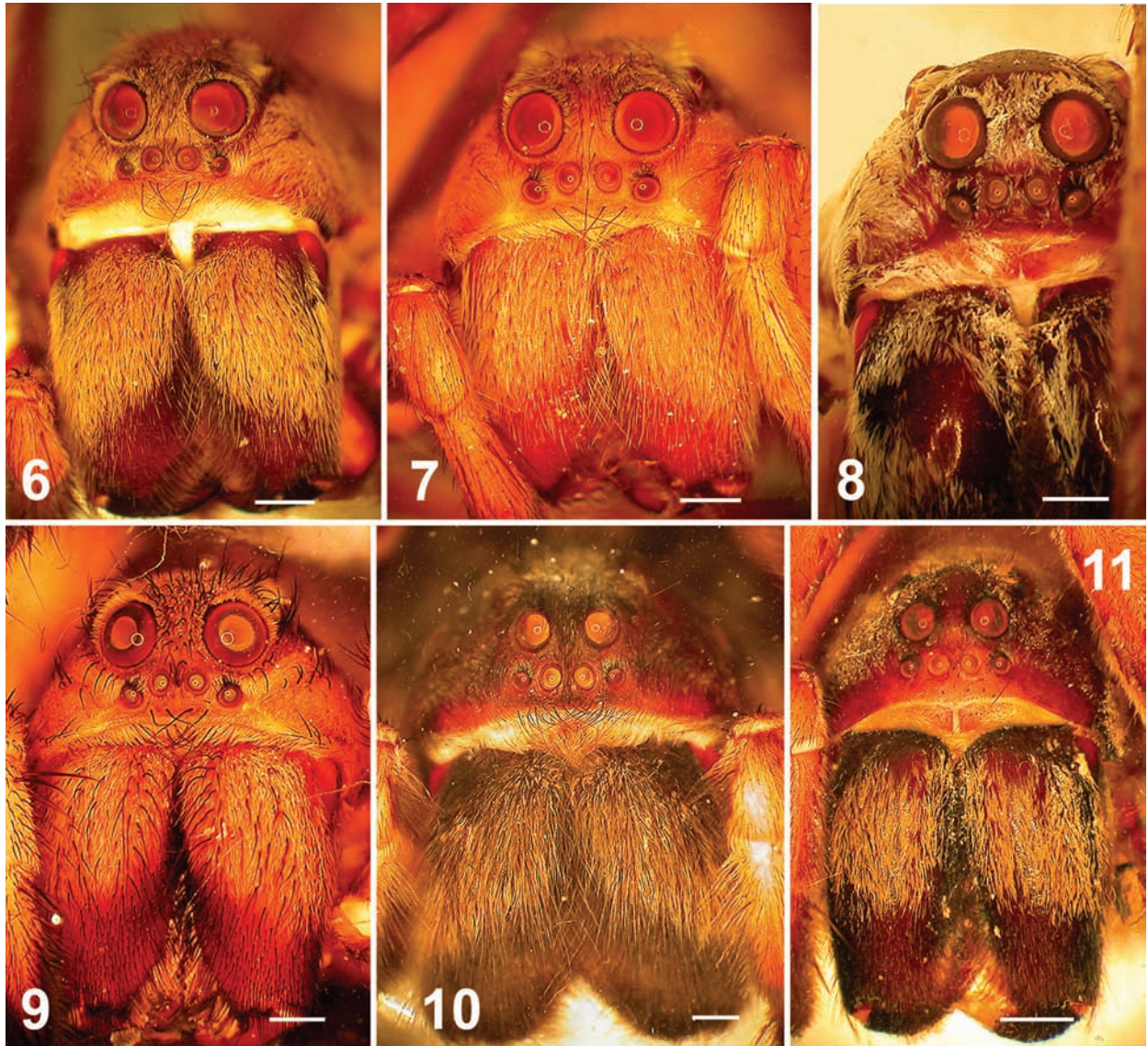
6, pl) is used instead of the 'basal lobe of embolus' by Griswold (1993: fig. 59, EL). Short spines occurring on the ventral surface of tarsi in *Lycosa* and *Zyuzicosa* gen. nov. (Figs 14-17, 22-23) were referred to by Zyuzin (1990) as 'spinules' which is adopted here. 'Chelicera length' was measured as the frontal length of the basal cheliceral segment on intact specimens, chelicerae were not removed.

Abbreviations used in the text and figures: AE = anterior elevation of the epigyne, AER = anterior row of eyes, AME = anterior median eye, ALE = anterior lateral eye, C = conductor, E = embolus, LL = lateral

lobes of the epigyne, MA = median apophysis, Mt = metatarsus, PME = posterior median eye, Pl = palea, PLE = posterior lateral eye, PP = posterior process of the MA, Sc = scopula, Se = synembolus, SER = second row of eyes (formed by PMEs), Sp = spinules, T = tegulum, Tb = tibia, VP = ventral process of the MA. *Other abbreviations*: a.s.l. = above sea level, D = described, Distr. = district, nr. = near. Clypeus is the distance between AMEs and the frontal margin of carapace. The sequence of leg segments in measurement data is as follows: femur + patella + tibia + metatarsus + tarsus (total). All measurements are in mm.



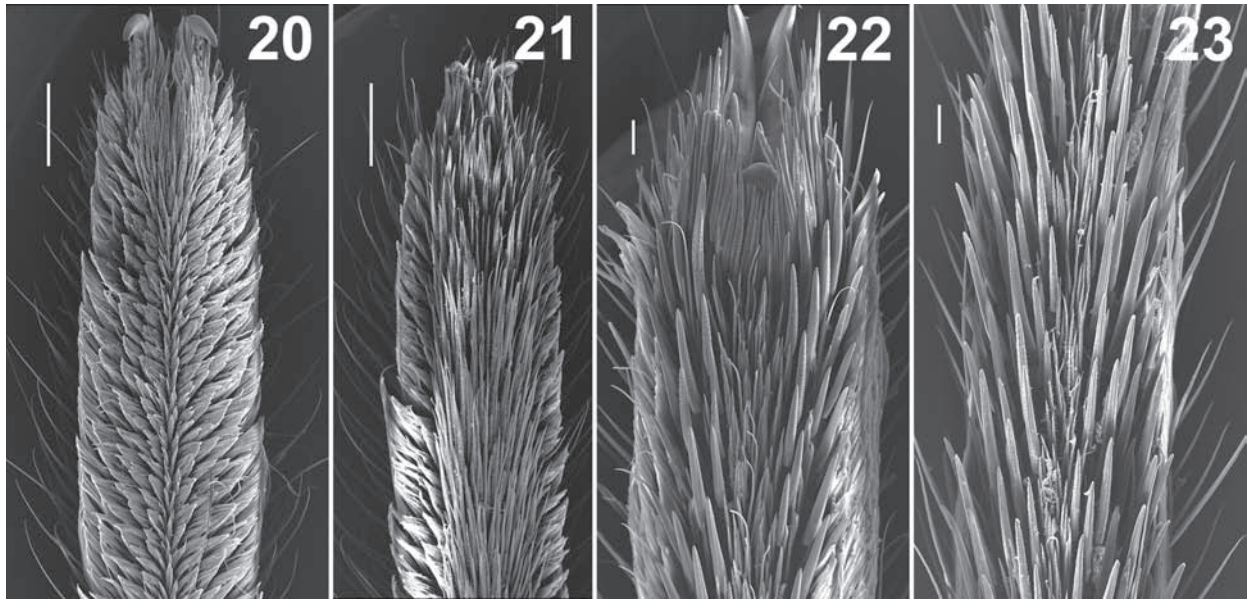
Figs 1–5. The copulatory organ and somatic characters of *Lycosa tarantula* (Linnaeus) from Spain (1–2), *Allohogna singoriensis* (Laxmann) from the South Ural Mts (3) and *Oculicosa supermirabilis* Zyuzin from Kyzylkum desert, South Kazakhstan (4–5): 1 – The male palp; 2–3, 5 – Female carapace, lateral view; 4 – Ditto, front view. Abbreviations as explained in the ‘Material and Methods’. Arrow on the Fig. 1 points to the origination of the embolus; those on Figs 2–3, 5 point to the lateral profile of the carapace. Scale bars = 1 mm.



Figs 6–11. Female carapace, front view: 6 – *Zyuzicosa turlanica* sp. nov. (paratype); 7 – *Zyuzicosa zeraavshanica* sp. nov. (paratype); 8 – *Zyuzicosa laetabunda* (Spassky) (holotype); 9 – *Lycosa tarantula* (Linnaeus) from Spain; 10 – *Allohogna singoriensis* (Laxmann) from the South Ural Mts; 11 – *Geolycosa dunini* Zyuzin et Logunov (paratype from Azerbaijan). Scale bars = 1 mm.



Figs 12–19. Female tarsi, ventral view: 12–13 – *Allohogna singoriensis* (Laxmann) from Astrakhan' Region, Russia (12, tarsus I, 13, tarsus IV); 14–15 – *Zyuzicosa zerafshanica* sp. nov. (paratype), (14, tarsus I, 15, tarsus III); 16–17 – *Lycosa tarantula* (Linnaeus) from Spain, (16, tarsus I, 17, tarsus III); 18–19 – *Oculicosa supermirabilis* Zyuzin from Kyzylkum desert, South Kazakhstan, (18, tarsus I, 19, tarsus IV). Abbreviations as explained in the 'Material and Methods'. Scale bars = 0.5 mm.



Figs 20–23. Female tarsi, ventral view: 20–21 – *Allohogna singoriensis* (Laxmann) from Astrakhan' Region, Russia (20, tarsus I, 21, tarsus IV); 22–23 – *Zyuzicosa zeravshanica* sp. nov. (paratype), (22, tarsus I, 23, tarsus III). Scale bars = (20–21) 0.5 mm, (22–23) 0.1 mm.

SYSTEMATICS

Family Lycosidae Sundevall, 1833

Subfamily Lycosinae Simon, 1898

Key to five central Asian genera of the burrowing Lycosidae

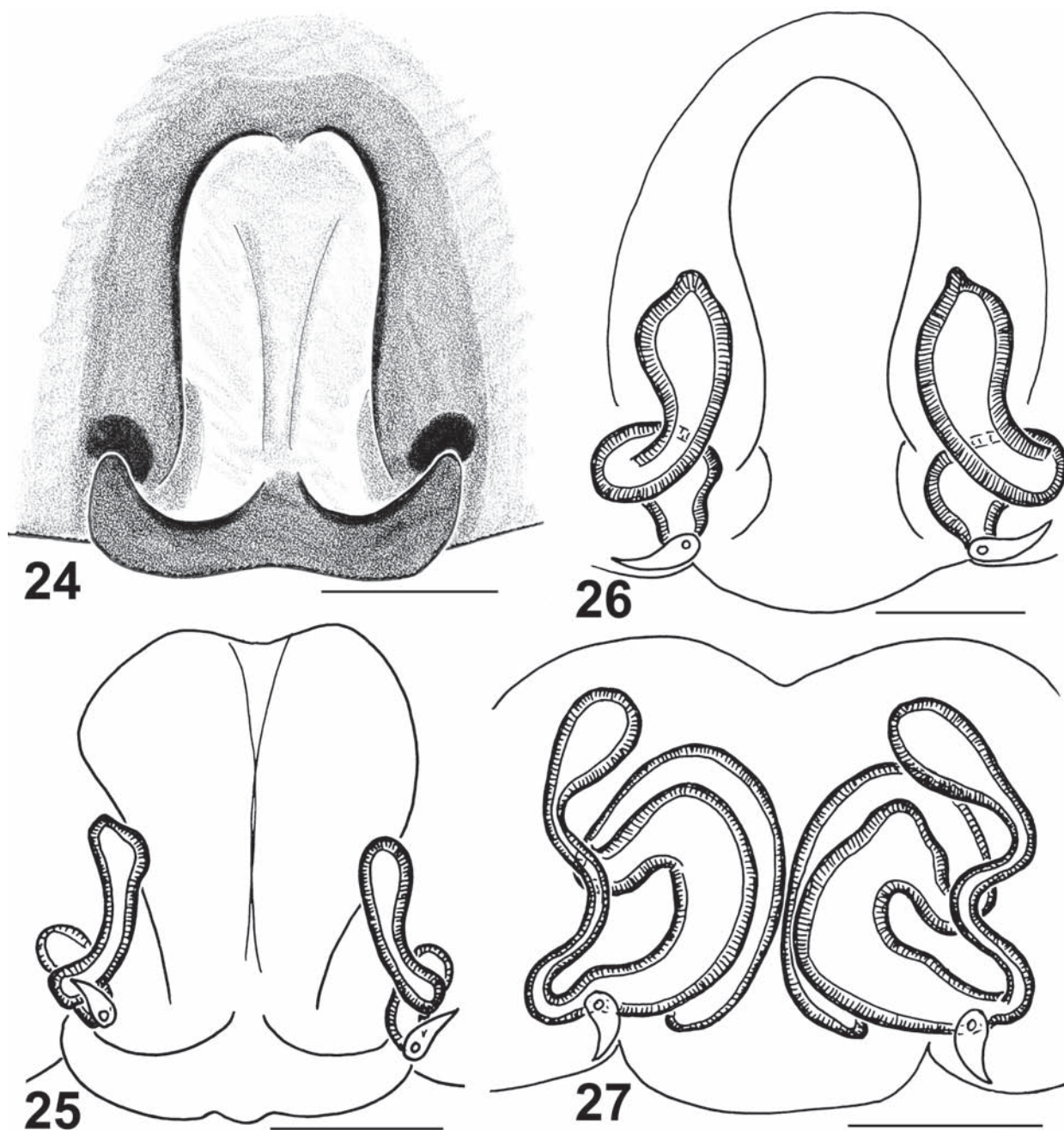
1. Cephalic region distinctly elevated (Fig. 5), two retro-marginal teeth, tarsal scopulae absent (Figs 18–19), leg II shortest *Oculicosa*
- Cephalic region not elevated, carapace with gradual descent of thoracic region (Figs 2–3, 56–60, arrowed), three retromarginal teeth, tarsal scopula present, leg III shortest 2
2. Second row of eyes about equal to anterior row; anterior row of eyes straight (Figs 10–11), tarsi I–II with dense scopulae only (no spinules) (Figs 12, 20) 3
- Second row of eyes distinctly wider than anterior row; anterior row of eyes recurved (Figs 6–9), tarsi I–II with scopulae and spinules (Figs 14, 16, 22) 4
3. Tarsi III–IV with dense scopulae only (no spinules) (Figs 13, 21), AME-diameter larger than clypeus height (AME/clypeus ratio 1.3–1.6; Fig. 10), embolus with a distal prominence, lateral lobes of epigyne present (Fig. 51) *Allohogna*
- Tarsi III–IV with scopulae and hair-like spinules, AME-diameter smaller than clypeus height (AME/clypeus ra-

