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New data on the spider genus *Siwa* Grasshoff, 1970 (Aranei: Araneidae)

Новые данные по паукам рода *Siwa* Grasshoff, 1970 (Aranei: Araneidae)

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КЛЮЧЕВЫЕ СЛОВА: Araneae, пауки-кругопряды, первая находка, Узбекистан, Ближний Восток.

ABSTRACT. The orb-weaver spider *Siwa dufouri* (Simon, 1874) is ocurred in Israel for the first time, in addition to *S. atomaria* (O. Pickard-Cambridge, 1876), previously known from this country. In its turn, the latter species, as well as the genus *Siwa* Grasshoff, 1970, are recorded for the first time in Uzbekistan, and in the entire Central Asian region. A new synonymy is established: *Larinia dufouri* Simon, 1874 = *Neoscona lotan* Levy, 2007, syn.n.

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РЕЗЮМЕ. Паук-кругопряд *Siwa dufouri* (Simon, 1874) впервые обнаружен в Израиле, в дополнение к *S. atomaria* (O. Pickard-Cambridge, 1876), ранее известному из этой страны. В свою очередь, последний вид, а также род *Siwa* Grasshoff, 1970, впервые отмечаются в Узбекистане и на всей территории Средней Азии. Устанавливается новая синонимия: *Larinia dufouri* Simon, 1874 = *Neoscona lotan* Levy, 2007, syn.n.

Introduction

The small spider genus *Siwa* Grasshoff, 1970, including only two species, is known from the Mediterranean countries, and from Iran and Azerbaijan [WSC, 2025]. The type species *Siwa atomaria* (O. Pickard-Cambridge, 1876) is considered to be a predominantly Eastern Mediterranean member of this pair, distributed from Egypt to Iran [WSC, 2025], while *S. dufouri* (Simon, 1874) has not been occurred outside the Western Mediterranean countries, i. e., easterward of Malta and Algeria [Levy, 1986; Dentici, 2018]. These two species have thus newer been recorded within the same country, and *S. atomaria* was known in Israel only from one locality [Levy, 1986].

The present study is based on an examination of the material, recently collected from Israel and Uzbekistan and deposited in the Steinhardt Museum of Natural History. The study has revealed, among other spider taxa, both mentioned species belonging to *Siwa*. One of them (*S. dufouri*) has surely been found in Israel and in the entire Eastern Mediterranean for the first time. The range of the second species, *S. atomaria*, has been found extending to the Syrdarya River in Uzbekistan; concurrently, this eastermost record represents the first occurrence of the genus *Siwa* in Central Asia. The information regarding the structure of the male and female copulatory organs (including illustrations showing a previously unknown structure of the receptacles and seminal ducts) and collecting sites of *Siwa* spp. in Israel and Uzbekistan is provided herein.

Material and methods

Photographs were taken using an Olympus SZX16 stereomicroscope with a Canon EOS 80D digital camera attached to it. The source images were digitally assembled using the Helicon Focus 7.3.2 Pro software (http://www.heliconsoft.com/). Illustrations of the female copulatory organs were made following maceration of the dissected epigyne in a 10% potassium hydroxide aqueous solution and cleaning in 85% lactic acid. Upon becoming transparent and gently stained, these structures were then placed in a dish with 85% lactic acid and fixed on a glass microsphere layer for image making. Following examination, the preparations were cleaned, transferred to small microvials and stored together with the corresponding specimens.

The distributional map was created using the freely available background platform (https://maps-for-free.com/).

To maintain continuity with the reproduced original illustrations by Levy [1986], the used abbreviations are partially the same: C — conductor, E — embolus, M — median apophysis, Sa — stipes apophysis, Sc — scape, Ta — terminal apophysis, Tb — subterminal apophysis, Tc — terminal accessory apophysis, Tg — tegulum. Additionally, the following abbreviations are used: Co — copulatory opening, Ef — epigynal fold, Fd — fertilization duct, Pb — paracymbium, Re — receptacle.

Acronym: SMNH — the Steinhardt Museum of Natural History, Tel Aviv, Israel (SMNH).

