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A NEW SPECIES OF SULCIA KRATOCHVIL (ARANEIDA, LEPTONETIDAE) FROM GREECE, AND A DISCUSSION OF SOME JAPANESE CAVERNICOLOUS LEPTONETIDAE

by

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(With 7 text-figures)

A NEW SPECIES OF SULCIA

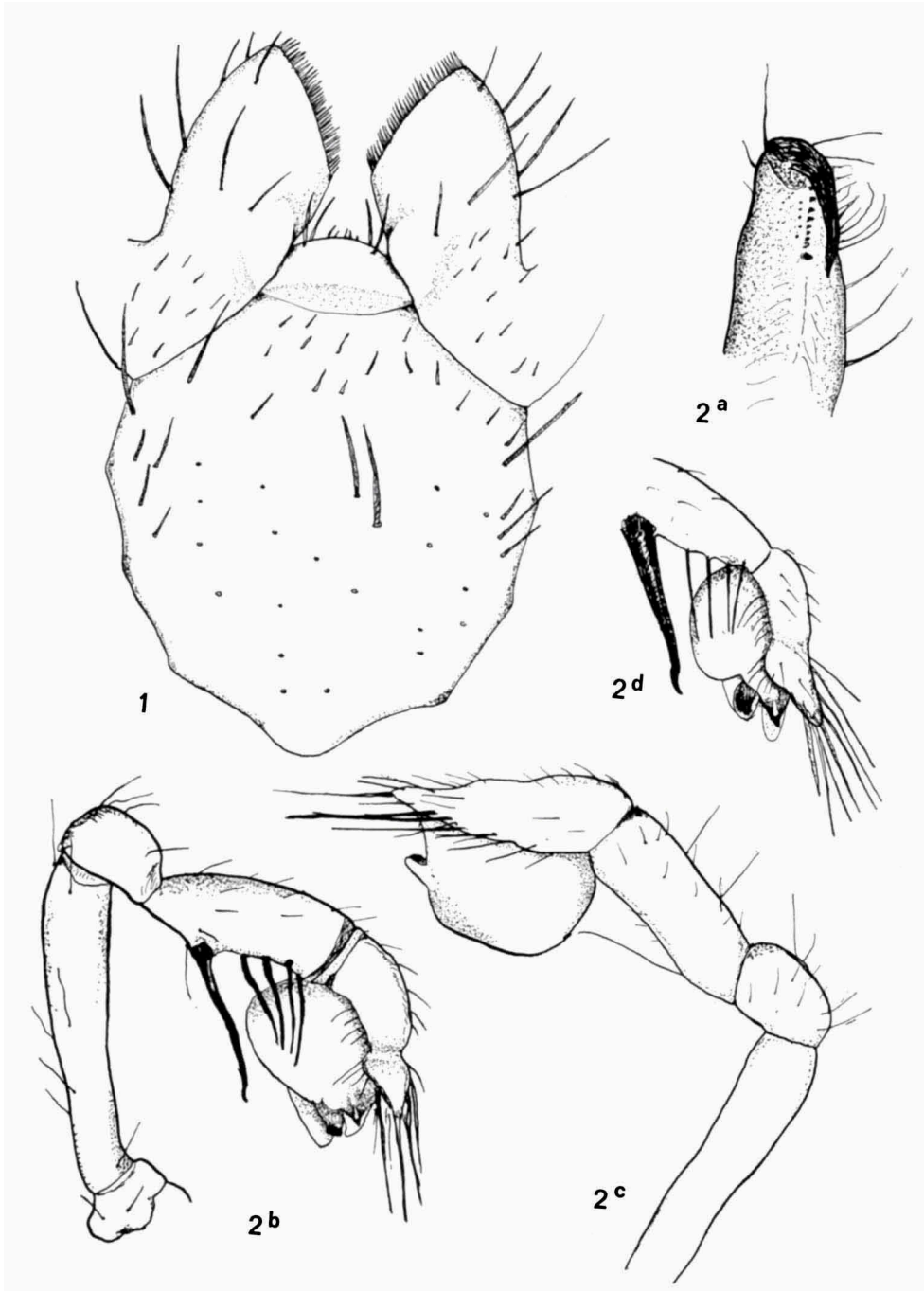
In 1962, Dresco described the first representative of the genus *Sulcia* from the Greek mainland, *Sulcia lindbergi*. Recently, Brignoli (1968a) considered this species a subspecies of *Sulcia cretica* Fage. The genus is also known from Dalmatia, Hercegovina, Montenegro, and some adjacent islands (Kratochvil, 1938) and from the Island of Crete (Fage, 1945).