- tio 0.7; Fig. 11), embolus with a ventral sharpened tooth, lateral lobes of epigyne absent *Geolycosa*
4. MA plate-shaped and with two processes (Figs 64–66), synembolus bipartite (Figs 36, 39, 66), epigynal depression well-developed (Figs 40–49), anterior elevation of the epigyne absent, septal pedicel poorly marked or absent, spermathecae simple, with ducts and receptacles tube-shaped (Figs 33, 72–77) *Zyuzicosa* gen. nov.
 - MA hook-shaped, synembolus singular (resembling embolus) (Fig. 1), epigynal depression absent, anterior elevation of the epigyne present (Fig. 50), septal pedicel present and distinct, spermathecae relatively complex, with long, S-shaped ducts (Fig. 27) *Lycosa*

Zyuzicosa gen. nov.

Type species. *Zyuzicosa baisunica* sp. nov. from Uzbekistan, Surkhandarya Area, Central Asia (the male, holotype in the ZMMU; examined).

Etymology. The new genus is dedicated to Dr. Alexey A. Zyuzin (Almaty, Kazakhstan), a retired expert on the Lycosidae who collected all the new species described here. The generic name consists of two parts: “Zyuzi”, referring to the surname Zyuzin, and the second half of the generic name *Lycosa*, to which the majority of large burrowing wolf spiders are traditionally assigned. The generic name is feminine in gender.



Figs 24–27. Female copulatory organs: 24 – epigyne, ventral view (25–27) spermathecae, dorsal view; 24–25 – *Zyuzicosa laetabunda* (Spassky) (holotype); 26 – *Oculicosa supermirabilis* Zyuzin from Kyzylkum desert, South Kazakhstan; 27 – *Lycosa tarantula* (Linnaeus) from Spain. Scale bars = (24–25, 27) 0.5 mm, (26) 0.25 mm.

Diagnosis. The genus *Zyuzicosa* gen. nov. belongs to the subfamily Lycosinae (*sensu* Zyuzin 1993; cf. Murphy et al. 2006) and is most similar to *Lycosa* (see Table 2). The new genus differs from the other Lycosinae by a combination of the following characters: the median apophysis is plate-shaped and bifurcated (Figs 34–39, 64–66); the latero-apical origin of the embolus (apical in *Lycosa*, arrowed in Fig. 1); the synembolus bipartite (Figs 36, 39, 66); the epigynal atrium present and well-developed (Figs 40–49); the septal pedicel is poorly marked or absent, with the median septum being practically reduced to the posterior transverse plate (Figs 72, 74, 76) and the spermathecae are tube-shaped, with receptacles only slightly wider than the insemination ducts (Figs 33, 73, 75, 77). See also the 'Key to Genera' given above. In the absence of a phylogenetic analysis of the Palaearctic genera of Lycosidae, two diagnostic characters can be considered putative synapomorphies: the bipartite synembolus (Figs 36, 39, 66) and the well-developed epigynal atrium (Figs 40–49).

The new genus can be separated from *Allohogna* Roewer, 1955 and *Geolycosa* by the second row of eyes being distinctly wider than the first (Figs 6–8; both rows are about equal in *Allohogna* and *Geolycosa*, cf. Figs 10–11), by the procurved first row of eyes, the spinulated tarsi I and II (Figs 14, 22), and the completely different conformation of the copulatory organs (see Table 2).

Oculicosa is clearly different from all other genera of the Central Asian burrowing lycosids, including *Zyuzicosa* gen. nov., in having its cephalic region distinctly elevated (Fig. 5), leg II shortest, no scopulae on tarsi (only ordinary spines; Figs 18–19), and two retromarginal teeth (three in all other genera).

Comments. One of the species included in *Zyuzicosa* gen. nov. (*viz.*, *Z. afghana*) was earlier assigned by Roewer (1960) to the genus *Avicosa* Chamberlin et Ivie, 1942. The latter taxon was originally described as a subgenus of *Schizocosa* Chamberlin, 1904, with the type species *S. (Avicosa) minnesotensis* (Gertsch, 1934) (see Chamberlin and Ivie 1942), elevated to genus by Roewer (1955b), but later was synonymized with *Schizocosa* by Dondale and Redner (1978). According to Dondale and Redner (1978, 1990), the genus *Schizocosa* is restricted to North America and consists of 21 species. It can easily be distinguished from *Zyuzicosa* gen. nov. by the conformation of the copulatory organs, namely the small and scale-shaped synembolus, the well-pronounced septal pedicel of

the epigyne and two conspicuous anterior epigynal pockets. Besides, none of the *Schizocosa* species is a true burrower, although females of some species can make shallow nest-holes in the ground at egg-laying time (Dondale and Redner 1990: fig. 3). The species *Avicosa salara* Roewer, 1960 described from Afghanistan from both sexes (see Roewer 1960: fig. 14) is of uncertain taxonomic assignment, but belongs neither with *Avicosa*, nor with *Zyuzicosa* gen. nov.

Four Central Asian species of wolf-spiders were assigned by Roewer (1955b, 1959) to *Allocosa* Banks, 1900 (type species – *Lycosa funerata* Hentz, 1844). According to Dondale and Redner (1983, 1990), the genus *Allocosa* comprises 18 species in North and Central America and an unknown number in South America. This genus can be easily separated from other lycosid genera, including *Zyuzicosa* gen. nov., by the peculiar bifurcated median apophysis (fork-shaped) and the plain epigynal plate, with the copulatory openings situated on its posterior margin (see Dondale and Redner 1983). All *Allocosa* species are relatively small (3–10 mm long) and none of them is a burrower. On the basis of Roewer's figures alone (Roewer 1955b: Figs 10, 12), all the *Allocosa* species described from Afghanistan (*A. manmaka* Roewer, 1960, *A. pellita* Roewer, 1960 and *A. sangtoda* Roewer, 1960) do not belong in *Zyuzicosa* gen. nov. and should be placed either in *Arctosa* C.L. Koch, 1847 (cf. Guy 1966: Figs 26–27) or in a genus related to it. Incidentally, Dondale and Redner (1990: p. 232) mentioned that true members of *Allocosa* resemble those of *Arctosa*. The fourth Central Asian species, *A. kulagini* (Spassky, 1941), was described from Tajikistan from a single male (Spassky 1941: sub *Lycosa k.*). Unfortunately, a correct taxonomic assignment of *A. kulagini* cannot be verified now, as its holotype is not available in the collection of ZISP, where all Spassky's type specimens are deposited, while the description and original illustrations by Spassky (1941: figs 5–6) do not allow correct identification.

Numerous other species from the Palaearctic and Afrotropical Regions assigned to *Allocosa* and *Schizocosa* by Roewer (1955b, 1959; listed in Platnick 2010) are in need of revision of their taxonomic status. It is very likely that none of them actually belong with either of these two genera. This task is outside the scope of the present study and will be dealt with separately.

Description. Large to very large burrowing wolf spiders (males 8.5–18.1, females 22.0–29.0), with the well-pronounced male dwarfism recorded in the three

Table 2. Comparison of five central Asian genera of the burrowing wolf spiders (Lycosidae)

Characters	<i>Zyuzicosa</i> gen. n.	<i>Lycosa</i> Latreille, 1804	<i>Oculicosa</i> Zyuzin, 1993	<i>Allohogna</i> Roewer, 1955	<i>Geolycosa</i> Montgomery, 1904 ²⁾
Somatic Morphology					
Carapace profile	slightly marked gradual descend of thoracic region, eye field not elevated (Figs 56–60)	slightly marked gradual descend of thoracic region, eye field not elevated (Fig. 2)	pronounced descend of thoracic region, eye field distinctly elevated (Fig. 5)	gradual descend of thoracic region, eye field not elevated (Fig. 3)	gradual descend of thoracic region, eye field not elevated (see Zyuzin, 1990: fig. 1)
Labium, length/wide ratio	0.9	0.8	0.8	0.9	0.9
Cheliceral armature: pro- + retromarginal teeth	3 + 3	3 + 3	3 + 2	3 + 3	3 + 3
Tarsi I–II	scopula and spinules ¹⁾ (Figs 14, 22)	scopula and hair-like spinules (Fig. 16)	no scopula, spines only (Fig. 18)	dense scopula, no spinules (Figs 12, 20)	dense scopula, no spinules (as in <i>Allohogna</i>)
Tarsi III–IV	scopula (only on lateral sides) and spinules (Figs 15, 23)	scopula (only on lateral sides) and spinules (Fig. 17)	no scopula, spines only (Fig. 19)	dense scopula, no spinules (Figs 13, 21)	scopula and hair-like spinules (as tarsi I–II in <i>Lycosa</i>)
Leg formula	IV,I,II,III	IV,I,II,III	IV,I,III,II	IV,I,II,III	IV,I,II,III
SER/AER ratio	1.3–1.8	1.3–1.4	1.6–1.7	0.9–1.0	1.0–1.1
PME/AME ratio	2.1–2.7	2.5–2.9	2.8	1.5–1.7	1.7–2.1
AER-line³⁾	slightly procurved (Figs 6–8)	slightly procurved (Figs 9)	slightly procurved (Fig. 4)	straight (Fig. 10)	straight (Fig. 11)
AME/clypeus ratio	1.0–1.3	1.0–1.2	1.1–1.4	1.3–1.6	0.7
Male Copulatory Organs					
Median apophysis, shape	wide plate (trapezoid or triangle), with strong ventral and proximal processes (Figs 34–39, 64–66)	hook-shaped, the hook directed backward (Fig. 1; see also Zyuzin and Logunov, 2000: Figs 1–3)	wide plate, with the ventral process and transverse ridge (see Zyuzin, 1993: Figs 6–8)	elongated blade, with a prominence (as in <i>Allopecosia</i> spp.) (see Fuhr and Niculescu-Burlacu, 1971: fig. 96c)	elongated blade, with a ventral sharpened tooth (see Zyuzin and Logunov, 2000: Figs 5–8)
Hyaline conductor	present, well developed	present, well developed	present	present, well developed	present

Symbolus, shape	bipartite: a sharpened lamella with the wide, strongly sclerotized base (Figs 36, 39, 66)	singular: as a sharpened lamella, resembling embolus (Fig. 1)	singular: as a sharpened lamella, resembling embolus (see Zyuzin, 1993: Figs 6–7)	singular: as wide, blade-shaped lamella (see Fuhn and Niculescu-Burlacu, 1971: fig. 96c,d)	singular: as a wide, blade-shaped lamella (see Zyuzin and Logunov, 2000: Figs 5, 7)
Origin of embolus¹⁾	lateroapical	apical (arrowed in Fig. 1)	mesolateral	lateroapical	lateroapical
Female Copulatory Organs					
Epigynal atrium	present, well pronounced, variable in shape (Figs 40–49)	absent (Fig. 50)	present, well pronounced and narrow (see Zyuzin, 1993: fig. 4)	absent (Fig. 51) or present	absent; but with deep longitudinal groove (see Zyuzin and Logunov, 2000: Figs 9–10)
Septal pedicel	poorly marked or absent	distinct and widened, usually fused with epigynal grooves	poorly marked or absent	distinct	distinct
Lateral lobes	absent	absent	absent	present	absent
Anterior elevation	absent	present (Fig. 50)	absent	absent	absent
Spermathecae	tube-shaped, with thin and short insemination ducts (Figs 73, 75, 77)	S-shaped, with thin and very long insemination ducts (Fig. 27)	ovoid, with thin and short insemination ducts (Fig. 26)	dumb-bell-shaped (see Fuhn and Niculescu-Burlacu, 1971: fig. 96b)	dumb-bell-shaped (see Dondale and Redner, 1990: Figs 13, 16, 17)
Distribution					
Zoogeographic region	Palearctic (Central Asia only)	Palearctic, Oriental and Afrotropical (?)	Palearctic (Central Asia only)	Palearctic	Palearctic and Nearctic

¹⁾ 'Spinules' are the short spines set in longitudinal rows on the ventral surface of tarsi (*sensu* Zyuzin, 1990), in two genera (*Lycosa* and *Geolycosa*) spinules are thin and hair-like.