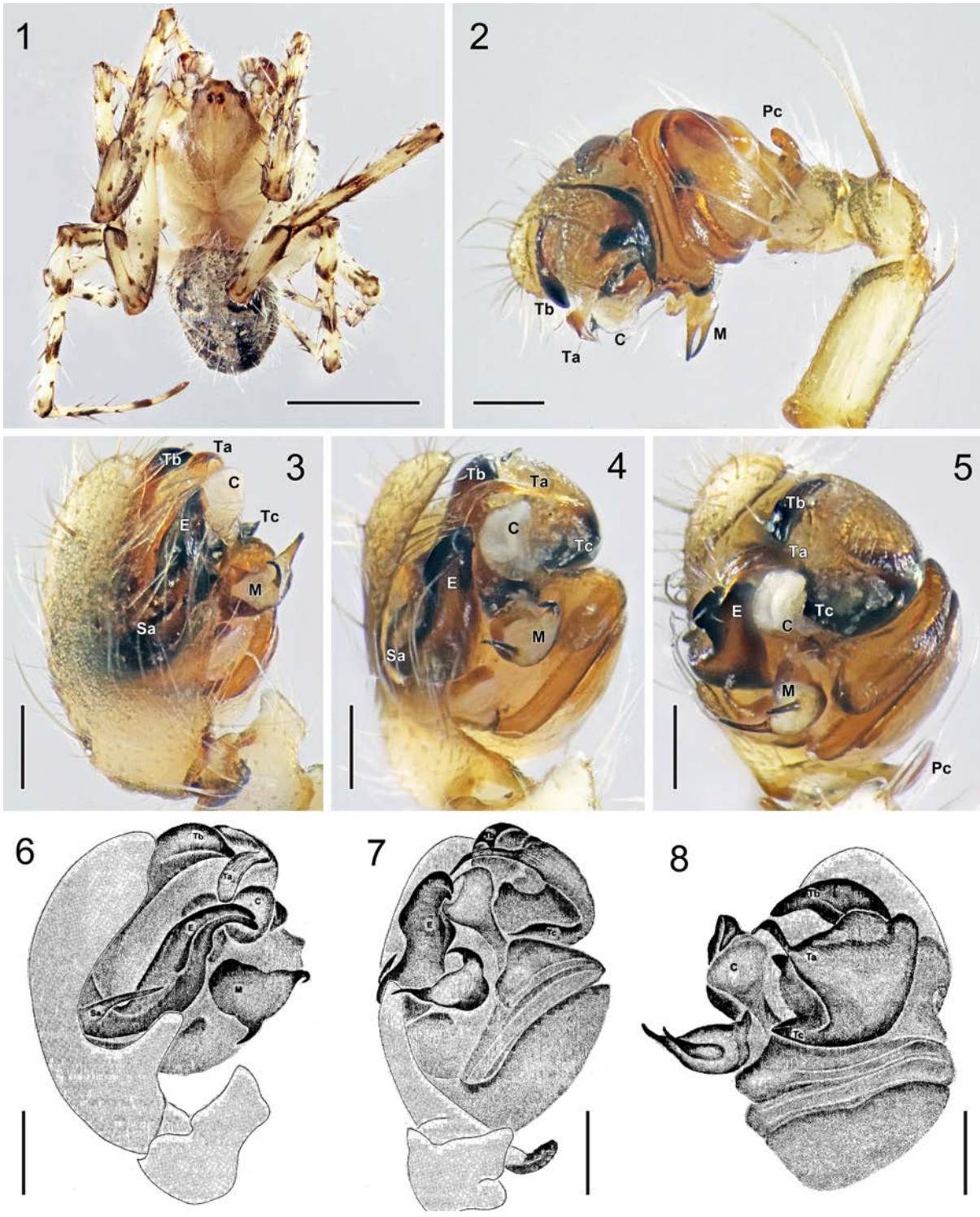
Results

Family Araneidae Clerck, 1757
Genus *Siwa* Grasshoff, 1970

Siwa Grasshoff, 1970b: 409; Levy, 1986: 1.

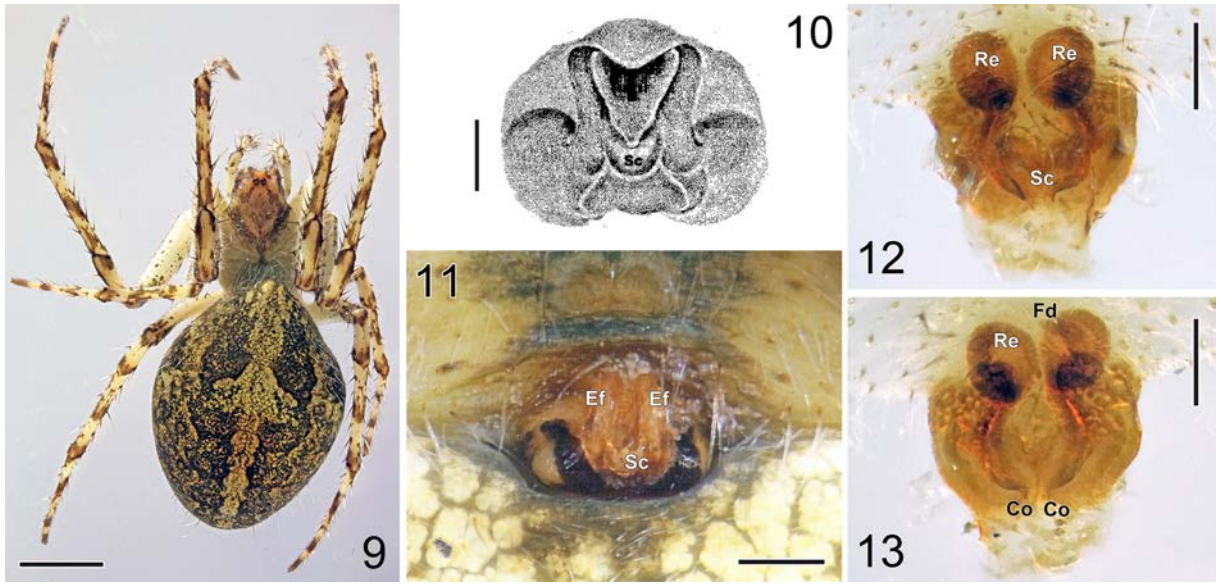
TYPE SPECIES: *Epeira atomaria* O. Pickard-Cambridge, 1876 (from Egypt), by original designation.

