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Revision and classification of the Holarctic species of the *Ozyptila rauda* group (Araneae, Thomisidae)

Heikki Hippa, Seppo Koponen & Ilkka Oksala

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The monophyletic *O. rauda* group includes the following species (distribution in parentheses): *O. rauda* Simon = *O. septentrionalium* Koch = *O. obsoleta* Kulczynski = *O. terrea* Kulczynski, n. syn. (southern Central Europe, Siberia), *O. arctica* Kulczynski, n. stat. (Fennoscandia, Siberia, northern North America), *O. pullata* (Thorell) = *O. kotulai* Kulczynski, n. syn. (southern Central Europe, southern Russia), *O. balkarica* Ovcharenko (Caucasus), *O. orientalis* Kulczynski (Kamtchatka), *O. yosemitica* Schick (western USA) and *O. conostyla* sp. n. (Turkey). *O. rauda* (♂♀), *O. arctica* (♂♀), *O. pullata* (♂♀) and *O. orientalis* (♀) are redescribed. The following phylogeneny of the group is suggested: *O. pullata* and *O. arctica* are sister species, the others forming sister groups in the sequence *O. rauda*, *O. balkarica*, *O. yosemitica* + *O. orientalis* and *O. conostyla*.

Heikki Hippa, Zoological Museum, University of Helsinki, P. Rautatiekatu 13, SF-00100 Helsinki 10.
Seppo Koponen and Ilkka Oksala, Zoological Museum, Department of Biology, University of Turku, SF-20500 Turku 50.

1. Introduction

There has been a lengthy uncertainty and confusion concerning the identity and taxonomic status of the species of *Ozyptila* Simon (*Oxyptila* Simon of authors) referable to the *O. rauda* group. Part of the problems have been recognized and attempts have been made to resolve them (Holm 1945, Dondale & Redner 1975). The results have, however, proved unsatisfactory and fresh confusion has arisen during the present attempts to apply the opinions expressed earlier on the taxonomy of this group. Nobody has attempted to locate and consider all the described species of the *O. rauda* group.

The aim of the present paper is to review the whole *O. rauda* group and to establish its taxonomy, including the interrelationships of the species. In addition an as-yet undescribed Palaearctic species needs to be described.

2. Material and methods

The material studied is preserved in the following collections, later referred to by the abbreviations in parentheses: Zoological Museum, University of Helsinki, Helsinki (ZMH); Zoological Institute, Academy of Sciences of the USSR, Leningrad (ZIL); Canadian National Collections, Ottawa (CNC); Museum National d'Histoire Naturelle, Paris (MNHN); Czechoslovakian National Museum of Natural History, Prague (NMP); Swedish Museum of Natural History, Stockholm (SMNH); Zoological Museum, Department of Biology, University of Turku, Turku (ZMT); and Zoological Institute, Polish Academy of Sciences, Warsaw (PAS).

Concerning the nongenitalic characters, all the verbal descriptions are intentionally restricted to a minimum and whenever possible they have been replaced by references to descriptions in the literature. The illustrations of genital structures are regarded as requiring no written description.

The drawings were made by the aid of a camera lucida attached to a stereomicroscope from specimens in fluid.

The terminology of the male palpal bulbus follows that of Dondale & Redner (1975).

3. *Ozyptila rauda* group

The *O. rauda* group is here regarded as including those species of the genus in which the male palpal tibia has a transverse ventral apophysis arising from the prolateral side, and in which there is a strong projecting tegular apophysis on the bulbus and a subapically ser-