²⁾ The present notion on *Geolycosa* is based on two Palearctic species, as diagnosed by Zyuzin and Logunov (2000), and on the published account on the Canadian species by Dondale and Redner (1990).

³⁾ The position of anterior eye row follows the pattern suggested by Roewer (1959: fig. 2).

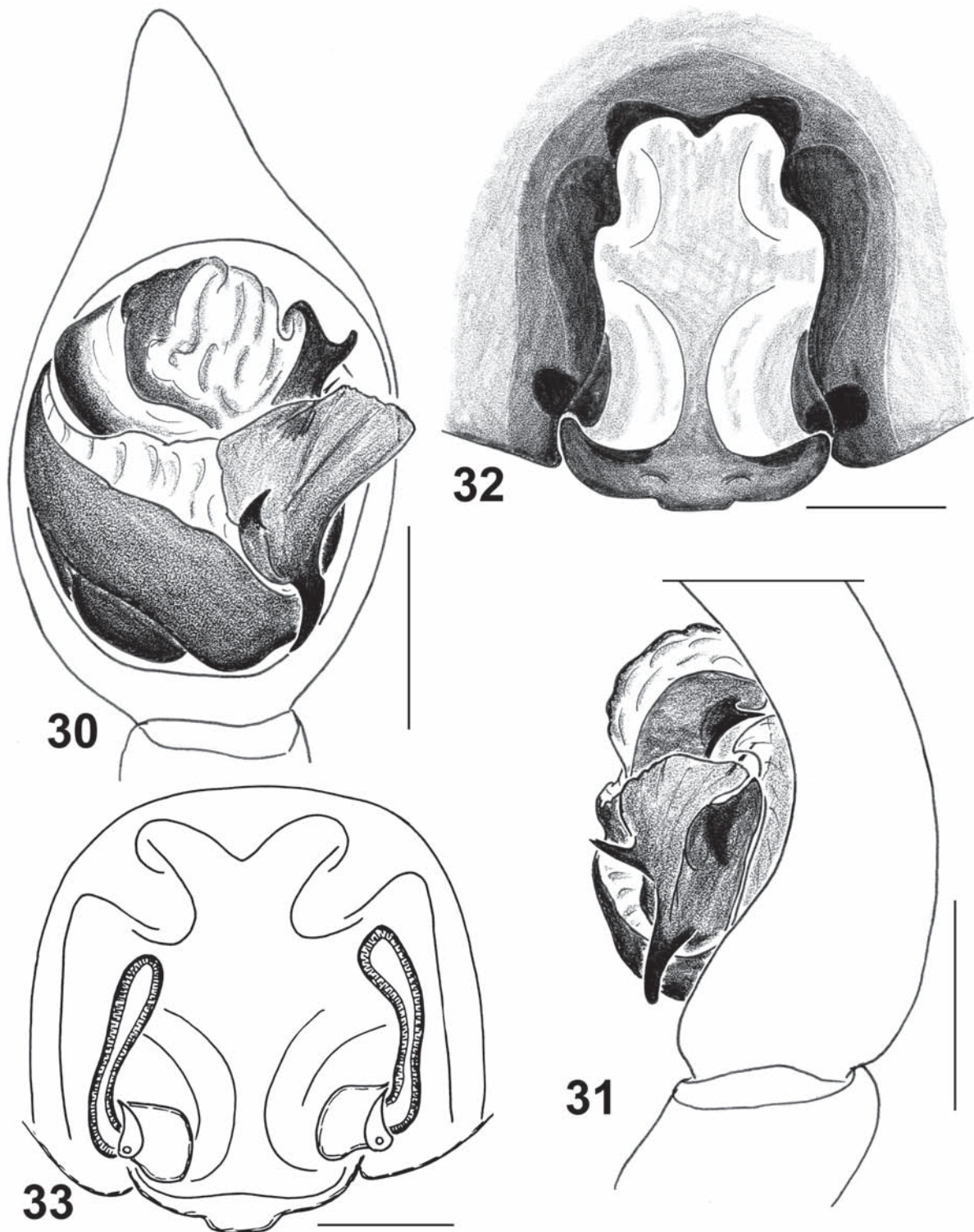
⁴⁾ Origin of the embolus is its starting point that can be described in three modes (*sensu* Zyuzin, 1993): mesolateral, lateroapical and apical.



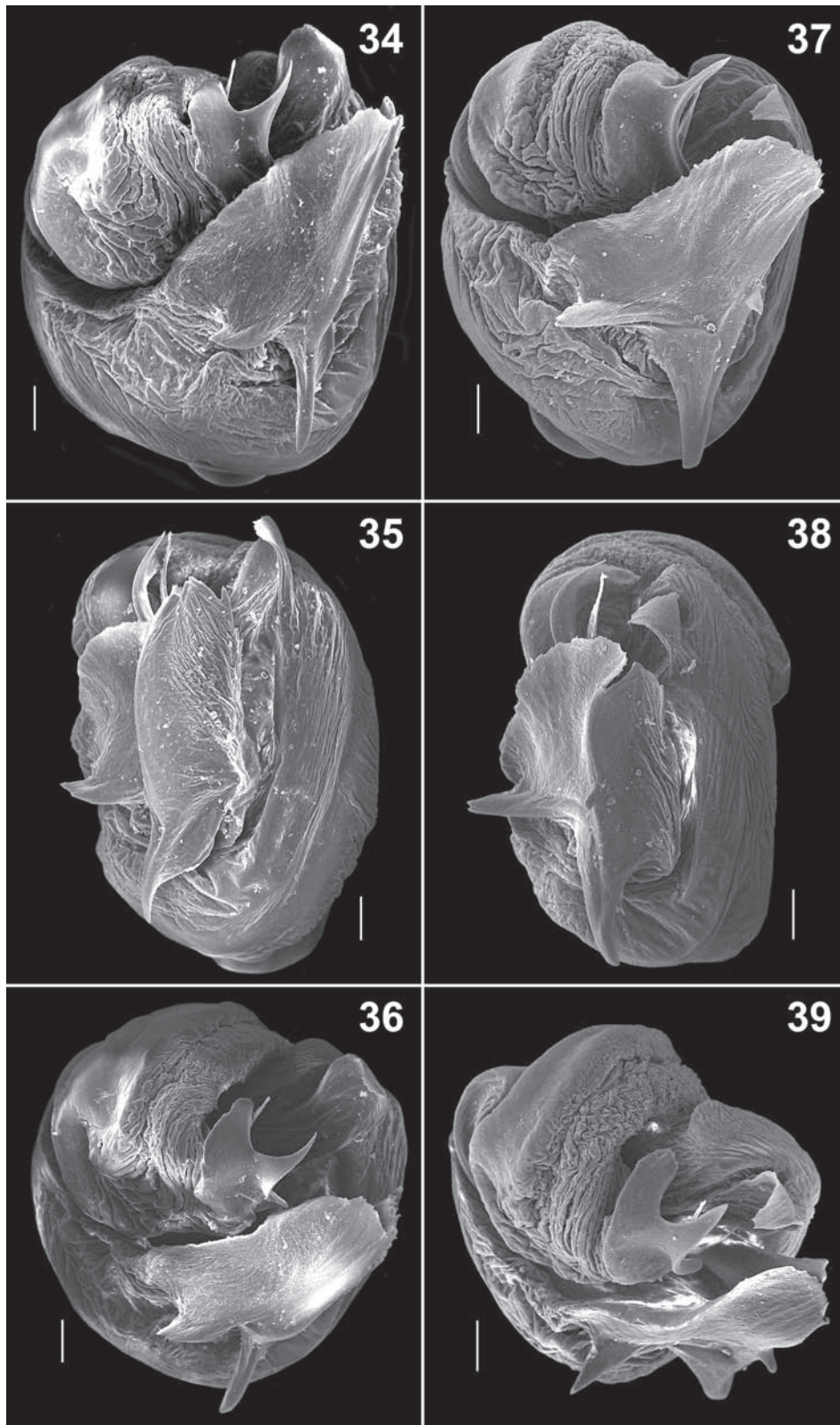
Figs 28–29. Female (left) and male (right) of *Zyuzicosa baisunica* sp. nov. (paratypes): 28 – dorsal view; 29 – ventral view. Scale bars = 10 mm.

species for which both sexes have been described (Figs 28, 62, 78). *Carapace*: relatively low and flat in both sexes, elevation towards ocular area poorly marked (Figs 56–60; cf. Fig. 5); in both sexes carapace densely clothed with whitish appressed hairs and with distinct dense marginal pubescence, which is known to be characteristic of lycosid burrowers (Zyuzin 1990). *Chelicerae*: large, vertical, in their proximal two-thirds densely clothed with whitish appressed

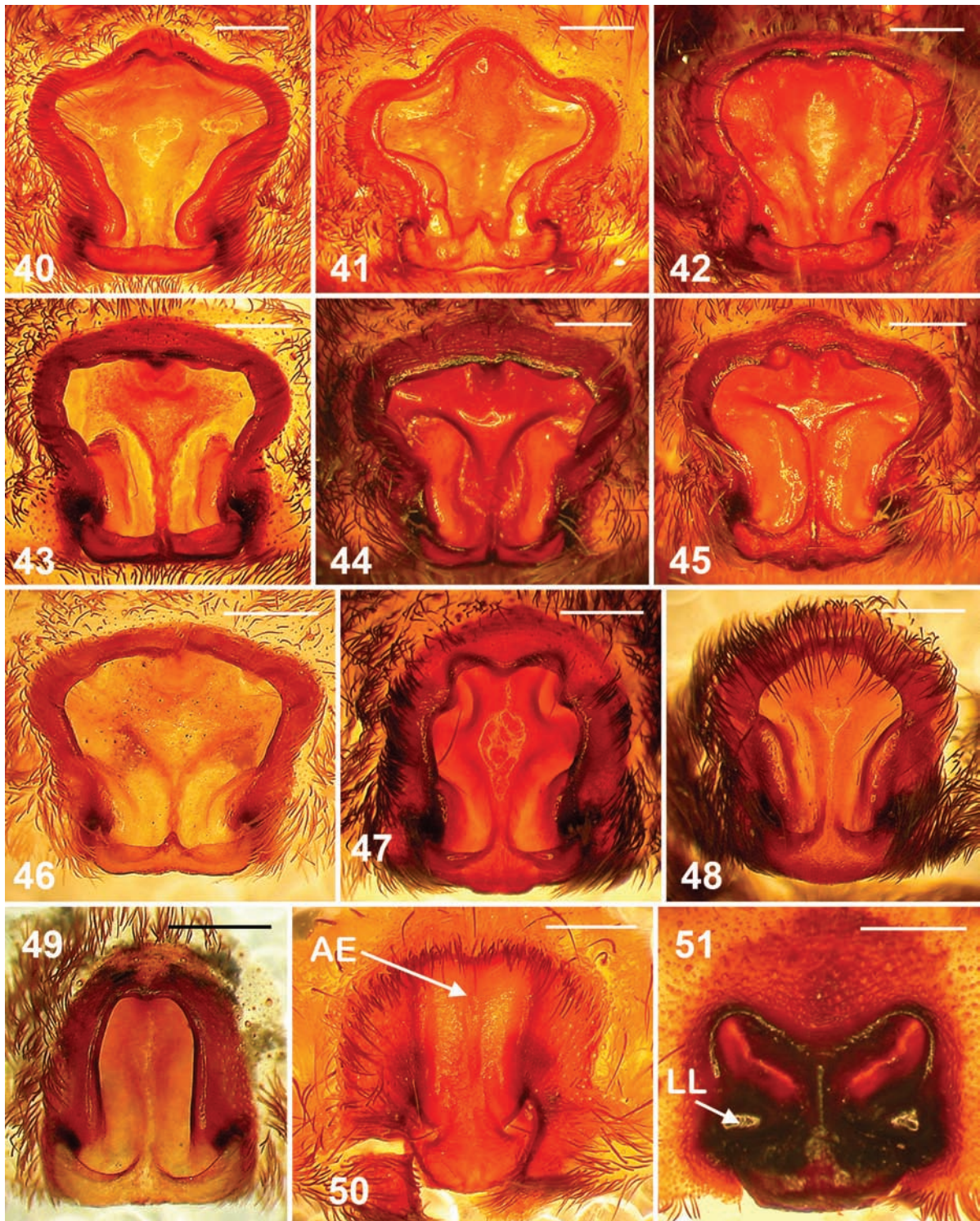
hairs (Figs 6–8); cheliceral armature consists of three promarginal and three retromarginal teeth. *Eyes*: AER procurved, distinctly (1.3–1.8 times) shorter than SER (Figs 6–8); PME 2.1–2.7 times diameter of AME. *Clypeus*: narrow, its height equal or slightly (1.3 times) less than AME diameter (Figs 6–8). *Labium*: slightly wider than long (length/width ratio 0.9). *Sternum*: ovoid, usually densely covered with brown/black hairs in both sexes (Figs 29, 63, 81),



Figs 30–33. *Zyuzicosa baisunica* sp. nov. (paratypes): 30 – Male palp, ventral view; 31 – Ditto, dorsal view; 32 – Epigyne, ventral view; 33 – Spermathecae, dorsal view. Scale bars = 0.5 mm.