NOTES: The genus was originally described as a monotypic taxon based on *S. atomaria* [Grasshoff, 1970]. Levy [1986]



Figs 1–8. *Siwa atomaria* (O. Pickard-Cambridge, 1876), male from Uzbekistan (1–5) and holotype male from Egypt (6–8; after Levy [1986]; ©the British Arachnology Society, reproduced with permission from the copyright holder): 1 — habitus, dorsal; 2 — palp, retrolateral; 3, 6 — distal degments of palp, prolateral; 5, 7 — same, ventral; 6 — same, frontal; 8 — same, retrolateral. Abbreviations: C — conductor, E — embolus, M — median apophysis, Pc — paracymnium, Sa — stipes apophysis, Ta — terminal apophysis, Tb — subterminal apophysis, Tc — terminal accessory apophysis, Tg — tegulum. Scale bars: 1 — 2 mm; 2–8 — 0.2 mm.

Рис. 1–8. *Siwa atomaria* (O. Pickard-Cambridge, 1876), самец из Узбекистана (1–5) и самец голотип из Египта (6–8; по Levy [1986]; ©the British Arachnology Society, воспроизведено с разрешения правообладателя): 1 — габитус, вид сверху; 2 — пальпа, ретролатерально; 6 — дистальные членики пальпы, пролатерально; 5, 7 — то же, снизу; 6 — то же, спереди; 8 — то же, ретролатерально. Сокращения: C — кондуктор, E — эмболюс, M — медиальный апофиз, Pc — парацимбиум, Sa — стипес, Ta — терминальный апофиз, Tb — субтерминальный апофиз, Tc — дополнительный субтерминальный отросток, Tg — тегулум. Масштаб: 1 — 2 мм; 2–8 — 0,2 мм.



Figs 9–13. *Siwa atomaria* (O. Pickard-Cambridge, 1876), females from Uzbekistan (9, 11–14) and Israel (10; after Levy [1986]; ©the British Arachnology Society, reproduced with permission from the copyright holder): 9 — habitus, dorsal; 10, 11 — intact epigyne, ventral; 12 — dissected and cleaned epigyne, ventral; 13 — same, dorsal. Abbreviations: Co — copulatory opening, Ef — epigynal fold, Fd — fertilization duct, Re — receptacle, Sc — scape. Scale bars: 1 — 2 mm; 2–8 — 0.2 mm. Scale bars: 9 — 2 mm; 10–13 — 0.2 mm.

Рис. 9–13. *Siwa atomaria* (O. Pickard-Cambridge, 1876), самки из Узбекистана (9, 11–14) и из Израиля (10; по Levy [1986]; ©the British Arachnology Society, воспроизведено с разрешения правообладателя): 9 — габитус, вид сверху; 10, 11 — интактная эпигина, снизу; 12— вырезанная и очищенная эпигина, снизу; 13 — то же, сверху. Сокращения: Co — отверстие семяприемника, Ef — складка эпигины, Fd — оплодотворительный канал, Re — рецептакула, Sc — скапус. Масштаб: 9 — 2 мм; 10–13 — 0,2 мм.

revised the genus and added the second species, *S. dufouri* (originally described as a species of *Larinia* Simon, 1874). *Siwa* belongs to the nominative subfamily Araneinae, where together with other related taxa it constitutes the tribe Mangorini Simon, 1895. This small well-studied genus appears to be most closely related to the abovenoted speciose *Larinia*, as well as to the small mangorine genera *Kilima* Grasshoff, 1870 and *Lipocrea* Thorell, 1878 (see Levy [1986]).

Siwa atomaria (O. Pickard-Cambridge, 1876)
Figs 1–13, 23, 24, 26, 27.

Epeira atomaria O. Pickard-Cambridge, 1876: 577, pl. 59, fig. 9 (♂♀).

Siwa atomaria: Grasshoff, 1970: 409, fig. 18 (♂♀); Levy, 1986: 3, figs 1–9 (♂♀); Zonstein, Marusik, 2013: 24.

