

A survey of east Palaearctic Lycosidae (Araneae). I. On three closely related species of the *Pardosa falcata*-group

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Abstract — Three closely related species, *Pardosa azerifalcata* sp. n. (SE Azerbaijan), *P. jergeniensis* Ponomarev 1979 (northern Ciscausia) and *P. falcata* Schenkel 1963 (northern China and Mongolia), represent a separate species group. Illustrated descriptions of the three species are given. *P. donabila* Roewer 1955 (Iran) may belong to this group as well. *P. falcata* was found to be a senior synonym of *P. crucifera* Schenkel 1963 syn. n. *P. falcata* was reported from Mongolia for the first time.

Key words — *Pardosa*, Lycosidae, wolf spiders, east Palaearctic, new species, taxonomy, distribution

Introduction

Working on lycosids of Caucasus we found that a species occurring in southeastern Azerbaijan was remarkably similar to *Pardosa falcata* Schenkel 1963, known from China. From the figures provided by several authors it was not possible to discriminate these species. Therefore we decided to compare the two species, to check if they are not conspecific, and to provide detail illustrated redescriptions of them. During our study we found that *P. jergeniensis* Ponomarev 1979 from northern Ciscausia is also very similar to *P. falcata* and the species found in Azerbaijan.

Illustrations were made using both reflecting and transmitting light microscope with drawing and camera devices. Microphotographs were made by SEM Jeol JSM-5200 in the Zoological Museum, University of Turku. All measurements are given in millimeters.

The following abbreviations have been used for collections and museum: YMT-Yuri M. Marusik's temporary collection in Zoological Museum, University of Turku; ZMMU-Zoological Museum, Moscow State University; ZMUT-Zoological Museum, University of Turku; ZISP-Zoological Institute, St. Petersburg.

Survey of species

Pardosa azerifalcata sp. n.

(Figs. 1–5, 10–12, 17–18, 21–24, 29–31. Map 1)

Material examined: Holotype ♂ (ZMMU) and paratypes 2♂2

♀ (ZMMU and ZMUT), SE AZERBAIJAN, Ismailly Dist., Khanaya, 40°81'N 48°15'E, 700 m, 9.07.2001 (E. F. Guseinov).

Diagnosis. *P. azerifalcata* sp. n. is closely related to *P. falcata* Schenkel 1963 known from China (from Xinjiang to Jilin, and Inner Mongolia to Shaanxi) and south Mongolia (present record) and *P. jergeniensis* Ponomarev 1979 (northern Ciscausia). Females of the three species can be separated by the shape and relative size of epigynal septum and partially by the color pattern. *P. azerifalcata* sp. n. has relatively (compared to *P. falcata*) longer apical part of septum, thinner receptacula and some other characters pointed by arrows on Figs. 10–14, 16. Males of the new species have different shape of palea, terminal apophysis, tegular apophysis and embolus (differences pointed by arrows in Figs. 1, 2, 4, 6, 7, 9). Basal part of embolus in *P. azerifalcata* sp. n. is distinctly thinner than in *P. falcata*, and embolus curved more strongly. Sibling species can be rather easily separated by color pattern (cf. Figs. 17–20), lighter in *P. falcata* and *P. jergeniensis*, and distinctly darker in *P. azerifalcata* sp. n. *P. falcata* and *P. azerifalcata* sp. n. can be separated by spination as well by having 5 ventral spines on male metatarsus IV in *P. falcata* (4 in *P. azerifalcata* sp. n.) and only 1 retrolateral spine on metatarsi I–II in *P. falcata* (2 in *P. azerifalcata* sp. n.).

Description. Male. Body 5.50–5.63 long. Carapace: 3.0–3.38 long, 2.30–2.53 wide, dark brown, eye field black, yellow-brown band distinct in thoracic part only, lateral light stripes broken (Fig. 18). Sternum, labium and gnathocoxae grey. Sternum with light spot in anterior part. Chelicerae