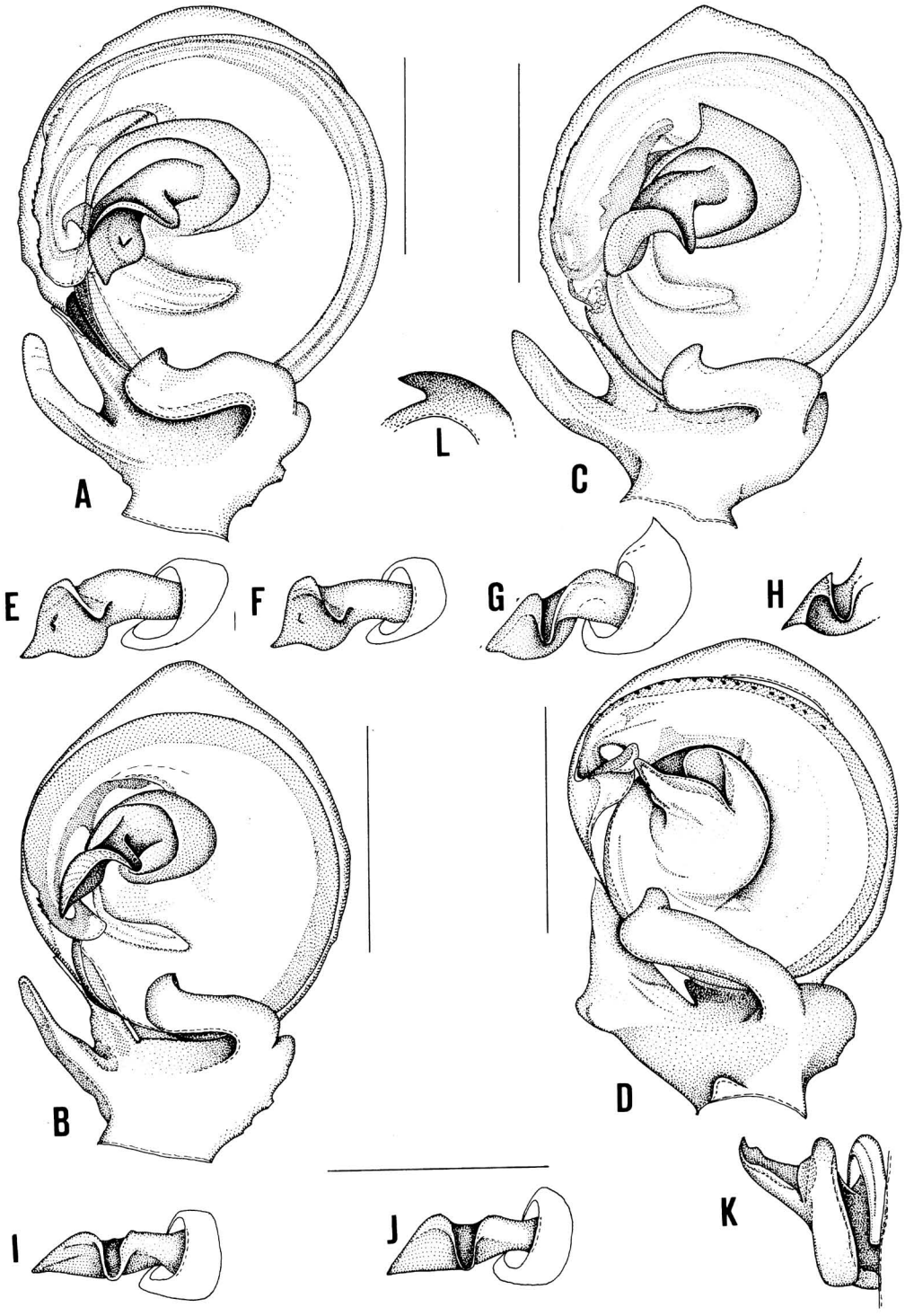

Fig. 1. Male palpal tibia and tarsus, ventral view (A–D), tegular apophysis, prolateral view (E–K) and the tooth of the basal tegular ridge, ventral view (L). – A, E and F: *Ozyptila rauda* Simon (A and E lectotype of *O. septentrionalium* L. Koch, F lectotype of *O. rauda*). – B, I and J: *O. arctica* Kulczynski (B and I specimen from Altai, J holotype). – C, G, H and L: *O. pullata* (Thorell) (C and G holotype in which the apex of tegular apophysis is broken, H and L specimen from Czechoslovakia). – D and K: *O. conostyla* sp. n. (holotype). Bar = 0.3 mm, same for all Figures of a species.