Selected references only, for full synonymy list see WSC [2024].

MATERIAL: ISRAEL: 1♂ (SMNH), *Arava Rift Valley*, environs of Kibbutz Qetura, 29°58.1′ N, 35°03.7′ E, 120 m a.s.l., 24.01.2023, S. Zonstein. UZBEKISTAN: 1♂ 2♀♀ (SMNH), *Sirdaryo Region*, Syrdarya River, sandy left bank opposite Chinaz Town, 40°53.9′ N, 68°42.2′ E, 250 m a.s.l., 6.05.2023, S. Zonstein.

NOTES: The habitus of male and female from Uzbekistan as in Figs 1 and 9, respectively. The palpal structures of the male from Uzbekistan are shown in Figs 2–5; they do not differ from those in a male collected from Israel and the holotype male from Egypt (see Figs 6–8 for the latter specimen). The species was redescribed in detail by Levy [1986]. However, the inner structure of the epigyne has not been studied and described until now. As revealed, the structural peculiarities of the epigyne in *S. atomaria* look as follows (see Figs 10–13). The central sclerotized part of the epigynal plate is limited by two subparallel folds (*Ef*), which may slightly diverge laterally (as in Fig. 10), or converge mesally (see Fig. 11); a small cup-like scape (*Sc*) is located close to the posterior folds junction. Copulatory openings (*Co*) are located somewhat posteriorly the scape, each of these paired holes leads to a bean-shaped receptacle (*Re*) and a short wide-conical fertilization duct (*Fd*).

DISTRIBUTION: Egypt, Israel, Azerbaijan (Naxçivan), Iran and Eastern Uzbekistan. See Fig. 27.

Siwa dufouri (Simon, 1874)
Figs 14–22, 25, 27.

Larinia dufouri Simon, 1874: 116, pl. 2, figs 5–6 (♀);

Araneus dufouri: Simon, 1929: 692, 762, figs 1070b, 1071b (♂); Grasshoff, 1970a: 218.

Siwa dufouri: Levy, 1986: 3, figs 10–17 (♂♀).

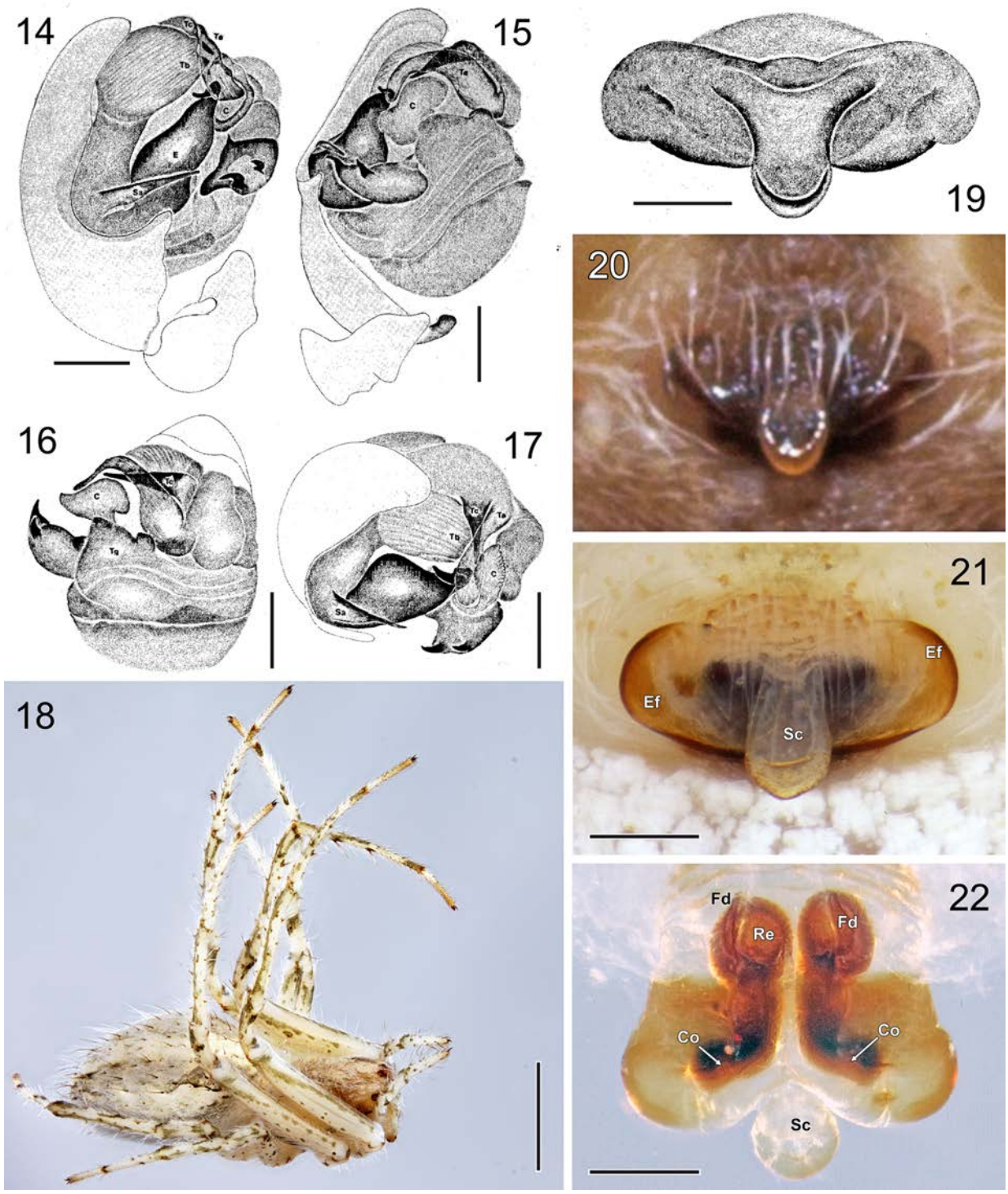
Neoscona lotan Levy, 2007: 27, figs 70–74 (♂), syn.n.; Zonstein, Marusik, 2013: 23.