In January 1969, my husband P. R. Deeleman, had the opportunity to visit the Koutouki Cave near the village of Ljopessi (officially also called Peania), situated at approximately 20 km west of Athens. This visit was made possible by the assistance of Mrs. A. Petrochilos and Mr. A. Kanellis, to whom we feel very much obliged. In this cave a new species of *Sulcia* was collected. The cave was discovered fairly recently; it has been exploited as a show cave with electric illumination since 1962. The spiders were found in the huge main chamber, where they were hanging in their webs in crevices in the wall or between stalagmites. The cave is also inhabitied by bats, terrestrial isopods, diplopods and Orthoptera (*Dolichopoda petrochilosi* Chopard). The original entrance is a vertical shaft of about 15 meters, it has been made accessible for tourism by an artificial entrance.

Sulcia kanellisi new species (figs. 1, 2, 4a, 6b, 7)

Material. — 1 ♂ (holotype), 6 ♀, 2 subad. ♂, 3 subad. ♀, Koutouki Cave near Ljopessi, Greece, 11 January, 1969, leg. P. R. Deeleman; 1 ♂, 1 ♀, id., leg. L. A. van Dam.

Description. — Length of adult ♂ (type) 2.4 mm, length of largest ♀ (paratype) 2.9 mm; cephalothorax: in ♂ 0.90 mm long, 0.67 mm wide, in ♀ 1.31 mm long, 0.96 mm wide.



Figs. 1-2. *Sulcia kanellisi* n. sp. 1, ♀, sternum, maxillae and labium, ventral view; 2a, ♂, chelicera, ventro-internal view; 2b, ♂, palp, external view; 2c, id., internal view; 2d, id., dorso-external view of tip. 1-2, × 72.

Cephalothorax. — Pale yellow, appendages slightly darker, abdomen whitish grey. Eyes completely lacking, in some specimens traces of the anterior medians discernible as small colourless pustules. Shape of the cephalothorax more or less elongate, lateral margins variable, sinuate or straight anteriorly, curved posteriorly. Anterior margin slightly convex, posterior margin straight or slightly excised. Cephalothorax in lateral view strongly arched, with highest point at about one third of its length; in head region length-height ratio about 2.5. Fovea poorly developed.

Chelicerae. — Length in ♂ 0.48 mm, in ♀ 0.67 mm; in male (fig. 4a) projected forward, in female vertical. Anterior row (fig. 2a) armed with nine teeth, the proximalmost somewhat larger than the others, the distalmost three more widely spaced. Posterior row with five small denticles. Chelicerous median brush with mostly glabrous setae, a few pilose ones present. Maxillae (fig. 1). — Outer surface with two strong bristles and some thinner ones. Exterior margin straight, basal part of medial side inflated ventrally; ventral surface bearing some long bristles. Labium (fig. 1). — Like in the other species of the genus. Sternum (fig. 1). — Length in ♂ 0.62 mm, in ♀ 0.82, length-width ratio 5:8, heart-shaped, posteriorly protruding between coxae IV.

Measurements (im mm) of legs and palp:

♂	coxa	trochanter	femur	patella	tibia	metatarsus	tarsus	total
I	0.33	0.10	1.92	0.24	2.26	1.78	1.10	7.73
II	0.29	0.10	1.78	0.24	1.78	1.44	0.86	6.49
III	0.24	0.10	1.68	0.24	1.44	1.34	0.76	5.80
IV	0.33	0.10	1.82	0.29	1.92	1.68	0.96	7.10
palp			0.50	0.15	0.24		0.30	1.19
♀								
I	0.40	0.14	2.69	0.37	2.88	2.30	1.49	10.27
II	0.35	0.14	2.16	0.43	2.21	1.92	1.25	8.46
III	0.35	0.14	1.92	0.29	1.92	1.25	1.01	6.88
IV	0.35	0.14	2.40	0.34	2.21	2.21	1.34	9.42
palp			0.67	0.20	0.48		0.72	2.07

Chaetotaxy of legs. — Amply supplied with spines; however, individuals with a complete set of spines rare, the spines being very fragile.