Figs 34–39. Male bulbs of *Zyuzicosa zerafshanica* sp. nov. (34–36, paratype) and *Z. baisunica* sp. nov. (37–39, paratype): 34, 37 – Ventral view; 35, 38 – Retro-lateral view; 36, 39 – Apical view. Scale bars = 0.1 mm.



Figs 40–51. Epigynes of *Zyuzicosa zerafshanica* sp. nov. (40–42, paratype), *Z. turlanica* sp. nov. (43–45, paratype), *Z. fulviventris* (Kroneberg) (46, holotype), *Z. baisunica* sp. nov. (47–48, paratype), *Zyuzicosa laetabunda* (Spassky) (49, holotype), *Lycosa tarantula* (Linnaeus) from Spain (50), and *Allohogna singoriensis* (Laxmann) from the South Ural Mts. (51): Dorsal view. Scale bars = 0.5 mm.

sometimes males without such dark hairs (Fig. 79). *Abdomen*: venter in both sexes typically with more or less large black area, occupying a half or more of the ventral surface, contrasting with the remaining yellow or brownish yellow area (Figs 29, 61, 63, 81). *Legs*: leg formula – IV,I,II,III; all leg segments but coxae yellow, with wide brown/black patches and annulations at the ends of tibiae; all segments covered with white and brown hairs; in both sexes, metatarsi and tarsi I–II ventrally with well-developed scopulae and longitudinal rows of spinules (Figs 14, 22), metatarsi and tarsi III–IV only with ventral longitudinal rows of spinules (scopulae are developed on lateral sides of the segments only; Figs 15, 23). *Female palp*: with a single palpal claw. *Female copulatory organs*: epigyne with well pronounced atrium of various shapes (Figs 40–49); septal pedicel poorly marked or absent; the median septum practically reduced to the posterior transverse plate (Figs 72, 74, 76); spermathecae tube-shaped, with thin and short insemination ducts (Figs 73, 75, 77). *Male copulatory organs*: cymbium with a cluster of rigid and straight bristles on its tips (Fig. 67), which is considered characteristic of lycosid burrowers (Zyuzin 1990, 1993); median apophysis wide (trapezoid or triangle), bulbous round and broad, sometimes wider than long (Fig. 52) with strong ventral and proximal processes (Figs 34–39, 64–66); synembolus bipartite, with a sharpened lamella and the wide, strongly sclerotized base (Figs 36, 39, 66); hyaline conductor present and well-developed; embolus with thin tip and rather wide pars pendula (Fig. 66), its origin lies in latero-apical position and only embolic tip is visible in between the lobes of synembolus in unexpanded palp (Figs 36, 39, 64).

Composition. To date, eight species are described in *Zyuzicosa* gen. nov.: *Z. afghana* (Roewer, 1960) (females); *Z. baisunica* sp. nov. (males and females); *Z. fulviventris* (Kroneberg, 1875) (females); *Z. gigantea* (males); *Z. laetabunda* (Spassky, 1941) (females); *Z. turlanica* sp. nov. (males and females); *Z. uzbekistanica* sp. nov. (males); and *Z. zerafshanica* sp. nov. (males and females).

Distribution. Central Asia (Maps 1–3): desert regions of Uzbekistan, southern Kazakhstan and northern Afghanistan.

Key to the species of *Zyuzicosa* gen. nov.

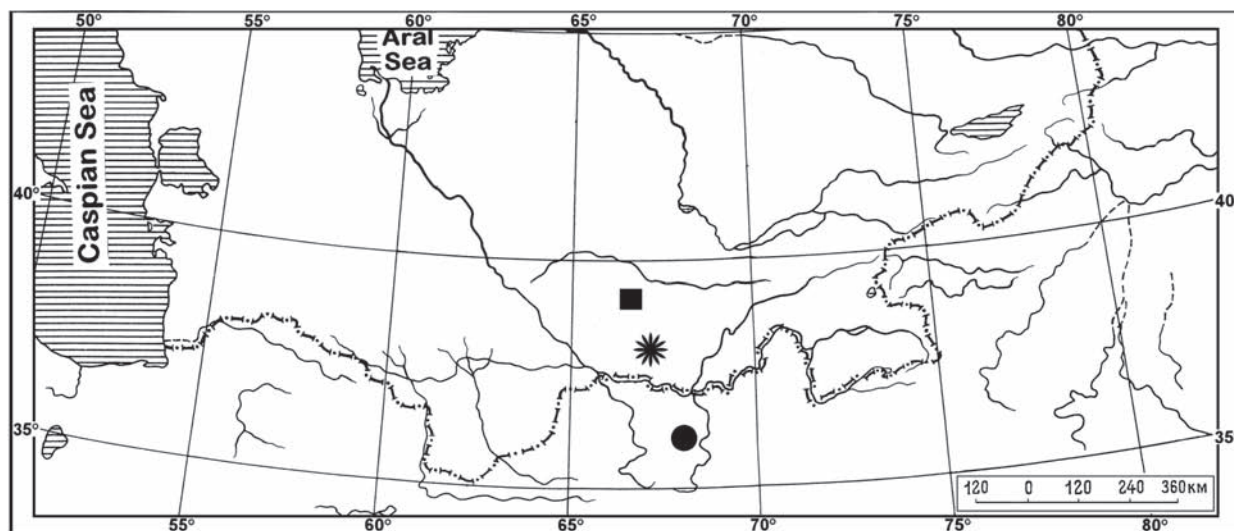
1. Males 2
- Females 6

2. The proximal process of the MA notched at its tip (arrowed in Fig. 68) *turlanica* sp. nov.
- The proximal process of the MA sharpened, not notched (Figs 30, 52, 54, 70) 3
3. The ventral process of the MA bifurcated (arrowed in Fig. 55) *uzbekistanica* sp. nov.
- The ventral process of the MA singular (Figs 31, 53, 71) 4
4. The lateral angle of the MA sharpened (arrowed in Fig. 70) *zerafshanica* sp. nov.
- The lateral angle of the MA obtuse (Figs 30, 52) 5
5. The bulbous wider than long (Fig. 52) *gigantea* sp. nov.
- The bulbous longer than wide (Fig. 30) *baisunica* sp. nov.
6. The posterior transverse epigynal plate distinctly split in two halves (Figs 43–45) 7
- The posterior transverse epigynal plate not split (Figs 40–42, 46–49) 8
7. The narrow median septum is well-marked (Figs 43–45, 74) *turlanica* sp. nov.
- The narrow median septum is not marked (Roewer, 1960: fig. 13) *afghana*
8. The median septum cross-shaped (Figs 32, 47–48) *baisunica* sp. nov.
- The median septum otherwise (Figs 40–42, 46, 49) 9
9. Receptacles visibly widened, pear-shaped (Fig. 73) *fulviventris*
- Receptacles not or slightly widened, tube-shaped (Figs 75, 77) 10
10. The epigynal depression narrow and elongate (Figs 24, 49) *laetabunda*
- The epigynal depression trapeziform (Figs 40–42, 76) *zerafshanica* sp. nov.

Zyuzicosa afghana (Roewer, 1960) comb. nov. (Map 1)

Avicosa afghana Roewer 1960: 17–18, fig. 13 (D female; the female, holotype in the Museum of Zoology and Entomology of the Lund University, Sweden; not found and not examined).

Diagnosis. This species is almost undoubtedly a member of *Zyuzicosa* gen. nov., since the female is characterized by the elongated depression of the epigyne, with the median septum being practically reduced to the posterior transverse plate (see Roewer 1960: fig. 13). The female of *Z. afghana* is most similar to those of *Z. laetabunda* and *Z. zerafshanica* sp. nov. (cf. Figs 24, 76), but can be easily distinguished from the former by the wider epigynal depression and the posterior transverse plate split in two halves, whereas from the latter it can be separated by the absence of



Map 1. Collection localities of *Zyuzicosa afghana* (Roewer) (circle), *Z. baisunica* sp. nov. (asterisk), and *Z. fulviventris* (Kroneberg) (square).

the marked median septum. The spermathecae of *Z. afghana* remains unstudied, and its male is unknown.

Unfortunately, the female holotype of *Z. afghana* has not been found in the collection of the Museum of Zoology and Entomology of the Lund University (Sweden). It is suspected that all the lycosid species described by Rower in 1960 were lost (T. Kronstedt, pers. comm.). However, as the species is a true member of *Zyuzicosa* gen. nov. and Roewer (1960) provided a reliable illustrated account of it, the species has been considered in the present paper.

Distribution. The type locality only: Afghanistan, Robatak (36°8'48"N, 68°24'7"E) (Roewer 1960: p. 18) (Map 1).

***Zyuzicosa baisunica* sp. nov.**

(Figs 28–31, 37–39, 47–48, 80–81, Map 1)

Type material. The male holotype (ZMUM) from UZBEKISTAN, Surkhandarya Area, Baisun [=Boysun] Distr., c. 46 km WSW of Denau [=Denov], SE foothills of Dzhetymkalyas Mt. Range, clayey slopes, 38°01'45"N, 67°27'20"E, 700–800 m a.s.l., 13–14.05.1994, A.V. Gromov, A.A. Zyuzin. – Paratypes. 19 males, 1 female (ZMUM), 3 males, 1 female (SZMN) and 3 males (BMNH), together with the holotype.

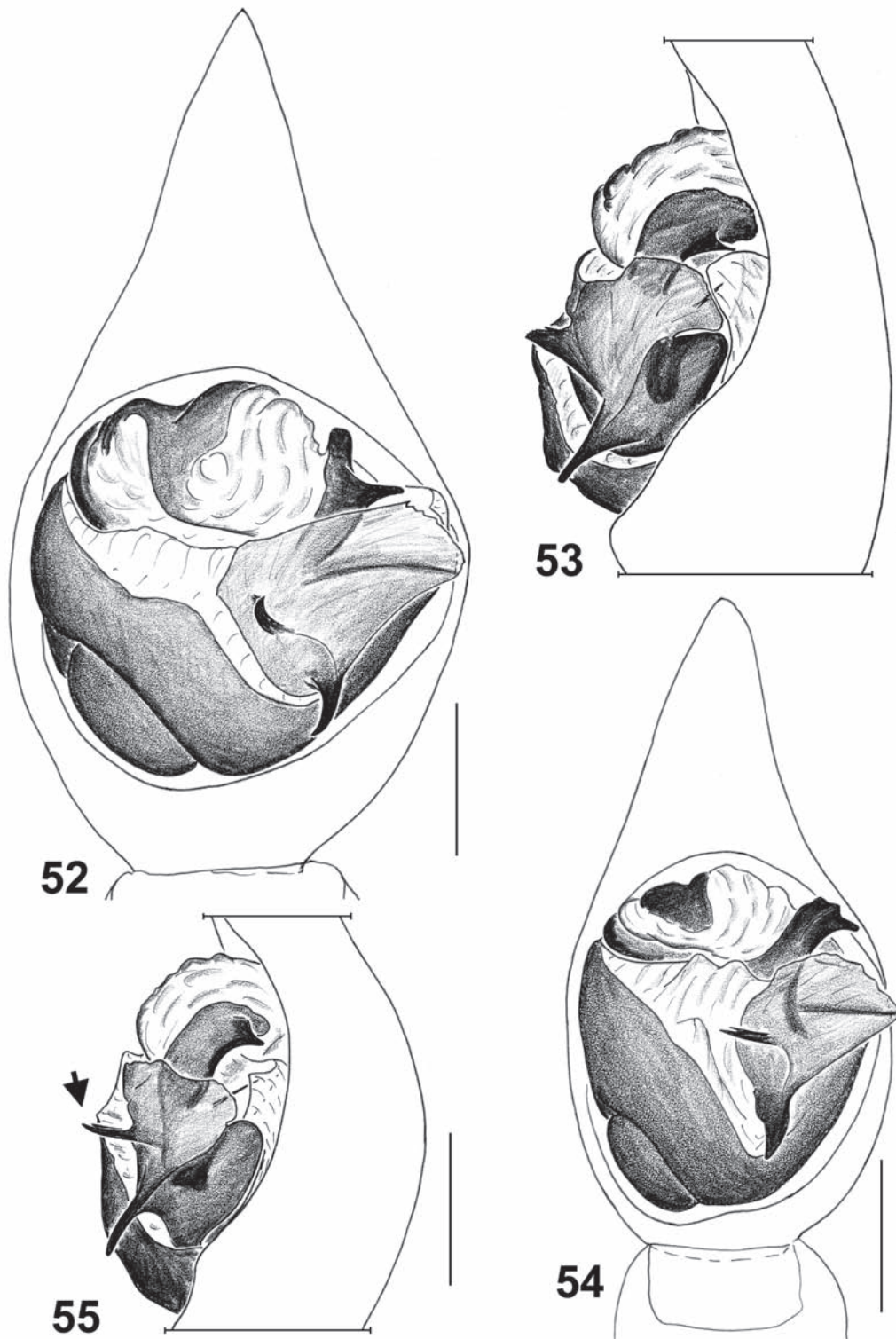
Etymology. The specific epithet is derived from the area from which the holotype was collected, the vicinities of Baisun in Uzbekistan.