Selected references only, for full synonymy list see WSC [2024].

MATERIAL: ISRAEL: 1♀ (SMNH), *Central Negev Desert*, environs of Khan Be'erotayim desert lodge 10 km SSE Nizzana (Nitzana) Village, 30°48.0′ N, 34°27.9′ E, 300 m a.s.l., 13.03.2019, S. Zonstein.

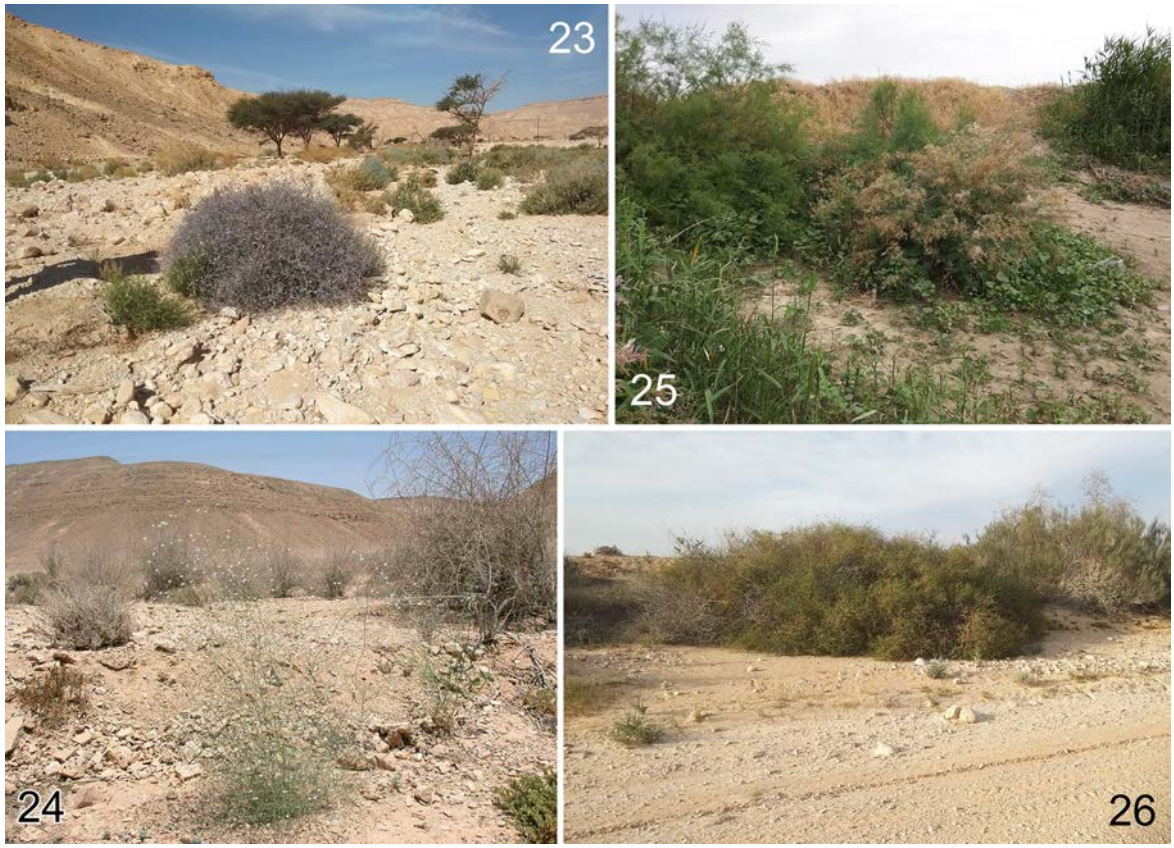
NOTES: The structure of the copulatory organs in specimens from France (after Levy [1986]) and Malta (after Dentici [2018]) is shown in Figs 14–17, 19 and 20. The dorsal habitus of a female collected from Israel as in Fig. 18. The structure of the epigyne is shown in Figs 21, 22; it appears to be quite different from that in *S. atomaria*. Unlike the most corresponding structures in *S. atomaria*, the paired copulatory openings (*Co*) in *S. dufouri* are located near the scape (*Sc*) base. The receptacles (*Re*) are rounded, been-shaped and similar to those in *S. atomaria*; while curved fertilization ducts (*Fd*) are dissimilarly longer and narrower.