Anterior legs: femora I with 2 prodorsals (positions 0.4 and 0.7), 1 retrodorsal (0.4); femora II 1-2 dorsals (0.4 and 0.7); tibiae I and II 2 dorsals, 4-5 prodorsals, 4-5 retrodorsals, 1 or 2 ventrals; metatarsi I and II with 1-2 dorsal spines (0.25 and 0.7).

Posterior legs: femora III and IV spineless; tibia III 1 dorsal, 2 prolaterals and 2 retrolaterals; tibia IV 2 dorsals, 2-4 prodorsals and 2-4 retrodorsals, 1 or 2 ventrals; metatarsi III and IV 1-2 dorsals (0.25 and 0.7).

All patellae with 1 dorsal spine. All femora with 1 trichobothrium in the basal part (0.2) and 1 distally (0.7-0.8); all metatarsi with a trichobothrium (0.4).

Palp (fig. 2b-d). — Male: femur spineless, only bearing setae; patellar spine not very strong. Tibial external surface with a longitudinal row of spines: the proximal very strong and conspicuous, its end curved as if it were a claw, followed by a series of 4 spines, arranged in a straight line, and a 5th somewhat more ventrally, at the level of the most distal spine of the row; 2 spines ventrally near the base of the article. None of the spines implanted on a tubercle, as opposed to the other representatives of the genus. The distal part of the palpal tarsus separated from the proximal by a distinct, though not very deep depression. The outer margin on the distal side of the depression extending into a small lobe, bearing a strong seta near the base, followed by some weaker setae; the tarsal apex bears a bundle of bristles.

Tip of bulb similar in structure to that in the Dalmatian species: ventrally with two appendages inserted, the shorter one chitinous, with a rounded, toothed distal edge, the longer one lamellar; the embolus, which is short and pointed, and accompanied by a longer lamina, situated dorsally of the two appendages.

Palpal femur in female without strong spines, ventrally with some bristles; patella with one long spine dorsally, tibia spineless, two trichobothria on the dorsal side, tarsus ventrally with a pair of spines near the base and 5-8 spines in a whorl on two thirds of the length of the article; terminal claw not serrate.

Abdomen. — Globular in both sexes. The ♀ paratype, of which the abdomen was dissected, contained six eggs. The sclerotised part of the vulva (fig. 6b) consists of two wound tubes.

Remarks. — Metatarsi II and III bear ventrally near their base an organ, consisting of a transverse row of 5-6 long, fine hairs, which towards their tip bend gracefully inward (fig. 7). Its taxonomic significance is uncertain. I observed it also with *Leptoneta crypticola* Simon, *Leptoneta infuscata* Simon and *Sarutana akiyoshiensis* Oi. It was absent, however, in the examined specimens of *Sulcia nocturna* Kratochvil, and *Sulcia orientalis occulta* Kratochvil.

The species is dedicated to Dr. A. Kanellis of the Zoological Department of the University of Thessaloniki.

Relationships. — *Sulcia kanellisi* is remarkable for the singular spinulation of the palpal tibia in the male, which has no counterpart among the Leptonetidae. Because of some important characters (reduction of the eyes, dentition of the chelicerae) the species is a typical *Sulcia*; yet it is with

some hesitation that I include it in this genus: the absence of spines on the palpal femur, and the small external lobe on the distal border of the tarsal depression, approach it to *Paraleptoneta italica* (Simon), a species that occupies a somewhat isolated position within the genus *Paraleptoneta* (Fage, 1913). Besides, the differences between the genera *Paraleptoneta* and *Sulcia* are slight and mainly quantitative, they are found chiefly in the number and positions of the denticles of the chelicerae. The latter are often found to be variable within a population. In the genus *Sulcia* the eyes show different degrees of reduction; some species are blind or almost blind. There are certain characters in the armament of the palpal femur and tibia, which are more often found in one genus than in the other; a more complex armament of the palpal femur is found more frequently in *Sulcia,* a more complex tibial array is usual in *Paraleptoneta,* but there are several exceptions. These characters are not as valid for distinguishing the genera as is usually accepted. It will no doubt prove to be inevitable to rearrange the species of the two genera. The assemblage of characters of both genera in our new species also pleads in favour of the fusion of *Paraleptoneta* and *Sulcia,* as advocated by Brignoli (1968b: 35-36). A revision of the Leptonetidae is greatly impeded by the scarceness of material.