Diagnosis. This species differs from all the known *Zyuzicosa* species in having a well-pronounced, cross-shaped median septum of the epigyne in females (Figs 32, 47–48) and by the shape of the median apophysis in males (Figs 30–31, 37–39). The female of *Z. baisunica* sp. nov. is superficially similar to that of *Lycosa kemp*i Gravely, 1924 from north India, Pakistan, Nepal and SW China (*sensu* Yin *et al.*, 1997: Figs 59b–c) in the cross-shaped median apophysis of the epigyne, but the latter species differs in having the much stronger and wider receptacles.

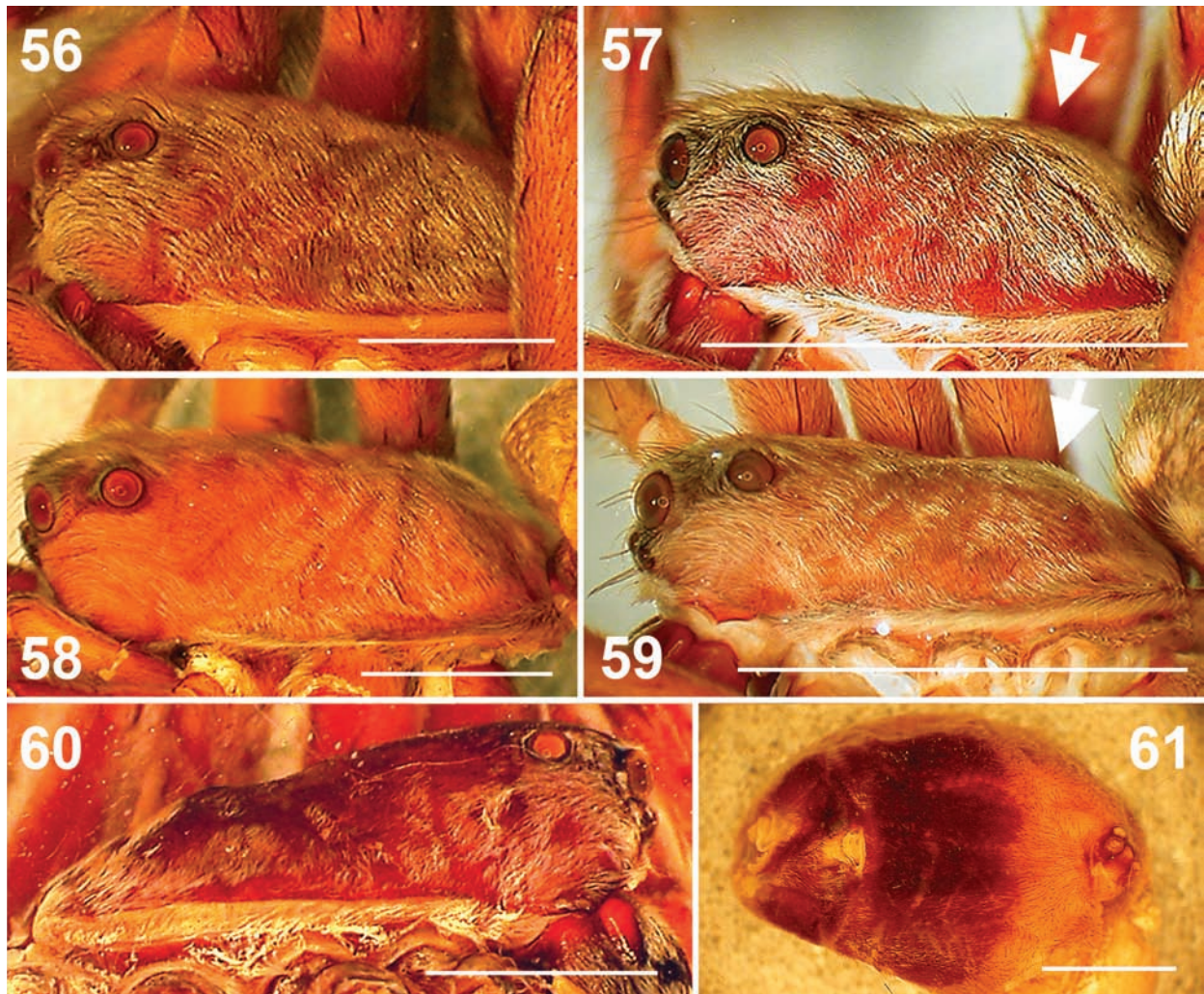
Comments. *L. kemp*i is hardly a member of *Zyuzicosa* gen. nov., as its male possesses the elongated median apophysis (not as a wide plate) and the singular synsymbolus (see Buchar 1997: fig. 28). Yet, the latter author correctly considered *L. kemp*i not a true member of *Lycosa* belonging elsewhere.

Distribution. The type locality only (Map 1).

Description. *Male* (holotype). **Measurements.** Carapace 5.25 long, 4.00 wide. Eye sizes and inter-distances: AME 0.24, ALE 0.23, PME 0.60, PLE 0.47, AME-AME 0.16, AME-ALE 0.10, PME-PME 0.50, PLE-PLE 1.33. Width of anterior eye row 1.13, second row 1.58, third row 1.90. Clypeus height 0.16, chelicera length 2.35. Abdomen 4.45 long, 3.00 wide. Length of leg segments: I 5.20 + 2.15 + 5.00 + 5.00 + 2.50 (19.85); II 5.00 + 2.20 + 4.30 + 4.75 + 2.50 (18.75); III 4.55 + 1.95 + 3.75 + 4.50 + 2.35 (17.10); IV 5.60 + 2.00 + 5.25 + 6.95 + 2.95 (22.75). *Col-*



Figs 52–55. Male palps of *Zyuzicosa gigantea* sp. nov. (52–53, holotype) and *Z. uzbekistanica* sp. nov. (54–55, holotype): 52, 54 – Ventral view; 53, 55 – Retro-lateral view. Arrow points to the ventral process of the median apophysis. Scale bars = 0.5 mm.



Figs 56–61. Carapace, lateral view, and abdomen, ventral view, of *Zyuzicosa* spp.: 56–57 – *Z. turlanica* sp. nov. (paratypes: 56, female, 57, male); 58–59 – *Z. zeraavshanica* sp. nov. (paratypes: 58, female, 59, male); 60–61 – *Z. laetabunda* (Spassky) (female holotype: 60, carapace, 61, abdomen). Arrows point to the lateral profile of the carapace. Scale bars = 5 mm.

ouration. Carapace light brown, densely covered with white appressed hairs (especially dense on eye field), with noticeable longitudinal median white stripe and two marginal white stripes of dense hairs (Figs 28, 80). Sternum and coxae brown, densely covered with dark brown hairs. Maxillae and labium brown, with yellow apices. Chelicerae dark brown, their proximal half anteriorly covered with white hairs. Abdomen: dorsum greyish yellow, with a T-shaped greyish brown cardinal spot and poorly marked reticulate greyish brown pattern; sides greyish yellow; venter proximal half dark brown, including book-lung cov-

ers and area between them, distal half yellow (Figs 29, 81). Spinnerets brownish. All leg segments but coxae, brownish yellow, with dark brown patches at the ends of tibiae; all segments covered with white and brown hairs. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only. Palps yellowish brown. Palpal structure as in Figs 30–31, 37–39.

Female (paratype). *Measurements*. Carapace 15.30 long, 10.80 wide. Eye sizes and interdistances: AME 0.58, ALE 0.58, PME 1.35, PLE 1.30, AME-AME

0.35, AME-ALE 0.23, PME-PME 1.00, PLE-PLE 3.30. Width of anterior eye row 2.80, second row 3.80, third row 4.75. Clypeus height 0.50, chelicera length 6.60. Abdomen 13.50 long, 10.00 wide. Length of leg segments: I 11.50 + 6.00 + 9.40 + 8.80 + 4.00 (39.70); II 10.40 + 5.60 + 8.70 + 8.70 + 4.00 (37.40); III 9.10 + 4.40 + 7.60 + 8.80 + 4.00 (33.90); IV 12.30 + 4.90 + 10.00 + 12.00 + 5.00 (44.20). *Colouration*. Carapace brown, densely covered with white appressed hairs (especially dense on eye field), with a noticeable longitudinal median white stripe and two marginal white stripes of dense hairs (Fig. 28). Sternum, coxae, maxillae and labium brown, densely covered with dark brown hairs. Maxillae and labium with yellow apices. Chelicerae dark brown, their proximal half anteriorly covered with white hairs. Abdomen: dorsum yellow, with a T-shaped greyish brown cardiac spot; sides yellow; venter proximal half (almost two thirds) dark brown, including book-lung covers and area between them, distal half yellow (Fig. 29). Spinnerets brownish. All leg segments but coxae, brownish yellow with dark brown patches at the ends of tibiae; all segments covered with white and brown hairs. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only. Palps brownish yellow, but tarsi brown. Epigyne and spermathecae as in Figs 32–33, 47–48.

***Zyuzicosa fulviventr* (Kroneberg, 1875) comb. nov.**
(Figs 46, 72–73, Map 1)

Tarentula fulviventr Kroneberg 1875: 41, pl. 4, fig. 29 (D female; the male, holotype in the ZMMU; examined).
Lycosa fulviventr: Roewer 1955b: 268.

Type material. The female holotype (ZMMU, Ta-1224) from UZBEKISTAN, “Dzham [=Jom], 13/V, Fedchenko / [Turkestan Research Expedition of the Imperial Society of Natural Sciences’ Lovers]”.

Diagnosis. This species is most close to *Z. turanica* sp. nov. and *Z. zerafshanica* sp. nov. but differs from both in the wide, pear-shaped receptacles (cf. Figs 72–73 and 74–77).

Comments. The male of *Z. fulviventr* remains unknown. It is possible that the male either of *Z. gigantea* sp. nov., or of *Z. uzbekistanica* sp. nov., described and known from single males and from regions neighbouring the type locality of *Z. fulviventr*, might be that of the latter species. The matter requires further attention in the future.

Distribution. The type locality only (Map 1).

Description. *Male* unknown.