DISTRIBUTION: Mediterranean, from Spain and southern France to Israel. See Fig. 27.



Figs 14–22. *Siwa dufouri* (Simon, 1874), male and female from France (14–17 and 19, respectively; after Levy [1986]; ©the British Arachnology Society, reproduced with permission from the copyright holder) and females from Israel (18, 21, 22) and from Malta (20; after Dentici [2018]): 14 — distal degments of palp, prolateral; 15 — same, ventral; 16 — same, retrolateral; 17 — same, frontal; 18 — habitus, dorsolateral aspect; 19–21 — intact epigyne, ventral; 22 — dissected and cleaned epigyne, dorsal. Abbreviations as in Figs 2–8, 10–13. Scale bars: 14–17, 19–21 — 0.2 mm; 18 — 2 mm; 20 — not scaled.

Рис. 14–22. *Siwa dufouri* (Simon, 1874), самец и самка из Франции (соотв. 14–17 и 19; по Levy [1986]; ©the British Arachnology Society, воспроизведено с разрешения правообладателя) и самки из Израиля (18, 21, 22) и Мальты (20; по Dentici [2018]): 14 — дистальные членики пальпы, пролатерально; 15 — то же, снизу; 16 — то же, ретролатерально; 17 — то же, спереди; 18 — габитус, вид сверху; 19–21 — интактная эпигина, снизу; 22— вырезанная и очищенная эпигина, снизу. Сокращения как на рис. 2–8, 10–13. Масштаб: 14–17, 19, 21 — 0,2 мм; 18 — 2 мм; 20 — не указан.



Figs 23–26. Biotopes inhabited by *Siwa* spp. in Israel (23, 24, 26) and Uzbekistan (25): 23, 24 — surroundings of Qetura; 25 — sandy bank of Syrdarya River, with *Tamarix* sp. on foreground; 26 — surroundings of Nizzana, *Retama* shrubland (Figs 23, 25, 26 — images courtesy of L. Friedman).

Рис. 23–26. Биотопы, где встречены *Siwa* spp. в Израиле (23, 24, 26) и в Узбекистане (25): 23, 24 — окр. Ктуры; 25 — песчаный берег Сырдарьи, с *Tamarix* sp. на переднем плане; 26 — окр. Ницаны, заросли *Retama* (рис. 23, 25, 26 — фотографии предоставил Laibale Friedman).