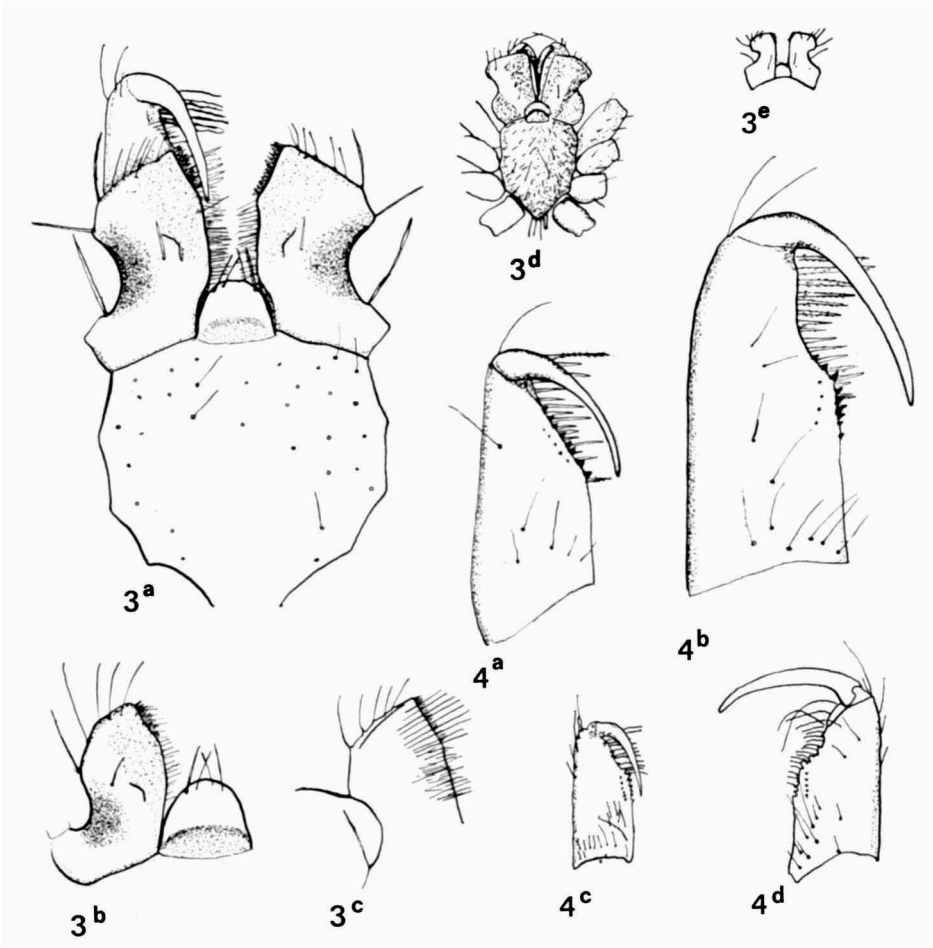
Discussion of the generic position of Leptoneta akiyoshiensis Oi

While visiting the Taishi-do Cave, one of the well known Akiyoshi caves in the southern part of Japan (Yamaguchi Prefecture), P. R. Deeleman, through the courtesy of Dr. S. I. Ueno, collected 1 ♂ and 1 ♀ of *Leptoneta akiyoshiensis* Oi, a leptonetid with reduced eyes.

In his study on the spiders of the caves of the Akiyoshi Pleateau, Yaginuma (1963) stated that "no morphological variation exists among the populations of Akiyoshi caves .... so that it may be surmised that the Akiyoshi caves have been connected till recently or are connected with each other".