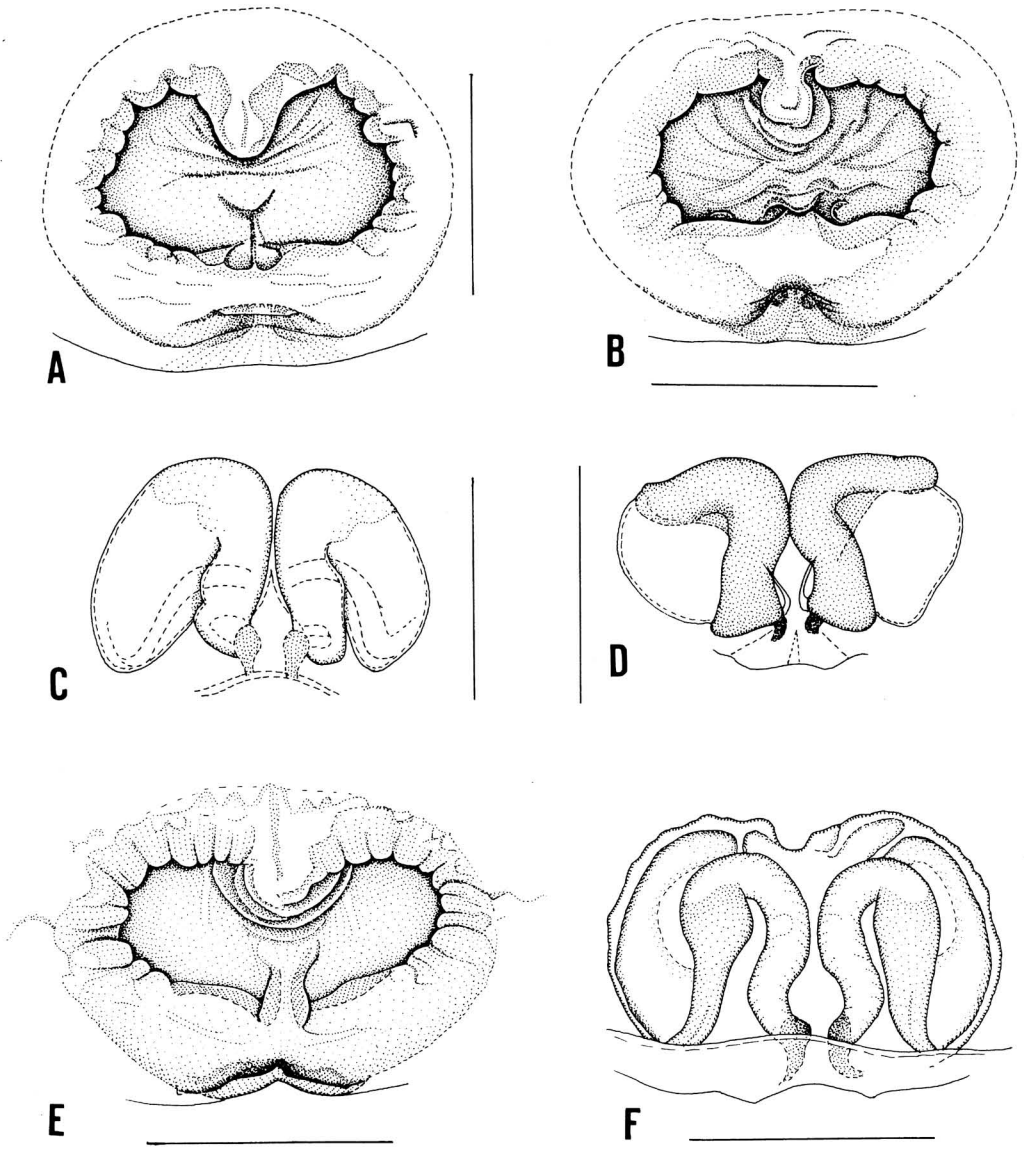

Fig. 2. Female epigyne, ventral view (A, B, E) and vulva, dorsal view (C, D, F). — A and C. *Ozyptila rauda* Simon (France). — B and D: *O. arctica* Kulczynski (USSR, Altai). — E and F. *O. pullata* (Thorell) (France). Bar = 0.3 mm.

rate or dentate embolus (Fig. 1). All the known females have a similar pit-like epigyne (Figs. 2 A, B).

The group includes the following species, considered as valid in the present paper: *O. rauda* Simon, *O. arctica* Kulczynski, *O. pullata* (Thorell), *O. balkarica* Ovcharenko, *O. orientalis* Kulczynski, *O. yosemitica* Schick and *O. conostyla* sp. n. *O. arctica* is holarctic, *O. yosemitica* Nearctic, the others Palaearctic. In addition, we have briefly examined an odd female from Caucasus which certainly belongs to this group. This may be the female of *O. conostyla* or even an additional species. A careful study of this specimen has not been possible.