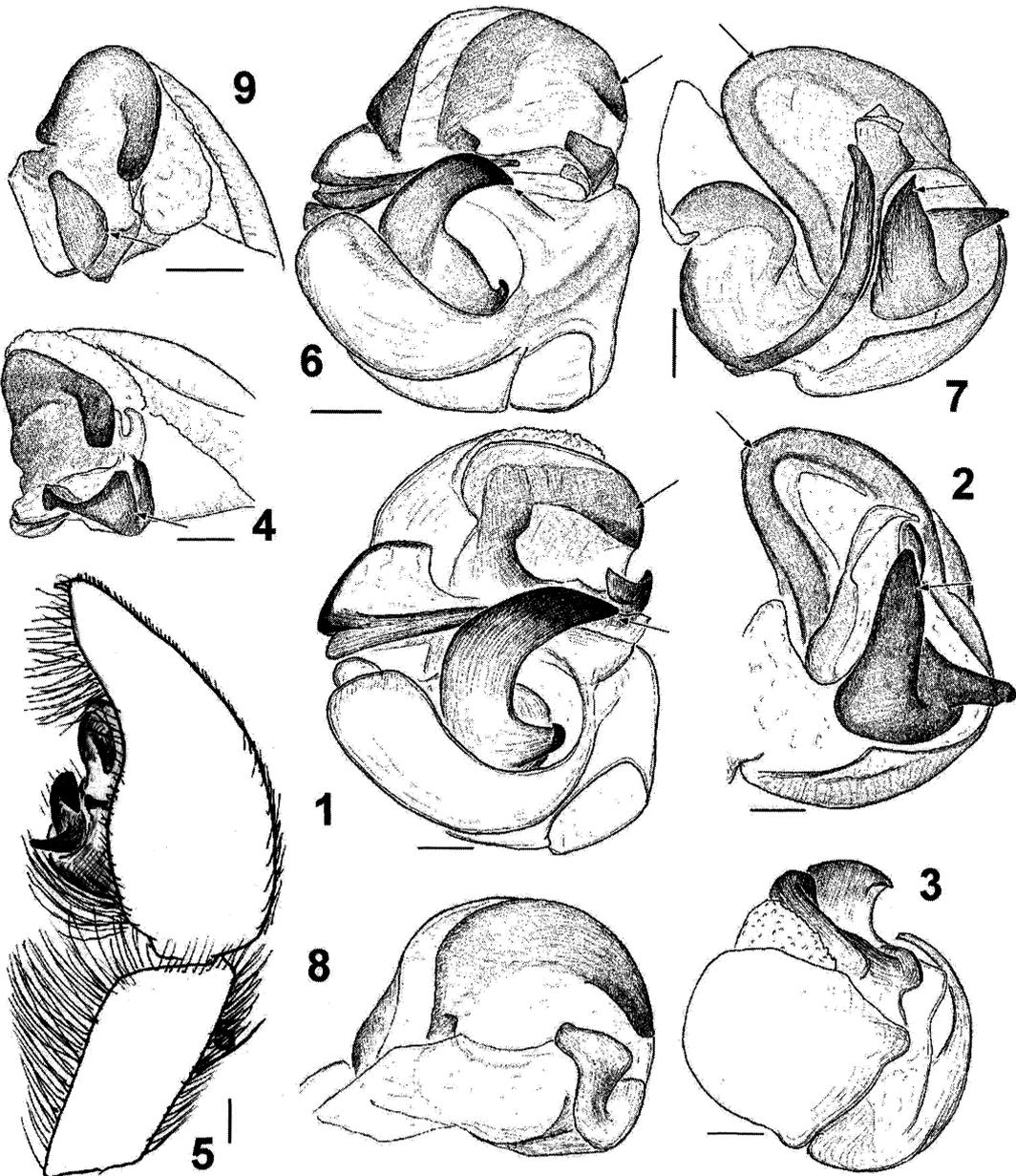
dark brown. Legs light yellow with light grey spots. Spination equal in both sexes. Abdomen dorsally grey with small sparse yellow spots, venter yellow with grey anterior part. Palp as in Figs. 1–5, 21–24, 29–30, with black cymbium covered with dense black hairs, tegular apophysis large with two well developed arms, base of embolus wide subdivided by furrow in two parts, tip of embolus slightly turned, terminal apophysis subdivided in two parts: one large bill shaped and another small one, palea with distinct ridge.

Leg measurements (♂)

	femur	patella	tibia	metatarsus	tarsus	total
I	2.58	1.15	2.50	2.60	1.63	10.46
II	2.63	1.15	2.25	2.88	1.55	10.46
III	2.63	1.18	2.38	3.38	1.38	10.95
IV	3.38	1.38	2.75	4.95	2.05	14.51

Spination of legs (♂ and ♀)

	femur	patella	tibia	metatarsus
I	3d+2p+2r	2d+1p+1r	3-3v+2d+2r+2r	2-2v+2p+2r
II	3d+2p+2r	2d+1p+1r	3-3v+2d+2r+2r	2-2v+2p+2r
III	3d+2p+2r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r
IV	3d+2p+1r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r



Figs. 1–9. Male palp of *Pardosa azerifalcata* sp. n. (1–5) and *P. jergeniensis* Ponomarev (6–9). — 1, 6, bulbus, ventral view; 2, tegulum, view from above; 3, apical portion of the bulbus, view from above; 4, 9, apical portion of bulbus, retrolateral view; 5, palp, retrolateral view; 7, embolus and tegulum, view from above. Scales: 0.1 mm.