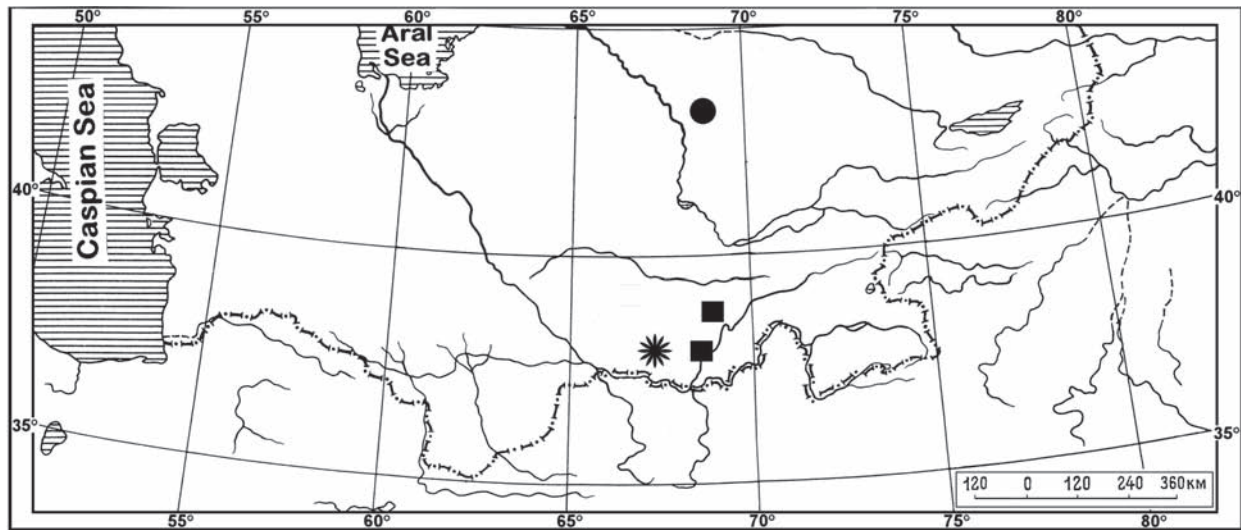
Female (holotype). *Measurements*. Carapace 10.10 long, 8.20 wide. Eye sizes and interdistances: AME 0.43, ALE 0.45, PME 1.15, PLE 0.93, AME-AME 0.38, AME-ALE 0.20, PME-PME 0.75, PLE-PLE 2.30. Width of anterior eye row 2.18, second row 2.83, third row 3.50. Clypeus height 0.33, chelicera length 4.90. Abdomen 10.00 long, 8.00 wide. Length of leg segments: I 8.10 + 3.60 + 6.20 + 6.20 + 3.10 (27.20); II 7.80 + 3.80 + 5.50 + 5.90 + 3.00 (26.00); III 7.10 + 3.60 + 4.90 + 6.10 + 2.90 (24.60); IV 9.30 + 3.90 + 7.10 + 10.10 + 3.90 (34.30). *Colouration*. Specimen is in bad condition and faded; left legs II and III are torn off. Carapace brown, densely covered with white appressed hairs (especially dense on eye field), and with marginal stripes of dense white hairs. Sternum and coxae brown, densely covered with dark brown hairs. Maxillae and labium brown, with yellow apices. Chelicerae dark brown, anteriorly densely covered with white hairs. Abdomen: dorsum yellowish, with brownish reticulate pattern and brown cardiac spot; sides greyish yellow; venter yellow, but the area between book-lungs brown and with dark brown transverse band behind the epigastric furrow. Spinnerets yellow. All leg segments but coxae, yellow, with brown rings at segment joints. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of short spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of short spinules only. Palps yellow. Epigyne and spermathecae as in Figs 46, 72–73.

***Zyuzicosa gigantea* sp. nov.**
(Figs 52–53, 80–81, Map 2)

Type material. The male holotype (ZMUM) from UZBEKISTAN, Surkhandarya Area, Baisun [=Boysun] Distr., c. 46 km WSW of Denau [=Denov], SE foothills of Dzhetymkalyas Mt. Range, clayey slopes, 38°03′00″N, 67°26′30″E, 850–950 m a.s.l., 12–13.05.1994, A.A. Zyuzin.

Etymology. The specific epithet is derived from the Latin ‘*gigantea*’, meaning ‘very large’ and reflecting the fact that the male of this species is significantly larger than dwarf males of the other described species of *Zyuzicosa* gen. nov.

Diagnosis. This is the largest species of *Zyuzicosa* gen. nov. (see Figs 80–81), which is easily recognizable from other members of the genus in the shape of



Map 2. Collection localities of *Zyuzicosa gigantea* sp. nov. (asterisk), *Z. laetabunda* (Spassky) (squares), and *Z. turlanica* sp. nov. (circle).

the median apophysis and its processes (cf. Figs 52 and 30, 54, 68, 70). In addition, the entire bulbus is wider than in other *Zyuzicosa* species.

Comments. The female of *Z. gigantea* sp. nov. remains unknown. It might be that this species is actually a male of *Z. fulviventris* known to date from the female holotype only (see above). The matter requires further attention in the future.

Distribution. The type locality only (Map 2).

Description. *Male* (holotype). *Measurements.* Carapace 10.10 long, 7.00 wide. Eye sizes and interdistances: AME 0.43, ALE 0.38, PME 0.89, PLE 0.83, AME-AME 0.25, AME-ALE 0.15, PME-PME 0.78, PLE-PLE 2.18. Width of anterior eye row 2.00, second row 2.68, third row 3.08. Clypeus height 0.42, chelicera length 4.00. Abdomen 8.00 long, 5.90 wide. Length of leg segments: I 9.10 + 4.00 + 7.50 + 8.50 + 3.40 (32.50); II 8.80 + 3.90 + 7.10 + 8.00 + 3.60 (31.40); III 7.70 + 3.50 + 5.90 + 7.10 + 3.30 (27.50); IV 10.70 + 3.40 + 8.30 + 10.10 + 4.20 (36.70). *Colouration.* Carapace brown, densely covered with white appressed hairs (especially dense on eye field; Fig. 80), and with marginal stripes of dense white hairs. Sternum and coxae brown, densely covered with dark brown hairs. Maxillae and labium brown. Chelicerae brown, anteriorly covered with white hairs. Abdomen: dorsum and sides greyish yellow, with a median brown band on dorsum (Fig. 81); venter proximal half dark brown, including book-lung covers, distal half yellow. Spinnerets yellow. All leg segments, but

coxae, yellow brownish, with dark brown rings at segment joints. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of spinules, metatarsi and tarsi III–IV only with ventral longitudinal rows of spinules. Palps yellowish brown. Palpal structure as in Figs 52–53.

Female unknown.

***Zyuzicosa laetabunda* (Spassky, 1941) comb. nov.** (Figs 8, 24–25, 49, 60–61, Map 2)

Lycosa laetabunda Spassky 1941: 16, plate 1, fig. 4 (D female; the female holotype in the ZISP; examined).

Lycosa laetabunda: Spassky and Luppova 1945: 45–46 (a second description based on the same female holotype).

Pardosa laetabunda: Roewer 1955b: 165.

Type material. The female holotype (ZISP) from southern TAJIKISTAN, “near the spring Chuchchi-Kuduk, 11.07.1939, Timnoev” [Khatlon Area, SW slope of Aktau Mt. Range, c. 38 km WSW of Kurgan-Tyube, c. 1 km NE of Kungradodыр (=Kungradadyr) Ruins, nr. Chuchchi-Kuduk (=Chuchu-Kuduk, Chuchchu-Kuduk) spring, 37°45′17″N, 68°19′51″E, 910–920 m a.s.l.].

Diagnosis. The elongated depression of the epigyne of the female of *Z. laetabunda* is most similar to that of *Z. baisunica* sp. nov. (cf. Figs 24 and 32; see also Spassky 1941: fig. 4). These species can easily be distinguished by the shape of median septum, which is narrow and straight in *Z. laetabunda* (Figs 24, 49)



Figs 62–63. Female (left) and male (right) of *Zyuzicosa turlanica* sp. nov. (paratypes): 28 – dorsal view; 29 – ventral view. Scale bars = 10 mm.

and cross-shaped in *Z. baisunica* sp. nov. (Fig. 32), and by the position and shape of the receptacles (cf. Figs 25 and 33). The male of *Z. laetabunda* remains unknown. See also comments above under *Z. afghana*.

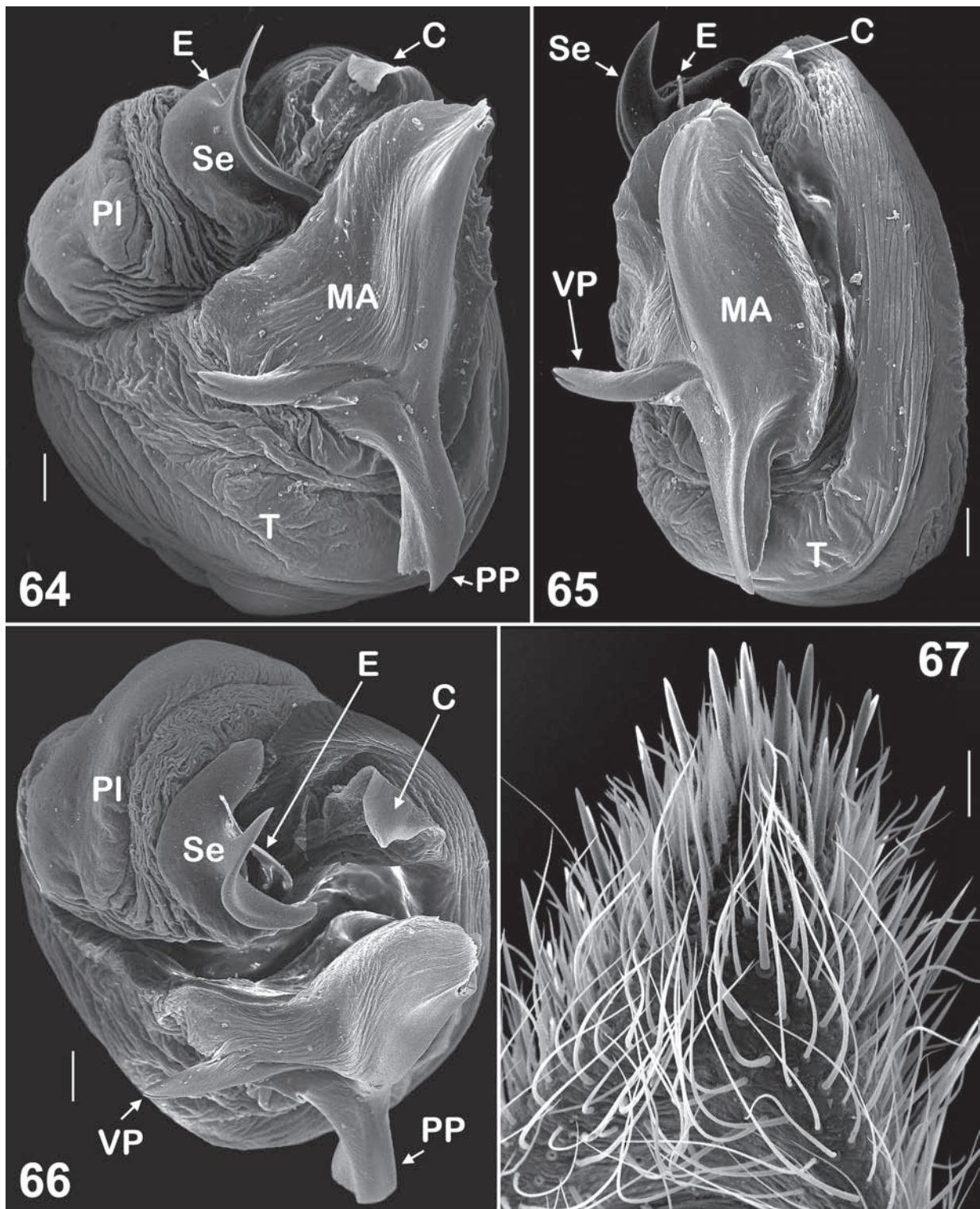
Comments. For unknown reasons, this species was described twice: first by Spassky (1941) and then by Spassky and Luppova (1945). Both descriptions were based on the same female holotype collected by Timnoev from Tajikistan (near the spring Chuchchi-

Kuduk) on t11.07.1939, but the latter one did not contain an illustration.