From this complex of caves two species of *Leptoneta* have been described: *L. uenoi* Yaginuma and *L. akiyoshiensis* Oi, the latter with reduced eyes. It might therefore be safely assumed that our specimens are identical with *L. akiyoshiensis* Oi; the original description (Oi, 1958), in the other characters, too, fits the animals well.

The examination of this material revealed also, however, a close relationship with *Sarutana glabra* Komatsu and even so much so that, as a consequence, the species should be transferred to the genus *Sarutana* Komatsu This statement can be elucidated as follows:



Figs. 3a-c. *Sarutana akiyoshiensis* (Oi). a, ♂, sternum, maxillae and labium, ventral view; b, ♀, maxilla and labium, ventral view; c, id., dorsal view. Fig. 3d. *Masirana kosodeensis* Komatsu, ♂, sternum, maxillae, labium and coxae, ventral view (after Komatsu, 1963). Fig. 3e. *Sarutana glabra* Komatsu, ♂, maxillae and labium (after Komatsu, 1957). Figs. 4a-d. Chelicera, posterior view. a, *Sulcia kanellisi* n. sp., ♂; b, *Sarutana akiyoshiensis* (Oi), ♀; c, *Masirana kosodeensis* Komatsu, ♂ (after Komatsu, 1963); d, *M. akahanei* Komatsu, ♂ (after Komatsu, 1963). 3a-c, 4a, × 72; 4b, × 142.

(1) The shape of the maxillae in *L. akiyoshiensis* — particularly in the male — differs from the usual type in the Leptonetidae: they are divergent, and their outer margins are strongly concave (fig. 3a-c). This type is found in the genus *Sarutana,* where the maxillae are so beautifully characterised by its author: "inside is paralleled to each other, but outside is C-letter shaped" (Komatsu, 1957: 70) (fig. 3e). In the Japanese *Falcileptoneta*

Komatsu, which genus includes the wide majority of the Japanese species formerly assigned to the genus *Leptoneta,* the maxillae are normal in shape; in the Japanese genus *Masirana* Kishida they have the same shape as in *Sarutana,* only they are wider (fig. 3d).

(2) The chelicerae bear 8 denticles in the anterior row (fig. 4b); the same number is found in *Sarutana,* there are 8-11 in *Falcileptoneta* and 10-11 in *Masirana* (figs. 4c-d).

(3) In the male palp, the femur bears 5 spines on the ventral side and some on the dorsal side; this situation corresponds to that in *Sarutana,* where femoral spines are reportedly numerous. In *Falcileptoneta* and *Masirana* the femora are unarmed.

(4) The embolus in *L. akiyoshiensis* is large and broad and slightly curved down, and it does not reach beyond the tarsal tip (fig. 5a); the tip is truncated, near the opening of the ductus a small claw is found. In *Sarutana kawasawai* Komatsu the embolus is similar, but has a toothed margin; of *Sarutana glabra* the shape of the embolus has not been recorded. In the genus *Falcileptoneta* the embolus is sickle-shaped, much thinner and tilted upward. The embolus in *Masirana* stretches beyond the tarsal tip and is curved upward.

In the male palp (figs. 5a-b) the external side of the tibial apex bears a strong, angled spine, making a 90° angle, and some dendroid plumed setae; in *Sarutana kawasawai* there is a tridentate black apophysis, *Sarutana glabra* is provided with two strong spines and a funnel-shaped projection. *Falcileptoneta* shows one or two straight spines, while all species of *Masirana* have a hooked spine and a funnel-shaped projection.