The *O. rauda* group as delimited here represents an expansion of the *O. rauda* group of Dondale & Redner (1975). The group is probably monophyletic. It seems probable that the curious transverse apophysis on the male palpal tibia represents an apomorphous character state, and considering the extreme structural similarity in the other characters it must be a synapomorphy within the group. To establish the strict monophyly of the *O. rauda* group, it is important to know the position of such species as e.g. *O. sanctuaria* (O. P.-Cambridge) of western Europe. In this species (see e.g. Locket & Millidge 1951) the palpal tibia has at least a superficial similarity to that of the species included here in the *O. rauda* group, even though the ventral apophysis is not very strongly oblique, but the bulbus is simple and lacks the tegular apophysis. Because the lack of a tegular apophysis is probably an autapomorphous condition, it does not exclude the species from the *O. rauda* group. On the basis of present knowledge it is, however, premature to speculate further on this matter.

Nothing new concerning *O. yosemitica* and *O. balkarica* has emerged. Both are recognizable according to the existing descriptions and diagnoses (Dondale & Redner 1975; Ovcharenko 1979). However, the other species are in need of revision and discussion.

The interrelationships within the *O. rauda* group are discussed under the individual species below.

Ozyptila rauda Simon

Oxyptila rauda Simon, 1875: 226.
Oxyptila septentrionalium L. Koch, 1879: 96.
Oxyptila obsoleta Kulczynski, 1881: 302.
Oxyptila terrea Kulczynski, 1926: 65. New synonymy.

Material studied: "Basses-Alpes! dans la Vallée de la Bléone! sur la route de Thoard! mont Léberon" (teste Simon 1875), 1 ♂ and 1 ♀ (syntypes of *O. rauda*, the male here designated as lectotype and accordingly labelled in coll. Simon in MNHN). See also the discussion below.

The *O. septentrionalium* material from Siberia described by Holm (1973), including the type material of *O. septentrionalium* of Koch (1879) and the lectotype of *O. septentrionalium* designated by Dondale & Redner (1975).

A drawing of the vulva of a syntype female of *O. terrea*: Kamtschatka, Ust-Kamtschatsk, 20.VI.1909 (in PAS).

Male and female: Male palp, Figs. 1 A, E, F; female epigyne and vulva, Figs. 2 A, C, 3C. For other characters, see Simon (1875), Koch (1879) and Holm (1945).

Discussion: In coll. Simon (MNHN) there are two samples identified as *O. rauda*. One consists of two females from B.A. (Basses-Alpes). The specimen tube contains almost illegible labels on which a date (191?) can be made out. This cannot be the type material. The specimens are referrable to *O. pullata* (see under that species). The other sample consists of a male and a female, designated "619 rauda E.S., Gall. ?? Bonn." This is most probably the whole or a part of the type material. From the original description it is evident that both male and female were included, but the actual numbers are not given. The male of this sample is designated the lectotype, as we are convinced it is one of the syntypes.

The identity of *O. septentrionalium* and *O. rauda* was established by Holm (1945). Having studied the type material of both species, we support his opinion.

After studying the type material of *O. septentrionalium* and Simon's material of *O. rauda* from Basses-Alpes, France, Dondale & Redner (1975) did not regard the species as being synonymous and for a reason not clear to us they regard their North American species as being *O. septentrionalium*. The latter in our opinion is quite obviously *O. arctica* (see under *O. arctica*). Moreover, they held that in Koch's (1879) type material the males only were *O. septentrionalium*, the females being *O. rauda*. Since the sample consisting of two females from Basses-Alpes in Coll. Simon is not referrable to *O. rauda* as stated, but rather to *O. pullata*, the view on *O. rauda* held by Dondale & Redner (1975) may have been based on *O. pullata*. However, this possibility is not supported by the opinion mentioned above held by them on the type material of *O. septentrionalium*.

O. obsoleta was first mentioned only, without a description, by Kulczynski (1881) and later described (Kulczynski 1882) from the

mountains of Central Europe. Chyzer & Kulczynski (1891) regarded it as being a synonym of *O. rauda*. The excellent, detailed illustrations of the male palp and female epigyne convince us of the synonymy and we have made no effort to actually see the types because we have regarded this as unnecessary. Holm (1945) also accepts this synonymy.