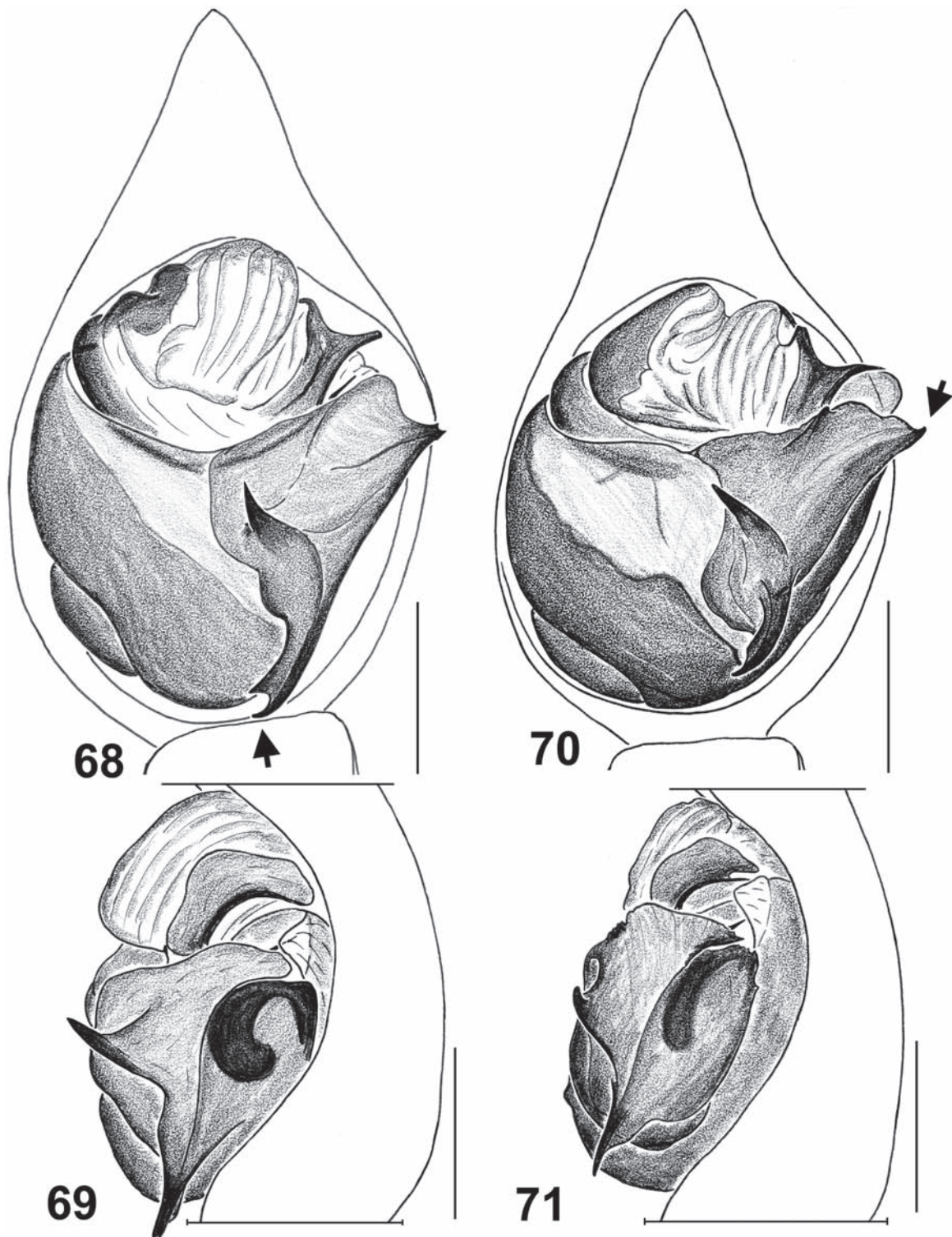
Distribution. A few localities in Tajikistan (Spassky 1941; Spassky and Luppova 1945; Andreeva 1976) (Map 2).

Description. *Male* unknown.

Female (holotype). **Measurements.** Carapace 13.70 long, 10.30 wide. Eye sizes and interdistances: AME 0.43, ALE 0.53, PME 1.13, PLE 0.90, AME-AME



Figs 64–67. Male palp of *Zyuzicosa turlanica* sp. nov. (paratype): 64 – bulb, ventral view; 65 – ditto, retro-lateral view; 66 – ditto, apical view. Abbreviations as explained in the ‘Material and Methods’. Scale bars = 0.1 mm.



Figs 68–71. Male palps of *Zyuzicosa turlanica* sp. nov. (68–69, paratype) and *Z. zeravshanica* sp. nov. (70–71, paratype): 68, 70 – Ventral view; 69, 71 – Retro-lateral view. Arrows point to the taxonomically important details of the palps mentioned in the 'Key to species'. Scale bars = 0.5 mm.

0.23, AME-ALE 0.20, PME-PME 0.85, PLE-PLE 2.25. Width of anterior eye row 2.35, second row 2.98, third row 3.60. Clypeus height 0.35, chelicera length 5.25. Abdomen 15.50 long, 10.00 wide. Length of leg segments: I 9.90 + 5.00 + 8.00 + 7.60 + 3.70 (34.20); II 9.60 + 4.60 + 6.90 + 6.90 + 3.80 (31.80); III 8.50 + 3.90 + 6.10 + 7.50 + 3.60 (29.60); IV 11.30 + 4.50 + 8.80 + 11.50 + 4.40 (40.50). **Colouration.** The specimen is in bad condition and faded; legs of the right side are torn off and the abdomen is separated from the carapace and damaged. Carapace russet, covered with white appressed scales, especially dense around eyes (Figs 8, 60). Sternum brown, densely covered with brownish hairs. Maxillae and labium russet, with yellow tips. Chelicerae dark brown. Abdomen: dorsum and sides yellowish grey; venter dark brown (due to the coverage of short brown hairs), with yellow distal area in front of the spinnerets (Fig. 61). Book-lung covers yellow, covered with short brown hairs. Spinnerets yellow, tinged with brown. All legs yellowish brown, densely covered with short appressed white scales; all tibiae with dark brown ventral patches at both ends of the segments. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of short spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of short spinules and poorly developed scopula on the segments' sides. Palps yellowish brown, covered with white appressed scales and white/brown hairs. Epigyne and spermathecae as in Figs 24–25, 49.

***Zyuzicosa turlanica* sp. nov.**

(Figs 6, 43–45, 56–57, 62–69, 74–75, Map 2)

Type material. The male holotype and female paratype (ZMUM) from KAZAKHSTAN, South Kazakhstan Area, Turkestan Distr., SW slope of Karatau Mt. Range, c. 1 km SE of Achisai, N env. of Turlan, grass-vermuth steppe, 43°32'15"N, 68°55'00"E, 750–800 m a.s.l., 23.06.1989, A.A. Zyuzin. – Paratypes. 2 males, 2 females (SZMN), together with the holotype.

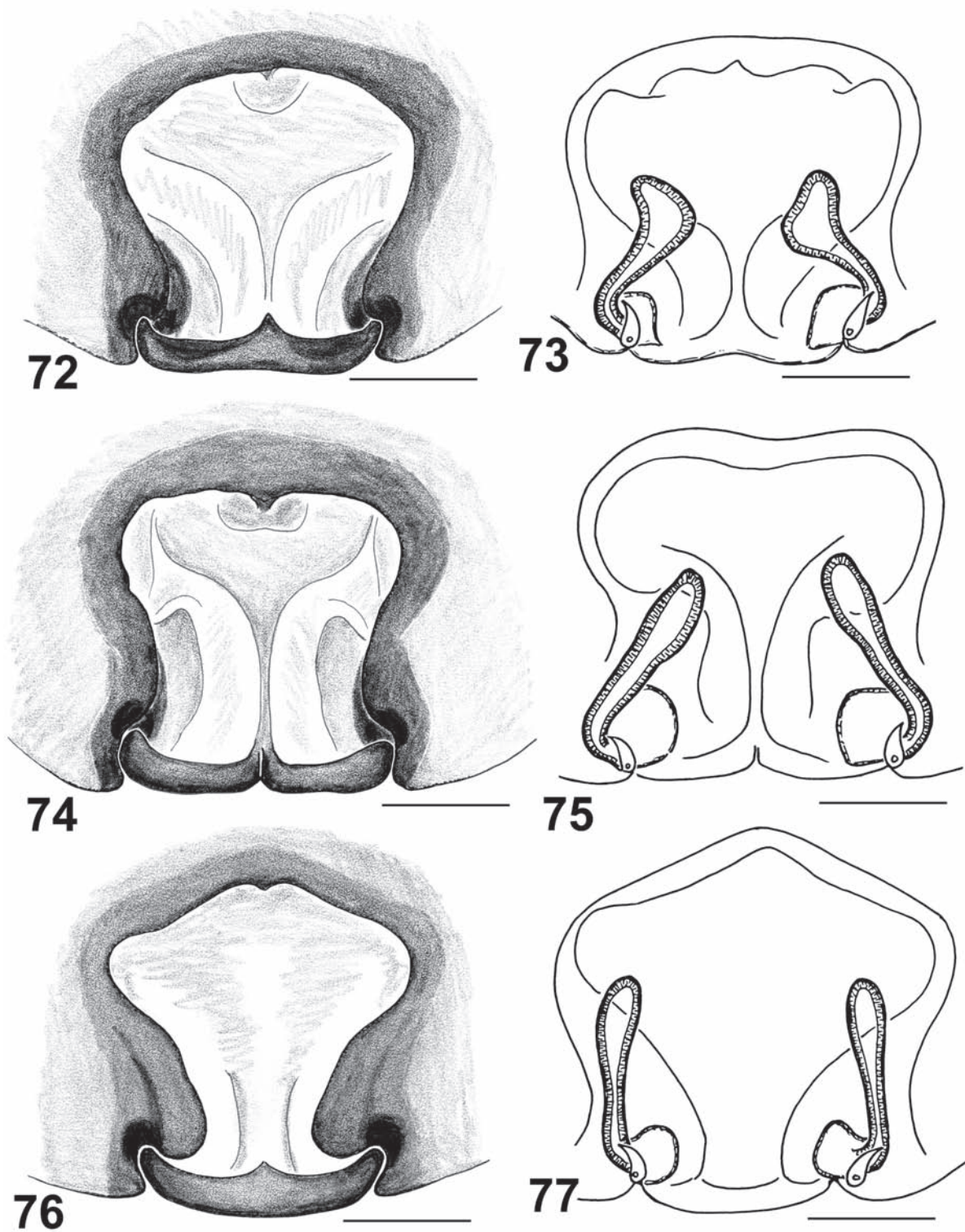
Etymology. The specific epithet is derived from the area from which the holotype was collected, the vicinities of Turlan in South Kazakhstan.

Diagnosis. This species differs from all the known *Zyuzicosa* species in having the relatively well-marked median septum of the epigyne in females (cf. Figs 43–45, 74 and 40–42) and the bifurcated tip of the proximal process of the median apophysis in males (Figs 64, 68).

Distribution. The type locality only (Map 2).

Description. *Male* (holotype). **Measurements.** Carapace 6.20 long, 4.50 wide. Eye sizes and interdistances: AME 0.24, ALE 0.23, PME 0.66, PLE 0.49, AME-AME 0.16, AME-ALE 0.06, PME-PME 0.40, PLE-PLE 1.15. Width of anterior eye row 1.18, second row 1.60, third row 1.83. Clypeus height 0.25, chelicera length 2.33. Abdomen 5.80 long, 3.35 wide. Length of leg segments: I 5.50 + 2.10 + 4.55 + 4.70 + 2.50 (19.35); II 5.25 + 2.15 + 4.10 + 4.50 + 2.40 (18.40); III 4.65 + 1.65 + 3.60 + 4.50 + 2.45 (16.85); IV 6.00 + 2.25 + 5.25 + 6.85 + 3.25 (23.60). **Colouration.** Carapace russet, densely covered with white appressed hairs, and with marginal white stripes of dense hairs (Fig. 57). Sternum and coxae yellow brownish, densely covered with brown hairs. Maxillae and labium yellowish brown. Chelicerae brown, their proximal half anteriorly covered with white hairs. Abdomen: dorsum greyish yellow, with a longitudinal pattern of paired yellow patches and stripes (Fig. 62); sides greyish yellow; venter yellow, but book-lung covers and area between them brown and dark brown transverse band behind epigastric furrow (Fig. 63). Spinnerets yellow. All legs brownish yellow, covered with white and brown hairs; tibiae IV with ventral brown patches at the ends of the segment. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only. Palps brownish yellow. Palpal structure as in Figs 64–69.

Female (paratype). **Measurements.** Carapace 14.50 long, 10.10 wide. Eye sizes and interdistances: AME 0.53, ALE 0.48, PME 1.35, PLE 1.05, AME-AME 0.28, AME-ALE 0.15, PME-PME 0.93, PLE-PLE 2.90. Width of anterior eye row 1.93, second row 3.40, third row 4.25. Clypeus height 0.50, chelicera length 6.50. Abdomen 14.50 long, 9.50 wide. Length of leg segments: I 10.80 + 5.10 + 8.60 + 8.10 + 3.50 (36.00); II 10.20 + 5.00 + 7.70 + 7.90 + 3.50 (34.30); III 9.00 + 4.20 + 6.10 + 8.20 + 3.60 (31.10); IV 11.80 + 4.80 + 9.30 + 12.10 + 4.70 (42.70). **Colouration.** Carapace russet, densely covered with white appressed hairs (especially dense on eye field), and with marginal white stripes of dense hairs (Figs 6, 56). Sternum, coxae, maxillae and labium red brown, densely covered with brown hairs. Maxillae and labium with yellow apices. Chelicerae dark brown, their proximal half anteriorly covered with white hairs. Abdomen: dorsum and sides greyish yellow, with no colour pat-



Figs 72–77. Female copulatory organs of *Zyuzicosa fulviventris* (Kroneberg) (72–73, holotype), *Z. turlanica* sp. nov. (74–75, paratype) and *Z. zerafshanica* sp. nov. (76–77, paratype): 72, 74, 76 – Epigyne, ventral view; 73, 75, 77 – Spermathecae, dorsal view. Scale bars = 0.5 mm.