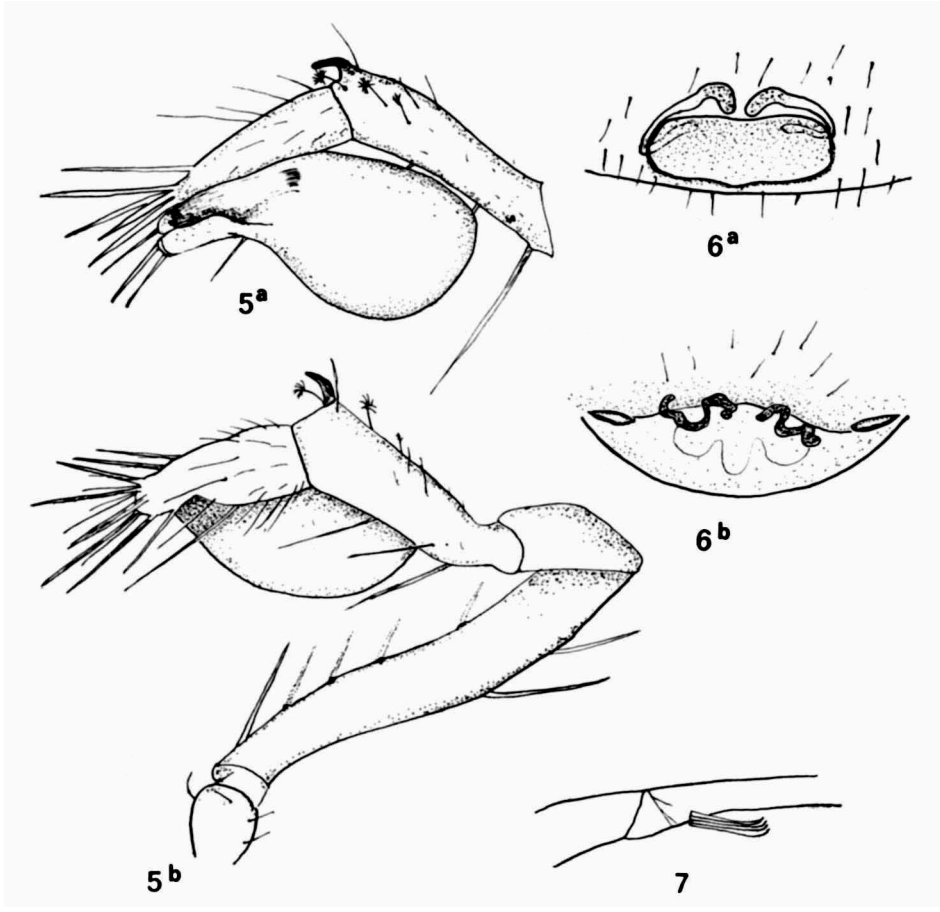
Further data on *S. akiyoshiensis.*

Measurements. — Cephalothorax in the male 0.86 mm long, 0.77 mm wide; sternum 0.58 mm long, 0.53 mm wide; chelicerae 0.48 mm long; in the female these measurements are 0.72, 0.67, 0.52, 0.48, and 0.39 mm, respectively.

Leg measurements of male.

	coxa	trochanter	femur	patella	tibia	metatarsus	tarsus	total
I	0.36	0.10	1.92	0.24	2.11	1.63	0.86	7.22
II	0.33	0.10	1.44	0.24	—	—	—	
III	0.26	0.10	1.25	0.24	1.25	1.15	0.65	4.90
IV	0.29	0.10	1.87	0.24	—	—	—	

Chelicerae (fig. 4b) slender, strongly excavated distally; setae of median brush pilose. Length-width ratio of labium 5:4. Femur I with 8 spines,



Figs. 5-6a. *Sarutana akiyoshiensis* (Oi). 5a, male palp, external view; 5b, id., internal view; 6a, vulva, dorsal view. Figs. 6b-7. *Sulcia kanellisi* n. sp. 6b, vulva; 7, ♂, tibia and metatarsus of leg III, lateral view. 5a-b, × 110; 6a-b, × 92; 7, × 142.

arranged irregularly on the dorsal and anterior surfaces, less spines in the female. Femur II in the male with 3 dorsal spines, in the female femora II-IV spineless, in the male femora III and IV spineless. Tibiae and metatarsi I-IV with some spines in both sexes, but less spinose in the female. In the female palp the patella with one strong spine dorsally, tarsus with 2 dorsal, 2 prolateral, 2 retrolateral and 2 pairs of ventral spines. The palpal femur spineless. On the inner wall of the vulva (fig. 6a) a membrane is inserted, carrying two tubes curving around the lateral edges of the membrane.

Distribution of the Palaearctic Leptonetidae

A survey of the Japanese caves in the course of the last 14 years has yielded a rich fauna of Leptonetidae, matching the variety of species in the Mediterranean region.