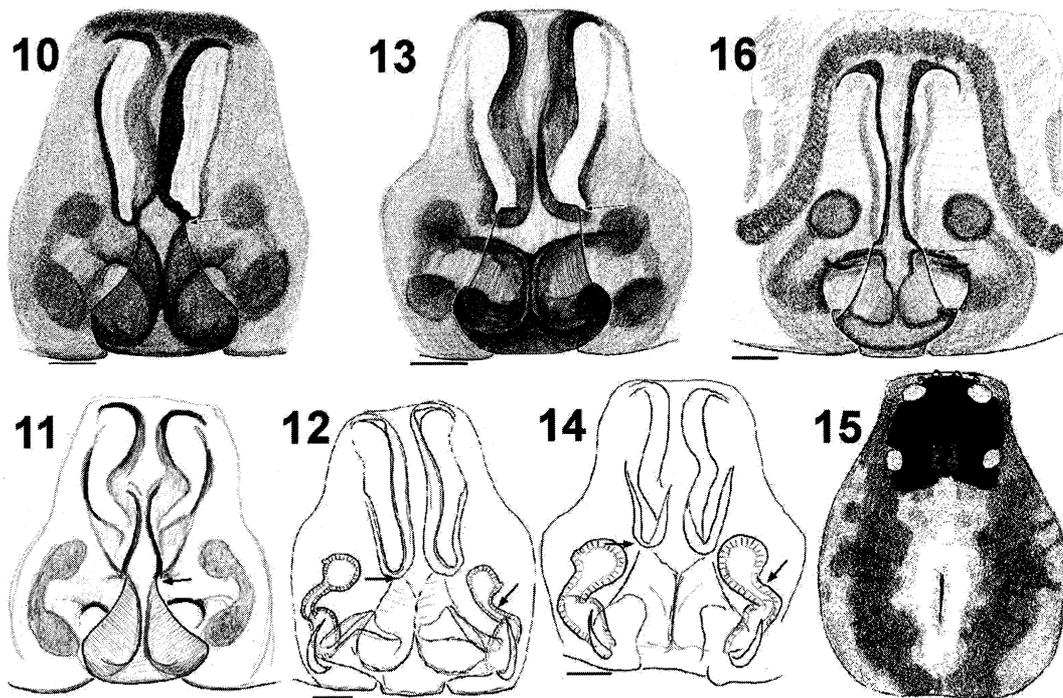
Female. Body 8.25 long. Carapace: 3.38–3.50 long, 2.63–2.80 wide, median band lighter and wider than in male, lateral light stripes penetrate to cephalic part (Fig. 17). Sternum with dense light hairs and median band along almost whole sternum. Gnathocoxae and chelicerae yellow. Legs with more distinct and dark rings. Abdominal pattern formed with larger and more distinct yellow spots, venter light grey. Epigyne as in Figs. 10–12, 31, with long and thin septum, beginning of basal part of septum (free part) is equal in width to septal stem, pockets untouched, fovea partly visible.

Leg measurements (♀)

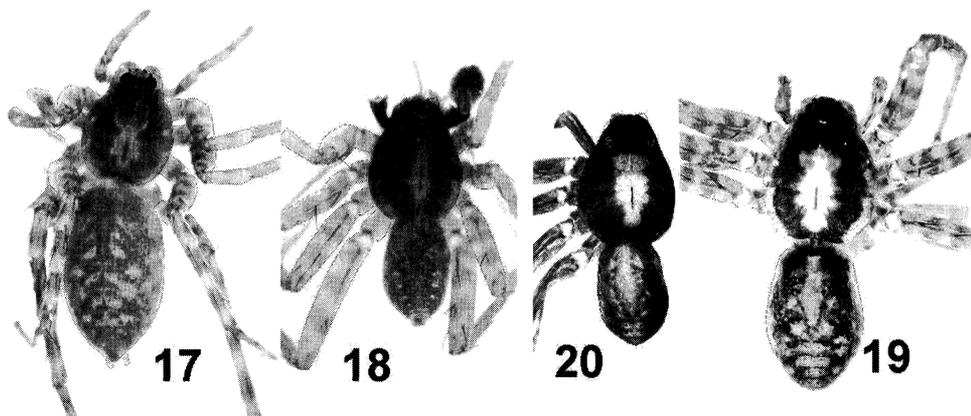
	femur	patella	tibia	metatarsus	tarsus	total
I	3.50	1.53	3.10	3.20	1.88	13.21
II	3.35	1.55	2.90	3.13	1.60	12.53
III	3.40	1.50	2.85	3.75	1.63	13.13
IV	4.40	1.53	3.90	6.05	2.38	18.26