O. terrea was described from Kamtchatka on the basis of the female only (Kulczynski 1926). Actually the original material consists of two juvenile females, the other close to the final molt (Dondale in litt.). The syntypes have not been available to us, but they have been studied by Dondale and Redner (in litt.). Kulczynski's (1926) illustration of the epigyne is quite misleading because it was not noted that the specimen was not an adult. Dondale and Redner (in litt.) managed to study the vulva of the subadult female; they also kindly submitted us a sketch from which our Fig. 3C has been prepared. The vulva distinctly belongs to *O. rauda* as was also suggested by Dondale (in litt.). *O. terrea* has not been recorded since its description.

O. rauda is similar to *O. arctica*. Their differences and relationships are discussed under the latter.

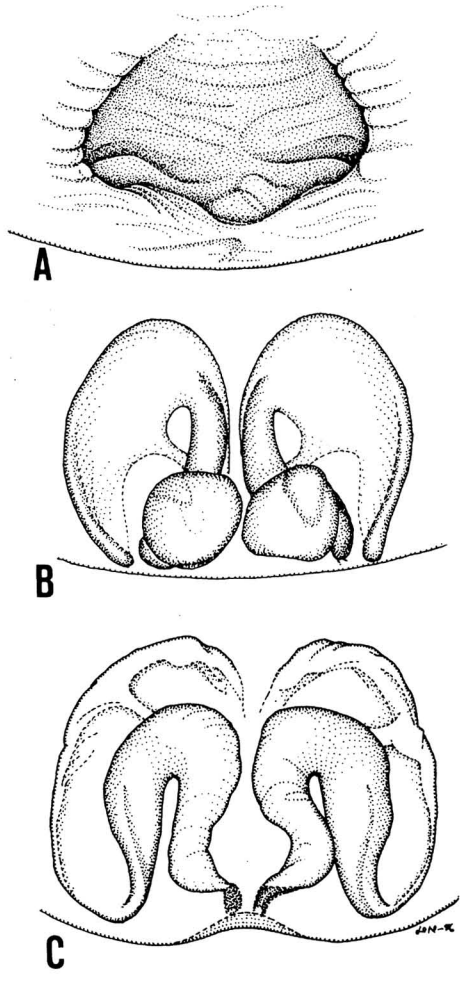

Fig. 3. Female epigyne, ventral view (A) and vulva, dorsal view (B, C). — A and B: *Ozyptila orientalis* Kulczynski (holotype). — C: *O. rauda* Simon (syntype of *O. terrea* Kulczynski). The drawings have been prepared from sketches made by J. H. Redner.

Ozyptila arctica Kulczynski, n. stat.

Oxyptila rauda E. Sim. var. *arctica* Kulczynski, 1908:51.
Oxyptila rauda Sim. subsp. *arctica* Kulczynski, Holm, 1945:66.
Oxyptila septentrionalium L. Koch a. sp. aff., Schenkel 1931:970.
Oxyptila rauda Sim. (*septentrionalium* Schenkel), Tullgren, 1944:75.
Ozyptila septentrionalium L. Koch, Dondale and Redner, 1975:163; Dondale & Redner, 1978:152.

Material studied: USSR, Siberia, "Vallis fluvii Jana inferioris" (Kulczynski 1908), 1 ♂ (holotype in ZIL).
USSR, SW Altai, Bertkum near Katanda, 2000 m, 3 ♂♂ and 4 ♀♀, exp. Mikkola, Hippa, Jalava (in ZMT and ZMH).
Finland, Utsjoki, numbers of males and females in several samples from regio sylvatica and regio alpina (in ZMT).
Canada, North West Territories, Salmita, 15.VII.1953. 1 ♂, J.G. Chilcott (in CNC).
USA, Alaska, Toolik Lake, 2.—8.7.1982, 2 ♀♀, S. Koponen (in ZMT).

Male: Palp, Figs. 1 B, I, J. For other characters, see Kulczynski (1908), Tullgren (1944), Holm (1945) and Dondale & Redner (1975, 1978).
Female: Epigyne and vulva, Figs 2 B, D. For other characters, see Kulczynski (1926), Schenkel (1931), Tullgren (1944), Holm (1945) and Dondale & Redner (1975).

Discussion: The synonymy presented above was already known to Holm (1945), but he regarded *O. arctica* as a subspecies of *O. rauda*, which on the basis of the facts as he knew them was quite reasonable. The later opinion of Dondale & Redner (1975, 1978) is based on factors unknown to us and the species they described as *O. septentrionalium* is undoubtedly *O. artica*, which they did not mention at all.