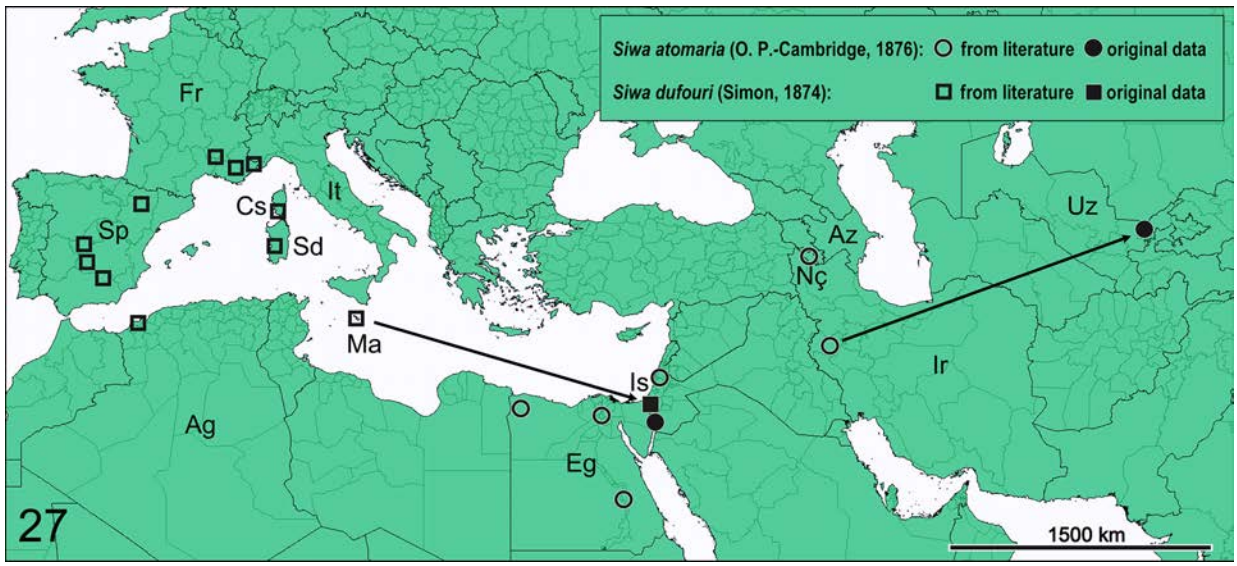
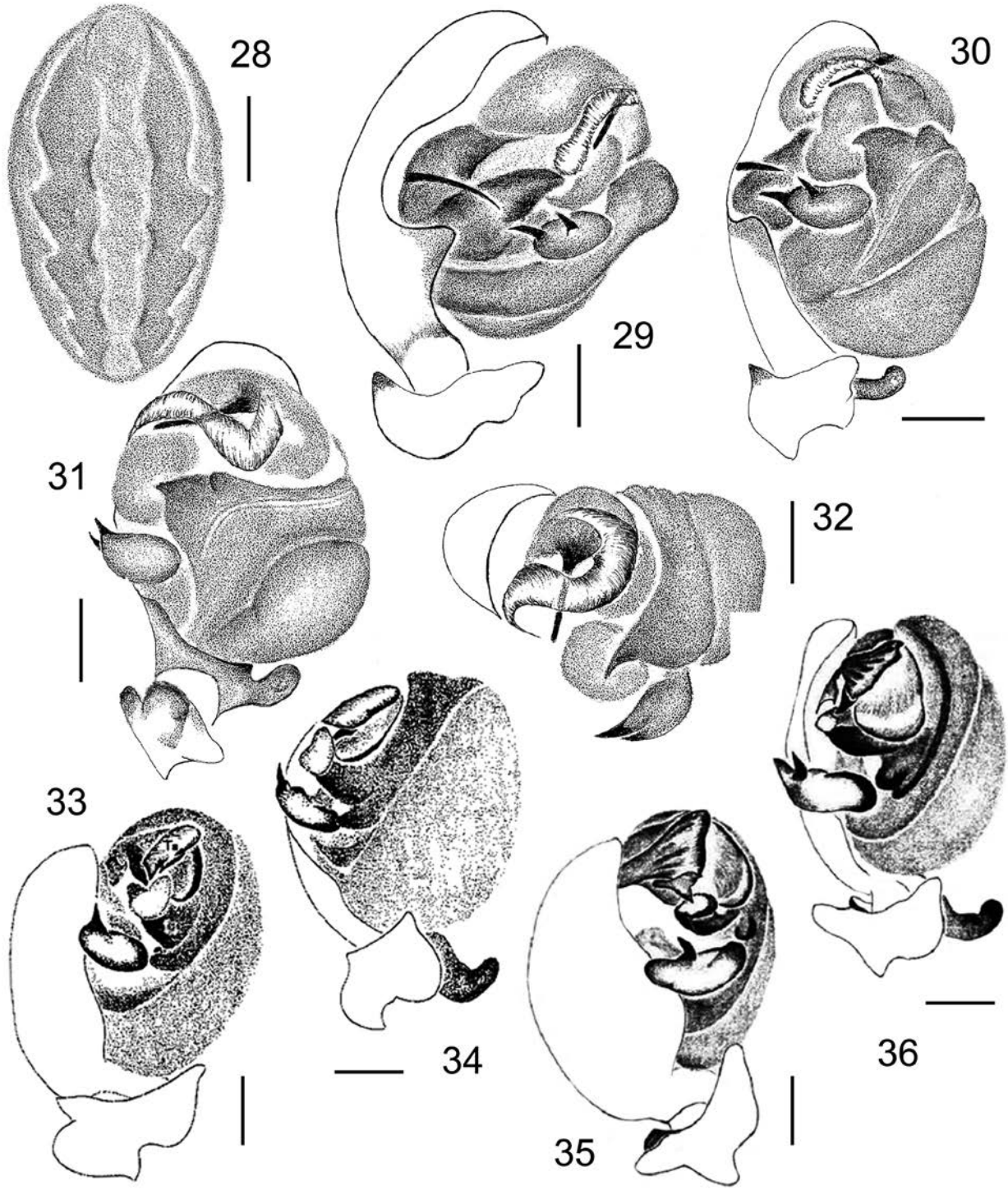


Fig. 27. Mapped records of *S. atomaria* (citrcles) and *S. dufouri* (squares), from literature and original data (enpty and solid signs, respectively). The distance between the two eastermost localities (previous and current ones) for each species is indicated with an arrowheaded line. Abbreviations (include only inhabited countries): Ag — Algeria, Az — Azerbaijan; Cs — Corse (France); Fr — France, Ir — Iran, Is — Israel, It — Italia, Ma — Malta, Nç — Naxçivan (Azerbaijan), Sd — Sardinia (Italy); Sp — Spain, Uz — Uzbekistan.