The species known at present from Japan are the following:

Falcileptoneta japonica (Simon, 1893) (only ♀); Yokohama.

F. melanocomata (Kishida, 1939); Ryuga Cave, Kochi Prefecture, Shikoku Island.

F. striata (Oi, 1952); Senriyama Experimental Farm, Suita, Osaka Prefecture.

F. speciosa (Komatsu, 1957); Kazaana Cave, Nagano Prefecture.

F. musculina (Komatsu, 1961); Yozawa Cave, Tokyo.

F. ushihanana (Komatsu, 1961) (only ♀); Ushihana Cave, Gifu Prefecture.

F. kugoana (Komatsu, 1961) (only ♀); Kugo Cave, Gifu Prefecture.

F. zenjoensis (Komatsu, 1965); Zenjo Cave, Tokushima Prefecture, Shikoku Island.

F. iriei (Komatsu, 1967) (only ♂); Tsubaki Cave, Kumamoto Prefecture, Kyushyu Island.

Sarutana glabra Komatsu, 1957; Saruta Cave, Shikoku Island.

S. akiyoshiensis (Oi, 1958); caves in Akiyoshi-dai Plateau, Yamaguchi Prefecture.

S. kawasawai Komatsu, 1970; Arakurado Cave, Kochi Prefecture.

Masirana cineracea Kishida, 1942; Saisho Cave, Nagano Prefecture.

M. nippara Komatsu, 1957; Nippara Cave, Tokyo.

M. kosodeensis Komatsu, 1963; Kosode Cave, Yamanashi Prefecture.

M. akahanei Komatsu, 1965; Furo Cave, Tokyo.

M. longimana Yaginuma, 1970b; Yuki-do Cave, Shimane Prefecture.

The genus *Falcileptoneta* was recently created by Komatsu (1970) to receive the majority of the Japanese *Leptoneta* species. The species *Leptoneta uenoi* Yaginuma, 1963 (Tonogawachi-no-ko-ana Cave, Akiyoshi-dai Plateau) and *Leptoneta tsushimensis* Yaginuma, 1970a (Nariaiko Mine, Tsushima Islands), tentatively placed in the genus *Leptoneta,* still await elucidation of their real relationships. *Falcileptoneta ushihanana* allegedly shows the same aberrant type of maxilla as the *Sarutana* species and might eventually prove to belong to this group. The genus *Falcileptoneta* is extremely close to the genus *Paraleptoneta* Fage, which latter genus is strongly heterogeneous. The Japanese species of Leptonetidae have all been found in caves, except *F. japonica* and *F. striata.* Only *F. kugoana* and *S. akiyoshiensis* show a reduction of the eyes.

The fauna of the East Asian continent is little known. Recently, a group of new leptonetid species was discovered in South Korea (Paik, Yaginuma & Namkung, 1969). These species are characterized by the structure of the male palpal tarsus: its external margin is projected into a thumblike processus on the proximal side of the depression. The tibia has 3 dorsal spines and 2 differently shaped projections near the apex. No appendages are present on the palpal femora. The chelicerae have 8-11 teeth on the outer, 4-8 on the inner margin.

All the same, a wide gap remains between the eastern and western Eurasian species. A similar gap is found in the distribution of the freshwater Isopods of the genus *Asellus* s.str. In North America a number of species of Leptonetids is known, at least some of which apparently are true *Leptoneta* species (Fage, 1931; Brignoli, 1970).