Figs 78–79. Female (left) and male (right) of *Zyuzicosa zerafshanica* sp. nov. (paratypes): 78 – dorsal view; 79 – ventral view. Scale bars = 10 mm.

tern (Fig. 62); venter dark brown in its proximal half, including book-lung covers and area between them and yellow in its distal half (Fig. 63). Spinnerets yellow. All leg segments but coxae, yellow with dark brown patches at the ends of tibiae; all segments covered with white and brown hairs. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only. Palps brownish yellow. Epigyne and spermathecae as in Figs 43–45, 74–75.

***Zyuzicosa uzbekistanica* sp. nov.**
(Figs 54–55, Map 3)

Type material. The male holotype (ZMUM) from UZBEKISTAN, Surkhandarya Area, Baisun [=Boysun] Distr., c. 46 km WSW of Denau [=Denov], SE foothills of Dzhetymkalyas Mt. Range, clayey slopes, 38°03'00"N, 67°26'30"E, 850–950 m a.s.l., 13.05.1994, O.V. Lyakhov.

Etymology. The specific epithet is derived from the country, Uzbekistan, from which the holotype was collected.

Diagnosis. This species differs from all the known *Zyuzicosa* species in having the visibly bifurcated ventral process of the median apophysis (see Fig. 55) and also by the shape of the median apophysis (Fig. 54).

Comments. The female of *Z. uzbekistanica* sp. nov. remains unknown. It might be that this species is actually a male of *Z. fulviventris* known to date from the female holotype only (see above). The matter requires further attention in the future.

Distribution. The type locality only (Map 3).

Description. *Male* (holotype). **Measurements.** Carapace 6.05 long, 3.90 wide. Eye sizes and inter-distances: AME 0.24, ALE 0.26, PME 0.69, PLE 0.54, AME-AME 0.19, AME-ALE 0.09, PME-PME 0.50, PLE-PLE 1.15. Width of anterior eye row 1.36, second row 1.67, third row 1.83. Clypeus height 0.23, chelicera length 2.50. Abdomen 4.65 long, 3.25 wide. Length of leg segments: I 6.10 + 2.70 + 5.35 + 5.80 + 3.25 (23.20); II 5.60 + 2.35 + 4.75 + 5.65 + 3.20 (21.55); III 4.50 + 2.20 + 4.00 + 5.55 + 3.00 (19.25); IV 6.75 + 2.70 + 6.00 + 8.75 + 4.00 (28.20). **Colouration.** Specimen is in poor condition with the 4th right leg partly broken. Carapace light brown, but eye field dark brown, covered with whitish appressed hairs



Figs 80–81. Males of *Zyuzicosa gigantea* sp. nov. (the larger specimens on the left, paratype) and *Z. baisunica* sp. nov. (the smaller specimens on the right, paratype): 80 – dorsal view; 81 – ventral view. Scale bars = 10 mm.

and with a longitudinal stripe and marginal stripes of white hairs. Sternum brownish, covered with brown hairs. Maxillae and labium yellow. Chelicerae yellow, tinged with brown. Abdomen: dorsum densely covered with dark brown hairs and with two longitudinal rows of light yellow patches; sides yellow; venter yellow, with dark brown patch in the proximal half of the abdomen, occupying the area between book-lung covers and behind the epigastric furrow. Book-lung covers and spinnerets yellow. All legs and palps yellow, covered with white and brown hairs. Metatarsi and tarsi I–II ventrally with well-developed scopula and longitudinal rows of spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only. Palpal structure as in Figs 54–55.

Female unknown.

***Zyuzicosa zeravshanica* sp. nov.**

(Figs 7, 14–15, 22–23, 34–36, 40–42, 58–59, 70–71, 76–79, Map 3)

Type material. The male holotype and female paratype (ZMUM) from UZBEKISTAN, Samarkand Area, Nurabad [=Nurobod] Distr., SW slope of Zeravshan Mt. Range, Dzham [=Jom] River canyon,

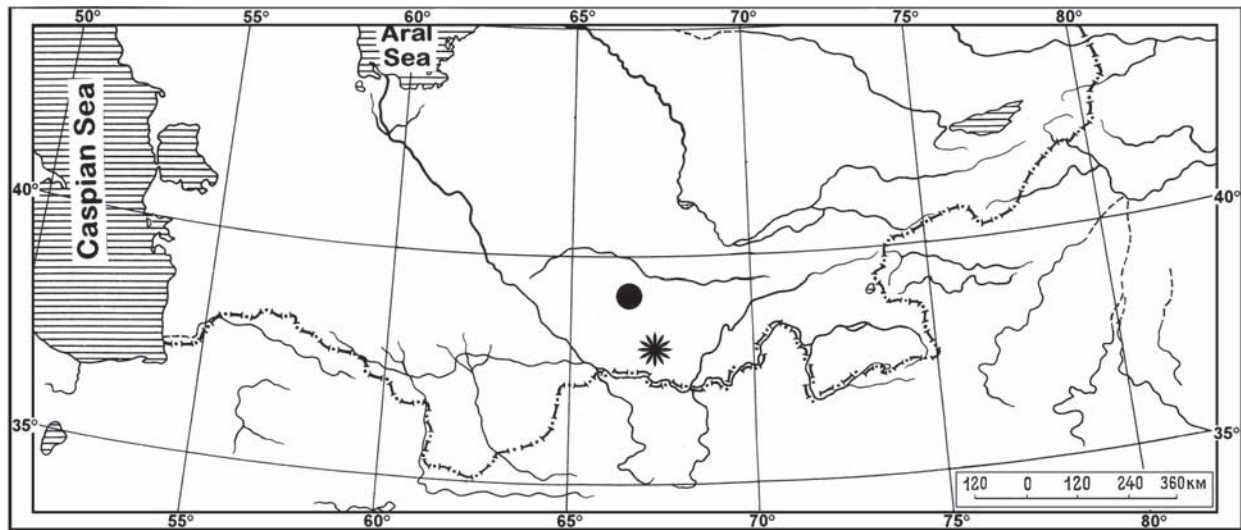
c. 10 km SE of Dzham [=Jom], desertified steppe, 39°22'50"N, 66°31'00"E, 850–1000 m a.s.l., 05.1990 (molted in lab, 06.1990), A.A. Zyuzin. – Paratypes. 3 males, 1 female (SZMN) and 1 male, 1 female (BMNH), together with the holotype.

Etymology. The specific epithet is derived from the area from which the holotype was collected, the Zeravshan Mt. Range in Uzbekistan.

Diagnosis. The female of *Z. zeravshanica* sp. nov. is closest to that of *Z. fulviventris* in that the median septum of the epigyne is reduced to the posterior transverse plate, but differs in the epigynal depression narrowing towards its rear end (cf. Figs 40–42, 76 and 46, 72) and in straight, narrow receptacles (the wide, pear-shaped ones in the latter species; cf. Figs 77 and 73). The male of *Z. zeravshanica* sp. nov. is most similar to that of *Z. turlanica* sp. nov., but can be easily separated by the shape and proportion of the median apophysis (cf. Figs 68 and 70). See also comments above under *Z. afghana*.

Distribution. The type locality only (Map 3).

Description. *Male* (holotype). *Measurements.* Carapace 5.50 long, 4.50 wide. Eye sizes and interdistances: AME 0.27, ALE 0.26, PME 0.65, PLE 0.53, AME-AME 0.19, AME-ALE 0.11, PME-PME 0.45, PLE-PLE 1.15. Width of anterior eye row 1.29,



Map 3. Collection localities of *Zyuzicosa uzbekistanica* sp. nov. (asterisk), and *Z. zeravshanica* sp. nov. (circle).

second row 1.63, third row 1.88. Clypeus height 0.17, chelicera length 2.30. Abdomen 5.30 long, 3.25 wide. Length of leg segments: I 5.10 + 2.30 + 4.10 + 4.30 + 2.50 (18.30); II 4.75 + 2.05 + 3.65 + 4.15 + 2.40 (17.00); III 4.15 + 1.85 + 3.15 + 3.95 + 2.30 (15.40); IV 5.80 + 2.10 + 4.80 + 6.60 + 2.55 (21.85). *Colouration*. Carapace yellowish brown, densely covered with white appressed hairs (especially dense on eye field), and with marginal white stripes of dense hairs (Fig. 59). Sternum and coxae yellow, densely covered with white hairs (Fig. 79). Maxillae and labium yellowish, tinged with brown and with white apices. Chelicerae brownish yellow, their proximal half anteriorly covered with white hairs. Abdomen: dorsum and sides greyish yellow, with a reticulate greyish brown pattern (Fig. 78); venter completely yellow (Fig. 79). Book-lungs yellow. Spinnerets yellow, tinged with brown. All legs brownish yellow, covered with white and brown hairs. Metatarsi and tarsi I–II ventrally with well-developed scopulae and longitudinal rows of spinules, metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only. Palps brownish yellow. Palpal structure as in Figs 34–36, 70–71.

Female (paratype). *Measurements*. Carapace 11.40 long, 7.50 wide. Eye sizes and interdistances: AME 0.45, ALE 0.45, PME 1.43, PLE 1.10, AME-AME 0.25, AME-ALE 0.15, PME-PME 0.70, PLE-PLE 2.30. Width of anterior eye row 2.23, second row 3.00, third row 3.55. Clypeus height 0.33, chelicera length 5.20. Abdomen 11.00 long, 6.80 wide. Length of leg segments: I 9.20 + 4.70 + 7.00 + 6.70 + 3.50 (31.10);

II 8.20 + 4.50 + 6.20 + 7.00 + 3.40 (29.30); III 7.40 + 3.80 + 5.50 + 6.90 + 3.10 (26.70); IV 9.70 + 4.30 + 8.00 + 11.00 + 4.50 (37.50). *Colouration*. Carapace yellowish brown, densely covered with white appressed hairs (especially dense on eye field), and with marginal white stripes of dense hairs (Figs 7, 58). Sternum and coxae brownish, densely covered with brown hairs (Fig. 79). Maxillae and labium brownish, with yellow apices. Chelicerae dark brown, their proximal half anteriorly covered with white hairs (Fig. 7). Abdomen: dorsum and sides yellow, with a marked brown reticulate pattern (Fig. 78); venter yellow, but book-lung covers and area between them brown and with dark brown transverse band behind epigastric furrow (Fig. 79). Spinnerets yellow. All leg segments but coxae, yellow with dark brown patches at the ends of tibiae; all segments covered with white and brown hairs. Metatarsi and tarsi I–II ventrally with well-developed scopulae and longitudinal rows of spinules (Figs 14, 22), metatarsi and tarsi III–IV with ventral longitudinal rows of spinules only (Figs 15, 23). Palps brownish yellow. Epigyne and spermathecae as in Figs 40–42, 76–77.

DISCUSSION

Marikovski (1956), Zyuzin (1990, 1993) and Aisenberg et al. (2010) discussed a number of specific morphological adaptations to burrowing of wolf spiders. Of these, all the *Zyuzicosa* species possess a black ventral colour pattern on the sternum, coxae

and abdomen (Figs 29, 63, 79), the fur-like pubescence on the carapace (Figs 56–60) and a cluster of rigid and straight bristles on the cymbial tips in males (Fig. 67). The slope of the carapace is not prominent (Figs 57, 59), being similar to that in the genus *Lycosa* (Fig. 2; see also Zyuzin 1990: fig. 3).

Three of the eight known species of *Zyuzicosa* gen. nov., for which both sexes are known, display extreme sexual size dimorphism (SSD), with typical dwarf males (Figs 28, 62, 78). The body length of these males is 37–49% of that of corresponding females. Such extreme SSD might have resulted from selection acting on small male size, in a similar way to that hypothesized for sexually dimorphic mygalomorphs (Main 1990; Vollrath and Parker 1997; Vollrath 1998). Main (1990) postulated that the reduced size in males of certain Mygalomorphae is advantageous in hazardous habitats (characterized by high seasonal aridity or periodic flooding of the ground) in which the species occur. Small males can avoid hostile conditions more easily. In such environments, the females are safe in their burrows and less at risk than the roving males, which are subject to higher adult mortality (see Vollrath and Parker 1997; Mas et al. 2009). According to Vollrath (1998), the dwarfing could be one of the major adjustments in adapting to such high-risk habitats.

In the absence of good biological information for *Zyuzicosa* species, apart from field and lab observations by one of their collectors (A. Zyuzin, pers. comm.) that females and juveniles do make burrows, the above assumption requires detailed empirical research on behavioural, life-history and demographic traits of *Zyuzicosa* species in order to understand how SSD in *Zyuzicosa* gen. nov. could have evolved and is maintained. The problem of SSD in wolf spiders, including extreme SSD in *Zyuzicosa* gen. nov., will be thoroughly discussed by the author in a separate paper, which is now in preparation.

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