Distribution. Known from the type locality only.

Etymology. The specific name is an arbitrary combination of letters derived from two words “Azerbaijan” and “falcata”, showing area of distribution and relationships.



Figs. 10–16. Epigyne and carapace of *Pardosa azerifalcata* sp. n. (10–12), *P. falcata* Schenkel (13–15) and *P. jergeniensis* Ponomarev (16). —10–11, 13, 16, epigyne, ventral view; 12, 14, epigyne, dorsal view; 15, female carapace. Scales: 0.1 mm.



Figs. 17–20. Pattern of *Pardosa azerifalcata* sp. n. (17–18) and *P. falcata* Schenkel (19–20). —17, 19, female; 18, 20, male.

Pardosa falcata Schenkel 1963

(Figs. 13–15, 19–20, 25–28, 32–34. Map 1)

Pardosa falcata Schenkel 1963, p. 363, f. 210a–b (♂) (holotype ♂ in NMNH; not examined).*P. crucifera* Schenkel 1963, p. 374, f. 217a–c (♀) (holotype ♀ in NMNH; not examined). **New Synonymy***P. falcata*: Yin et al. 1997, p. 99, f. 92a–f (♂♀); Song et al. 1999, p. 330, f. 194J, U (♂♀); Song et al. 2001, p. 249, f. 153A–D (♂♀).**Material examined:** 2♂ 2♀ (YMT), MONGOLIA, South-Gobi Aimak, 42°30'N ~105°E, 18.07.1999 (M. Unruch) (New state record).**Diagnosis.** See in *P. azerifalcata* sp. n. Color pattern of this species is rather similar to those in *P. jergeniensis*, however male abdomen is darker (without yellow spots).**Description.** Male. Body 5.25–5.50 long. Carapace: 2.8–3.0 long, 2.13 wide, dark brown, eye field black, median band yellow widening in cephalic part brownish, lateral light stripes absent (Fig. 20). Sternum dark brown, with yellow median stripe in anterior half. Labium and chelicerae dark brown. Gnathocoxae light brown. Legs yellow, femora with longitudinal dark stripes dorsally. Spination different from that in female. Abdomen with yellow pattern of heart mark and two series of oval spots, sides blackish, venter of abdomen yellow with grey median band, area between pedicel and epigastral furrow grey. Palp as in Figs. 25–28, 32–33, cymbium black, covered with black hairs, other palp joints brown, tegulum elongated, tegular apophysis large with two well developed arms, base of embolus thin subdivided by furrow in two parts, embolus nearly straight, terminal apophysis subdivided in two equal parts, palea with distinct ridge.

Leg measurements (♂)

	femur	patella	tibia	metatarsus	tarsus	total
1	1.98	0.85	1.75	2.00	1.33	7.91
2	1.80	0.85	1.60	1.85	1.33	7.43
3	1.90	0.83	1.50	2.05	1.10	7.38
4	2.63	0.93	2.18	3.25	1.53	10.52

Spination of legs (♂)

	femur	patella	tibia	metatarsus
I	3d+2p+2r	2d+1p+1r	3-3v+2d+2p+2r	2-2v+2p+2r
II	3d+2p+2r	2d+1p+1r	3-3v+2d+2p+2r	2-2v+2p+2r
III	3d+2p+2r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r
IV	3d+2p+1r	2d+1p+1r	2-2v+2d+2p+2r	3-2v+2p+2r

Female. Body 7.5–7.6 long. Carapace: 3.38–3.88 long, 2.5–2.88 wide, brown, with wide yellow median band and lateral stripes reaching cephalic part, cephalic part black with two longitudinal stripes between PME (Fig. 15). Sternum dark brown with yellow median stripe in anterior part and series of yellow spots laterally. Labium and gnathocoxae yellow. Chelicerae yellow with brown stripes.