O. arctica and *O. rauda* are morphologically similar, but also in many respects different. In the male the tegular apophysis of *O. arctica* is narrow and not apically expanded in the same

way as in *O. rauda*, and it lacks the characteristic tooth subapically on the expanded part and the transverse groove on the small lobe in lateral view is complete, rather than incomplete as in *O. rauda*; moreover, the apical part of the embolus in the two species is distinctly, even if only slightly, different (Figs. 1 A, B, E, F, I, J). Structurally *O. arctica* is actually more close to *O. pullata* than *O. rauda*, especially in the structure of the tegular apophysis and the apical part of the embolus. We do not hesitate to regard *O. arctica* and *O. rauda* as separate species and even to claim that *O. arctica* and *O. pullata* form a common clade (synapomorphy: similar modification of the tegular apophysis with a complete transverse groove). The idea that *O. arctica* and *O. rauda* are subspecies is further refuted by their apparent co-existence in Siberia.

The females of *O. arctica* and *O. rauda* are very similar, but may be distinguished by the characters given by Holm (1945). The epigynes are nearly identical (Figs. 2 A, B) and we are not aware of any positive difference: at least in *O. arctica* epigynal variation is great, even within a population, and requires further studies (c.f. Fig. 2 B and Figs. by Kulczynski 1926, Schenkel 1931, Tullgren 1944 and Dondale & Redner 1975, 1978). The vulvae seem to be rather distinctly different (Figs. 2 C, D, for a different aspect of the vulva of *O. arctica*, see also Dondale and Redner 1975, 1978), but their variation still requires to be studied.

O. balcarica from the Caucasus is similar to *O. rauda*, *O. arctica* and *O. pullata*, but is distinguished by the elongated and curiously looped embolous (see Ovcharenko 1979) (apomorphy). The tegular apophysis in this species is similar to that of the other three, except that the transverse furrow with an associated lobe is lacking (plesiomorphy) and the species is apparently a sister group to *O. rauda* + *O. pullata* + *O. arctica*. All the four species and the Nearctic *O. yosemitica* are similar in having the tegular apophysis winded screw-like (synapomorphy), which separates them from the unwinded apophysis (plesiomorphy) of *O. conostyla* (see also under *O. conostyla*). See also under *O. orientalis*.

Ozyptila pullata (Thorell)

Xysticus pullatus Thorell, 1875a:93.
Oxyptila Kotulai Kulczynski 1898:92. New synonymy.
For other references, see Bonnet (1958) and the discussion below.

Material studied: Russland, Sarepta, 1 ♂, Becker (holotype of *X. pullatus*, in SMNH)
France, Basses Alpes 2 ♀ ♀, E.S. (other data unreadable) (in MNHN)
Czechoslovakia, 2 ♂ ♂ and 3 ♀ ♀ (in NMP).

Male: Palp, Figs. 1 C, G, H, L. For other characters, see Thorell (1875 a, b) and Kulczynski (1898).
Female: Epigyne and vulva, Figs. 2 E, F. For other characters, see Kulczynski (1898).

Discussion: *O. pullata* was described on the basis of one male specimen only. Nowadays the type consists of one palp only. *O. kotulai* was described from Hungary and Austria on the basis of both sexes. The description by Kulczynski (1898) is excellent and there is scarcely any doubt about the synonymy of *O. pullata* and *O. kotulai* even though the types of the latter were not checked. The reason why this synonymy was not discovered earlier is probably due to the solely verbal original description of *O. pullata*. Simon's material of *O. rauda* also includes females of *O. pullata* (also Å. Holm, in litt.). At least the male figured as *O. rauda* by Utochkin (1960) is *O. pullata*.

According to published data the species is apparently widely distributed in southern Central Europe and southern Russia (c.f. Bonnet 1958, Miller 1971).

O. pullata is similar to *O. rauda* and *O. arctica*, but is at once distinguished by having a tooth-like angle on the outer margin of the basal tegular ridge (Fig. 1). The tegular apophysis resembles that of *O. rauda* in general shape, but lacks the small tooth on the apical expanded part. The strong and complete transverse furrow (apparent apomorphy) on the tegular apophysis is similar to that of *O. arctica* and presumably the two are sister species. The female epigyne of *O. pullata* differs from that of *O. arctica* and *O. rauda* in having the pit shorter and broader and its bottom less prominently ridged (c.f. Figs. 2A, B, E and figs. by Kulczynski 1898 and Miller 1971). The vulva is also distinctive (Fig. 2).