The distribution of the Leptonetidae as a whole has a typical relict, disrupt character. These spiders are regarded as the remains of an old, tertiairy or older fauna (Fage, 1931: 112). The most primitive species living today (with at least the simplest structure of the male palp) is *Paraleptoneta italica* Simon, inhabiting the Alpes Maritimes (S. France) and the northern part of the Apennines (near Florence, Italy), and the not so closely related *Telemma tenella* Simon from the Pyrenees. To the west are, grouped around *P. italica* and assembled in the genus *Leptoneta,* the species derived from this form by division of the palpal tarsus and reduction of the number of cheliceral teeth, inhabiting the western Alps, the Pyrenees, the Cevennes, Sardinia and Corsica; they also have a representative in eastern Algeria (*L. kernensis* Simon) and reportedly also occur in the United States of America. Directly to the south of the area in which *P. italica* lives, a group of somewhat more evolved relatives is found with a circumtyrrhenian distribution, featured by a row of equidistant teeth on the palpal femora, implanted on small tubercles of equal size: *Paraleptoneta spinimana* Simon from Algeria and probably Sicily (Brignoli, 1969), *P. fagei* Roewer, 1953, from Sardinia, and the Italian species *P. parenzani* Dresco, 1954, from Campania, *P. patrizii* Di Caporiacco, 1950, from northern Latium and *P. pasquinii* Brignoli, 1967a, from the Pontine Archipelago. A species-group found in Turkey is very similar: the only species of this group of which we know the male (*P. sbordonii* Brignoli, 1968b) bears a specialized spine on the palpal tarsus, in addition the vulva is different from the vulva in the tyrrhenian group. The southeastern, Dalmatian group consists of a number of closely related forms, confined to a restricted area in the southeastern part of the Dalmatian coast plus adjacent islands (Kratochvil & Miller, 1939). In these Dalmatian species the array of the palpal femur is a more

differentiated modification of that in the former group, the palpal tibia may possess refined structures, their epigynes are more evolved than in the other groups: *Paraleptoneta maheni* Kratochvil & Miller, *P. hofferi* Kratochvil, *P. insulana* Kratochvil & Miller, *P. korculana* Kratochvil & Miller, and perhaps *P. montenegrina* Kratochvil & Miller. Rather mixed up taxonomically with this group are the species, brought together in the genus *Sulcia,* with highly specialized structures on both femora and tibia (except in the Greek species *S. kanellisi* n.sp.), a larger number of cheliceral teeth and a high degree of subterranean adaptation. They are confined to approximately the same region in Dalmatia and also in Hercegovina, Greece, Crete and perhaps Sardinia (Brignoli, 1967b). It has been suggested that they formerly occupied a much larger area in the Dinaric Alps, but have been replaced by the younger, expanded linyphiid genus *Troglohyphantes* at a period, when the islands were already separated from the mainland. In addition, we know two more genera in Europe of which the Sardinian genus *Segrea* Roewer, 1953, probably evolved independently. *Segrea strinatii* Denis, 1959, from Sicily, probably is incorrectly assigned to *Segrea. Cataleptoneta edentula* Denis, 1955, with intermediate characters between *Leptoneta* and *Paraleptoneta,* was discovered in a Libanese cave.

In East Asia, however, a number of not strongly differentiated forms, closely related to the Mediterranean genus *Paraleptoneta* survived in caves. They did not or weakly develop typical troglobite characters, such as thinning of the integuments, reduction of pigmentation and eye size, lengthening of the legs, etc. They all live in the southern part of Japan, under the same climatic conditions as in the Mediterranean region. At present two more genera are known in Japan, which might have descended from the same primordial form as the others by differentiation of the maxillae and the distal setae of the palpal tibiae.

Whether once the whole of Central Asia was inhabited by *Paraleptoneta*-like species that failed to cope with changing climatic and biotic conditions, or, as an alternative, the two groups were then connected by way of North America, is an intriguing question which might be solved by a deepening of the knowledge of both American and East Asian Leptonetidae.

RÉSUMÉ

Description d'une nouvelle espèce du genre *Sulcia,* provenant d'une caverne dans les environs d'Athènes, *Sulcia kanellisi* nov. spec. Elle se distingue à première vue des autres représentants du genre par la présence de 5 épines très fortes, non tubulaires à leur base, aux tibias des pattes-mâchoires du mâle. La première de ces épines est la plus forte, aussi longue que le tibia de la patte-mâchoire. L'auteur a étudié un ♂ et une ♀ de *Leptoneta akiyoshiensis* Oi d'une grotte du Japon méridional et suggère que cette espèce soit placée dans le genre *Sarutana* Komatsu. Les nombreuses Leptonetides

japonaises, décrites depuis 1957 passent en revue. Elle donne un aperçu des genres des Leptonetidae de l'Ancien Monde. Ils semblent être confinés aux contrées à climat méditerrannéen. Leur aire de répartition paraît être largement discontinue dans l'Asie Centrale et Orientale.

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