Legs yellow with grey rings. Abdominal pattern like in male while with more yellow spots, sides and venter light yellow (Fig. 19). Epigyne as in Figs. 13–14, 34, with long and thin septum, beginning of basal part of septum (free part) is wider than septal stem, pockets untouched, fovea partly visible.

Leg measurements (♀)

	femur	patella	tibia	metatarsus	tarsus	total
I	2.80	1.30	2.38	2.38	1.70	10.56
II	2.80	1.35	2.25	2.38	1.58	10.36
III	2.75	1.30	2.20	2.80	1.40	10.45
IV	3.68	1.45	3.30	5.10	2.15	10.52

Spination of legs (♀)

	femur	patella	tibia	metatarsus
I	3d+2p+2r	2d+1p+1r	3-3v+2d+2p+2r	2-2v+1p+1r
II	3d+2p+2r	2d+1p+1r	3-3v+2d+2p+2r	2-2v+2p+1r
III	3d+2p+2r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r
IV	3d+2p+1r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r

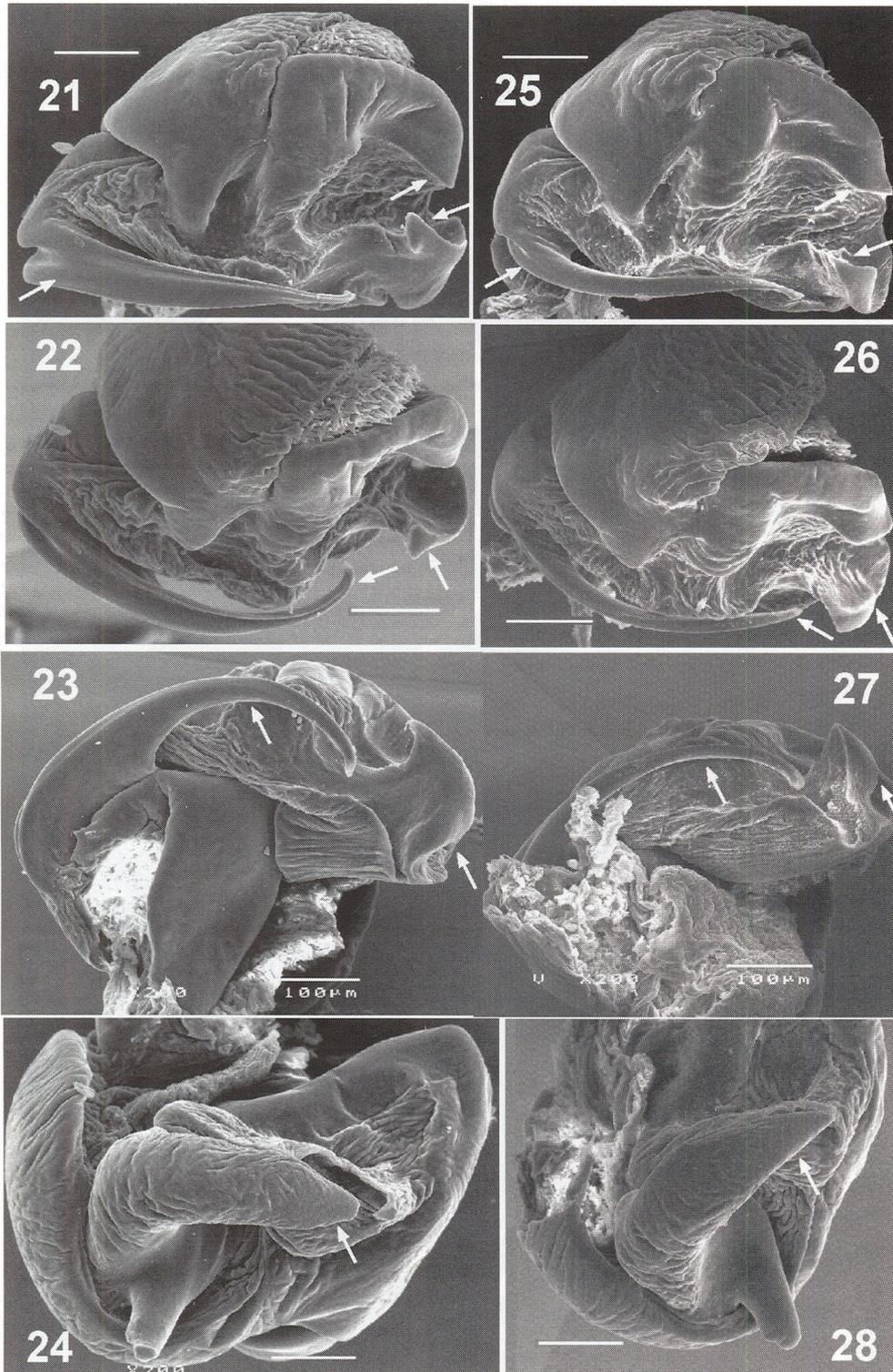
Distribution. This species was known to be distributed in northern China, from Xinjiang to Jilin and from Gansu to Shandong (Song et al. 1999). From Mongolia the species is reported for the first time. Judging from occurrence of the species in Jilin it is possible to expect its presence in adjacent Maritime Province of Russia.*Pardosa jergeniensis* Ponomarev 1979