Рис. 27. Распространение *S. atomaria* (кружки) и *S. dufouri* (квадраты), по литературным и оригинальным данным (соответственно, незаполненные и заполненные значки). Дистанция между двумя крайними восточными нахождениями (ранее и теперь) для каждого вида обозначена стреловидной линией. Сокращения (включают только названия стран в пределах ареала): Ag — Алжир, Az — Азербайджан; Cs — о-в Корсика (Франция); Fr — Франция, Ir — Иран, Is — Израиль, It — Италия, Ma — Мальта, Nç — Нахичевань (Азербайджан), Sd — о-в Сардиния (Италия); Sp — Испания, Uz — Узбекистан.



Figs 28–36. Structures in males of the three *Neoscona* species from Arava Valley, Israel: *N. lotan* Levy, 2007, syn.n. (28–32; after Levy [2007]; ©Magnolia Press, reproduced with permission from the copyright holder), *N. subfusca* (C. L. Koch, 1837) and *N. thesi* (Walckenaer, 1841) (respectively 33, 34 and 35, 36; after Levy [1998]): 28 — abdomen, dorsal; 29, 33, 35 — distal degments of palp, prolateral; 30, 34, 36 — same, ventral; 31 — same, retrolateral; 32 — same, frontal. Scale bars: 28 — 1 mm; 29–36 — 0.2 mm.

Рис. 28–36. Структуры самцов трех видов р. *Neoscona* из долины Аравы, Израиль: *N. lotan* Levy, 2007, syn.n. (28–32; по Levy [2007] ; ©Magnolia Press, воспроизведено с разрешения правообладателя), *N. subfusca* (C. L. Koch, 1837) и *N. thesi* (Walckenaer, 1841) (соответственно, 33, 34 и 35, 36; по Levy [1998]): 28 — абдомен, вид сверху; 29, 33, 35 — дистальные членики пальпы, пролатерально; 30, 34, 36 — то же, снизу; 31 — то же, ретролатерально; 32 — то же, спереди. Масштаб: 28 — 1 мм; 29–36 — 0,2 мм.

Discussion

Although all documented records of *Siwa dufouri* had previously been limited to the Western Mediterranean, Wunderlich [2011] mentioned in passing this species as also being presented in Israel. Since this sole mention was not based on relevant collection data, it was ignored and not accepted by subsequent authors, including the compilers of the WSC [2025].

In fact, somewhat earlier, Levy [2007] dealt with a single Israeli specimen of *S. dufouri*, when described *Neoscona lotan* from the southern Arava. Unfortunately, Levy has misidentified the species; although twenty years earlier he examined and depicted a male of *S. dufouri* collected from France (see Levy [1986]). Based only on the holotype male, *N. lotan* looks different from other congeners (including sympatric *N. subfusca* and *N. thesi*). The structure of the male palp in *N. lotan* certainly differs from that in other *Neoscona* spp.; however, it coincides with the structural details of the copulatory organs in males of *Siwa dufouri* (see Figs 14–17 and 29–36). The dorsal pattern of the abdomen in the holotype of *N. lotan* also matches its colouration in *S. dufouri* (see Figs 18 and 28). The transfer of *Neoscona lotan* to the genus *Siwa* and its synonymy with *Siwa dufouri* appears to be justified. Thus, a new synonymy is established: *Larinia dufouri* Simon, 1874 = *Neoscona lotan* Levy, 2007, **syn.n**.

As it may seem, the occurrence of *S. dufouri* in Israel, as well as *S. atomaria* in Uzbekistan, appears to be quite unexpected. In both cases, the range of each species extends eastward by approximately 2,000 km; i.e., expanding twice as much as known previously (Fig. 27). On the other hand, despite the long history of investigation, these spiders still be known from a few specimens collected from a few localities. It should be noted that both species could be occurred inhabiting little visited extra-arid habitats (see Melic [2000]).

Consequently, the ecology of *Siwa* spp. has not been sufficiently studied; it is currently known only from a few fragmentary data. Levy [1986] noted that in surroundings of Tiberias City, Israel, a single female of *S. atomaria* had been found building "an orbicular web among the roots of a tree, close to the water surface of the Sea of Galilee" [Op. cit., p. 3]. According to the newly received data, female of *S. dufouri*, collected from Khan Be'erotayim, was found sitting on its web built on the desert broom shrub, *Retama raetam* (Fabaceae). The two females and one male of *S. atomaria*, collected in Uzbekistan, were taken from shrubs of *Tamarix* sp. (Tamaricaceae). It should be emphasized that all the collected specimens listed in this study, including male of *S. atomaria* from Qetura, were revealed and caught exclusively at night, using a headlamp.

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