Ozyptila orientalis Kulczynski
Oxyptila orientalis Kulczynski, 1926: 64.

Material studied: A drawing of the epigyne and vulva of the holotype: Kamtschatka, Ust-Kamtschatskaja Koschka 7.IX.1908 (in PAS).
Male: Unknown.
Female: Epigyne and vulva, Figs. 3 A, B. For other characters, see Kulczynski (1926).

Discussion: Kulczynski's (1926) original material of *O. orientalis* consists of a single female specimen from Kamtchatka, which also seems to be the only known specimen of the species. The holotype has not been available to us, but it has been studied by Dondale and Redner (in litt.) who have also submitted us their drawings of the epigyne and vulva.

Based on Kulczynski's (1926) description, Holm (1945) regarded *O. orientalis* as a synonym of *O. arctica*. We had a similar view until the information received from Dondale and Redner (in litt.) showed that *O. orientalis* is clearly distinct from other species of the *O. rauda* group.

As was pointed out by Holm (1945) *O. orientalis* is greatly similar to *O. arctica* in nongenitalic morphology and we do not know of any distinguishing characters, except the structure of the epigyne and vulva. The epigyne and vulva of *O. orientalis* are characteristic and at once distinguish the species from other species of the *O. rauda* group, good diagnostic characters being, for example, the weakly differentiated median septum of the epigyne, deep transverse openings or slits on the depressed part of the epigyne and greatly swollen proximal or posteromedian part of the spermatheca (Figs. 3 A, B).

Not knowing the characters of the male palp we feel quite uncertain about drawing to conclusions on the relationship of *O. orientalis* to the other species of the *O. rauda* group. *O. orientalis* and the Nearctic *O. yosemitica* both have a swollen proximal part of the spermatheca; very prominently so in the former (Fig. 3 B), slightly but distinctly so in the latter (see Dondale and Redner 1975). We suppose that the swollen proximal part of the spermatheca represents an apomorphic character state in relation to the non-swollen one found in the other species of the group, and that it may also be a synapomorphy of *O. orientalis* and *O. yosemitica*, which would thus be sister species.

Ozyptila conostyla sp. n.

Material studied: holotype ♂: Turkey, Yozgat district, Calatli, wet grassy limestone slope, 11.IX.1971, P.T. Lehtinen (in ZMT).

Male: length of carapace 1.5 mm, length of tibia I 0.80 mm. Tibia I with two, metatarsus I with three, pairs of ventral spines; carapace with submedian stripes of hairs arising from large basal tubercles. Palp, Figs. 1 D, K.

Carapace dark brown, paler at ocular area, with a pair of submedian pale stripes which are narrow and indistinct on cephalic area, broad and posteriorly uniting on thoracic part, with indistinct sublateral pale patches anteriorly on thoracic part, with traces of paler radiating striae on thoracic part, the posterior sloping part pale grey-brown with pale lateral patches. Chelicher, labium and sternum dark brown, chelicher with large pale prolateral patch, sternum with §-shaped transverse pale band near front margin. Legs brown, metatarsi paler than tibiae, tarsi still paler, nearly yellowish, indistinct paler pattern especially at apices and prolateral surface of femora and patellae.

Female: Unknown, but see the discussion below.

Discussion: *O. conostyla* and *O. balkarica* are similar, differing from the other species of the *O. rauda* group in having only one retrolateral palpal tibial apophysis. This character state is apparently apomorphic, but convergent in the two species. In *O. conostyla* the ventral member of the retrolateral apophyses found in the other species is absent due to reduction: this is indicated by the shape of the retrolateral part of the tibia where signs of the reduced apophysis are evident. In *O. balkarica* it is clearly the dorsal member which is missing or strongly reduced. When compared with the species *O. arctica, O. rauda, O. pullata, O balkarica* and *O. yosemitica* the tegular apophysis also belongs to quite a different type in not being winded (plesiomorphy), the transverse tibial apophysis is rather more obliquely than transversely directed (plesiomorphy) and the dentation of the apical part of the embolus extends more basally (apomorphy). If the polarity of characters (character states) suggested above is correct, *O. conostyla* is a sister group of the other species discussed.

The female from Caucasus which was mentioned in the discussion under the *O. rauda* group may be the female of *O. conostyla*. A careful comparison with the male has, however, not been possible. The epigynal depression in this female is rather narrow, its posterior margin is lobe-like and partly over-hanging the depression.

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