(Figs. 6–9, 16. Map 1)

Pardosa jergeniensis Ponomarev 1979, p. 1589, fig. 1a–b (♂♀) (holotype ♀ and paratype ♂ in ZISP; examined).*P. jergeniensis*: Guseinov & Rubtsova 2001, p. 237 (misidentification).**Material examined:** ♀ holotype and 1♂ paratype (ZISP), KAZAKHSTAN, Atyrau (=Guryev) Area, Rengizsky Dist., cf. 20km NE of Ganyushkino Vil., lake shore, 20.05.1977 (A. V. Ponomarev).**Diagnosis.** This species can be easily separated from the sibling *P. falcata* and *P. azerifalcata* sp.n. by color pattern and copulatory organs. Males of this species unlike two other have distinct yellow abdominal pattern (like in female). Basal arm of tegular apophysis is subequal in length to the apical arm, tegulum of this species is clearly shorter than in two sibling species and tegular ridge is distinctly smaller. Epigynal septum of this species is relatively thin, but fovea large with distinct lateral margins.**Description.** Male. Body 4.5 long. Carapace: 2.5 long, 1.9 wide, dark brown, eye field black, median band yellow with clear margins, its widening in cephalic part brownish, submarginal band broken, light brown. Sternum dark brown, with yellow median stripe in anterior half. Labium and chelicerae dark brown. Gnathocoxae light brown. Legs yellow with brown rings. Spination equal to female. Abdomen with distinct yellow pattern of heart mark, two parallel

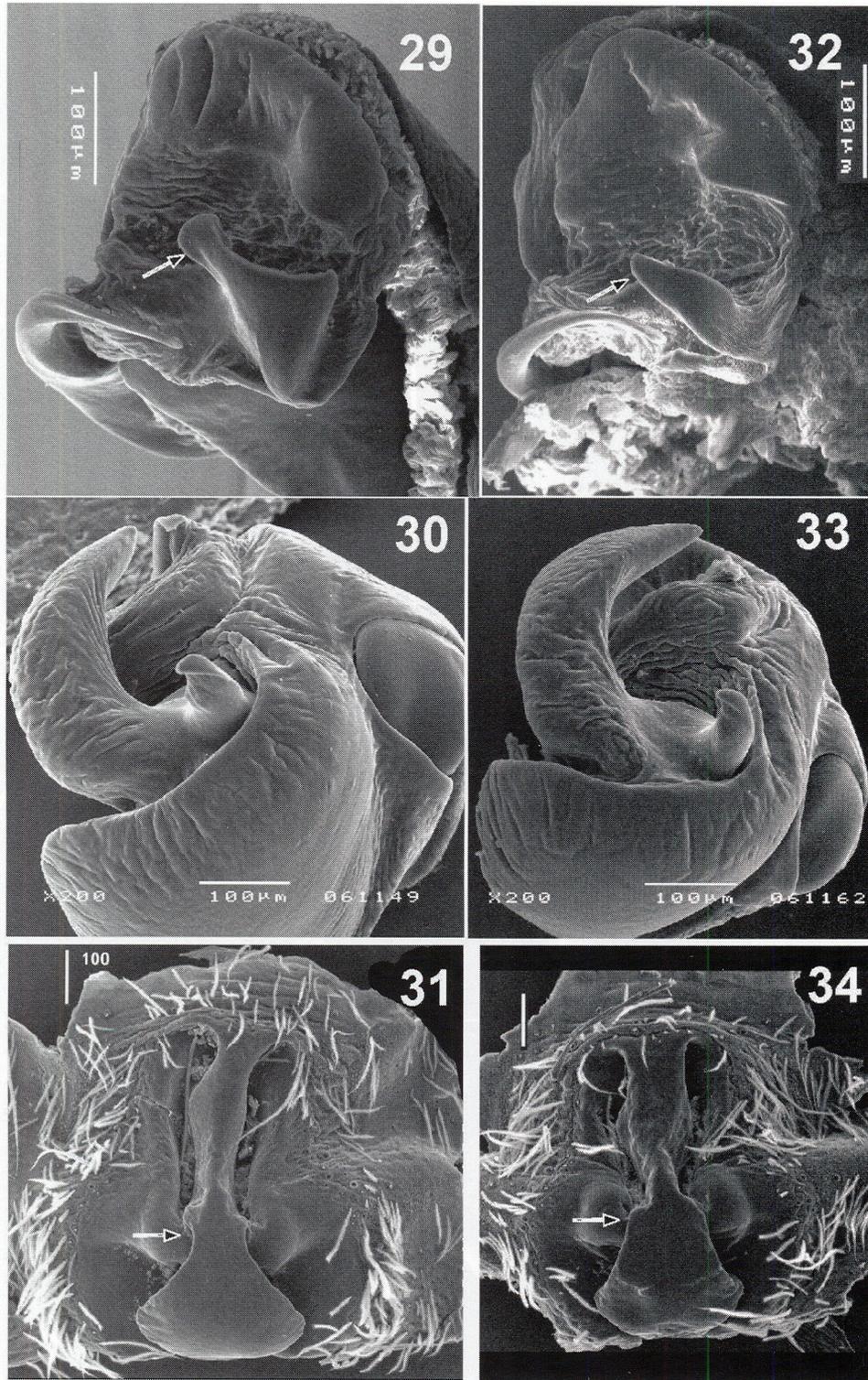
longitudinal bands aside, and series of transverse pairs of oval spots, sides blackish, venter of abdomen yellow with gray median band, area between pedicel and epigastral furrow gray. Palp as in Figs. 6–9, cymbium black, covered

with black hairs, other palp joints brown, tegulum elongated, tegular apophysis large with two well developed arms, bases of embolus thin subdivided by furrow in two parts, embolus relatively thick (in view from above), termi-

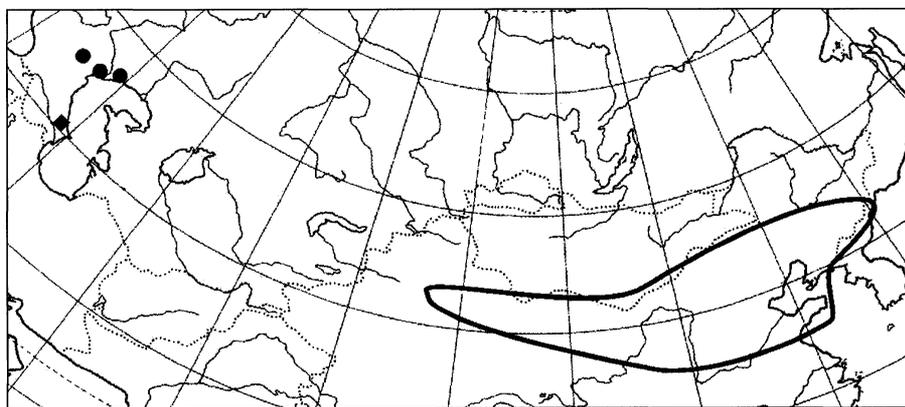


Figs. 21–28. Male palp of *Pardosa azerifalcata* sp. n. (21–24) and *P. falcata* Schenkel (25–28). —21, 25, apical portion of the bulb, ventral view; 22, 26, same, view from above; 23, 27, same, view from below; 24, 28, tegulum, view from above. Scales: 0.1 mm.

nal apophysis subdivided in two parts, large terminal and twice smaller subterminal part, palea with distinct ridge.



Figs. 29–34. Copulatory organs of *Pardosa azerifalcata* sp. n. (29–31) and *P. falcata* Schenkel (32–34). —29, 32, apical portion of the bulbus, retrolateral view; 30, 33, tegulum, ventral view; 31, 34, epigyne, ventral view. Scales: 0.1 mm.



Map 1. Distribution of three sibling species: *Pardosa azerifalcata* sp.n. (◆), *P. jergeniensis* Ponomarev (●) and *P. falcata* Schenkel (-).

Leg measurements (♂, leg I missing)

	femur	patella	tibia	metatarsus	tarsus	total
II	1.65	0.75	1.25	1.5	1.1	6.25
III	1.6	0.7	1.35	1.7	1.1	6.45
IV	2.25	0.9	1.9	2.6	1.25	8.9

Female. Body 7.6 long. Carapace: 3.5 long, 2.75 wide, pattern like in *P. falcata* with wide yellow median band and lateral stripes reaching cephalic part, cephalic part black with two longitudinal stripes between PME. Sternum dark brown with yellow median stripe in anterior part and yellow margins. Labium and gnathocoxae yellow. Chelicerae yellow with brown stripes. Legs yellow with brown rings. Abdominal pattern with contrast. Epigyne as in Fig. 16, with long and thin septum, septal base equal in width to apical pockets spread, basal part of septum about twice time shorter than stem (stem/basal part ratio 0.64), fovea with distinct lateral margins, transparent receptacula placed over basal part of septum.

Leg measurements (♀)

	femur	patella	tibia	metatarsus	tarsus	total
I	1.7	1.2	2.4	2.25	1.5	9.05
II	2.6	1.2	2.2	2.15	1.45	9.6
III	2.55	1.25	2.2	2.5	1.5	10
IV	3.5	1.25	3.25	4.65	1.9	14.55

Spination of legs (♂ and ♀)

	femur	patella	tibia	metatarsus
I	3d+2p+2r	2d+1p+1r	3-3v+2d+2p+2r	2-2v+2p+2r
II	3d+2p+2r	2d+1p+1r	3-3v+2d+2p+2r	2-2v+2p+2r
III	3d+2p+2r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r
IV	3d+2p+1r	2d+1p+1r	2-2v+2d+2p+2r	2-2v+2p+2r

Distribution. The species is known so far by the type series: Kalmykia and northwestern Kazakhstan (Map 1) only (cf. Mikhailov 1997). Record of this species from

Azerbaijan (Guseinov & Rubtsova 2001) refers to another species.

Discussion and comments

Three closely related species, *P. azerifalcata* sp. n., *P. falcata* and *P. jergeniensis* represent a separate species group within the genus *Pardosa*. When Zyuzin (1979) included *P. falcata* (sub *P. crucifera* Schenkel 1963, known by female only) to the *wagleri*-group, he left *P. falcata* (known at that time by male only) without grouping. Ponomarev (1979) attributed his species to the *wagleri* group as well. Conformation of male palp (chitinised palea in terminal part, long and strong basal arm of tegular apophysis) and epigyne (wide apical part of septum with parallel margins) of these two species are clearly different from these in representatives of the *wagleri* group.

Judging from the shape of epigyne and color pattern of *P. falcata* (Figs. 13–15) and illustrations of these in *P. crucifera* (cf. Figs. 217a–c in Schenkel 1963) and distribution of these taxa it is clear that they are conspecific, and therefore we synonymize them. As the description of *P. falcata* appeared earlier in the text (p. 363) and this name was used by many Chinese authors, and *P. crucifera* was described on page 373 and since original description was never recognized (identified) we treat *P. crucifera* **syn.n.** as a junior synonym of *P. falcata*. Interestingly *P. crucifera* was never listed in surveys of Chinese wolf spiders (cf. Yin et al. 1997; Song et al. 1999, 2001).

It seems that *Pardosa donabila* Roewer 1955 (cf. Figs. 1–2, in Roewer 1955), known from Iran, belongs to the same species group. However, it is larger than the other species (male 8 mm, female 9 mm).

It is worth mentioning that the *P. falcata* species group with three known sibling species, *P. azerifalcata* sp. n., *P. falcata* and *P. jergeniensis*, has a rather rare disjunctive Caspio-Chinese range. Around ten species of spiders from different families (Salticidae, Theridiidae, Thomisidae, Uloboridae) and several supraspecific taxa have Caucaso-Far Eastern range with a gap about 70°, and disjunction in

P. falcata group is only about 35° (cf. Map 1). Up to now we know only one very similar case in Linyphiidae: *Tiso camillus* Tanasevitch 1990. This species occurs in Azerbaijan and Xinjiang-Tuva, cf. Marusik et al. [2000, sub *Bishopiana glumacea* (Gao, Fei & Zhu 1992)]. Among sibling species of lycosids disjunctive ranges seem to be very rare. We can list as example only a pair of geographically distant allied species: *Acantholycosa sternerii* (Marusik 1993) (South Siberia) and *A. solituda* (Levi & Levi 1951) (Rocky Mountains) (cf. Kronstedt & Marusik 2002).

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