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RESEARCH ARTICLE

A new species of wolf spiders of the genus *Lycosa* (Aranei: Lycosidae) from Iran

Новый вид пауков-волков рода *Lycosa* (Aranei: Lycosidae) из Ирана

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Abstract. A large burrowing wolf spider, *Lycosa macrophthalma* **sp. nov.**, is described from the holotype female from central Iran. The new species can be easily distinguished from all congeners by the presence of anterior epigynal hoods and a protrusion between their edges and the septum. *Lycosa macrophthalma* **sp. nov.**, *L. aragogi* Nadolny et Zamani, 2017, *L. piochardi* Simon, 1876, *L. praegrandis* C.L. Koch, 1836, and *L. tarantula* (Linnaeus, 1758) have a similar conformation of the endogyne and represent diagnostic characters of the genus *Lycosa* Latreille, 1804 sensu stricto.

Резюме. Крупный роющий паук-волк *Lycosa macrophthalma* **sp. nov.** описан по голотипу (самке) из центрального Ирана. Новый вид отличается от остальных представителей рода наличием передних карманов эпигины и выпуклой области, которая находится между этими карманами и септумом. *Lycosa macrophthalma* **sp. nov.**, *L. aragogi* Nadolny et Zamani, 2017, *L. piochardi* Simon, 1876, *L. praegrandis* C.L. Koch, 1836 и *L. tarantula* (Linnaeus, 1758) имеют общую схему строения эндогины, характерную для рода *Lycosa* Latreille, 1804 sensu stricto.

Keywords: wolf spider, Middle East, Iran, Lycosidae, *Lycosa macrophthalma*, new species

Ключевые слова: паук-волк, Ближний Восток, Иран, Lycosidae, *Lycosa macrophthalma*, новый вид

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Introduction

With 2430 species in 123 genera, Lycosidae represents one of the largest spider families. Although the monophyly of Lycosidae is well supported both by morphological characters and molecular data (Dondale, 1986; Wheeler et al., 2017), a clear delineation of the type genus *Lycosa* Latreille, 1804 is still problematic due to the enigmatic type species *L. tarantula* (Linnaeus, 1758) which was originally described without illustrations. Several authors provided illustrations or photos of the spiders provisionally identified as "*Lycosa tarantula*" based on the specimens from France and Spain (Simon, 1937: Figs 1696, 1697; Zyuzin & Logunov, 2000: Fig. 3, 3A; Logunov, 2010: Figs 1, 27; Oger, 2020). Yet, the illustrations of the male and female copulatory organs and general appearance of *L. tarantula*, based on the topotypes from Apulia (Italy), have been presented only once by Pepe (2005: Figs 3–5). Despite the figures in the latter paper being rather schematic, they clearly show the characters considered by Zyuzin & Logunov (2000) as the main diagnostic characters of the genus: large size; the tongue-shaped septum of the epigyne, with an elongated anterior part; the male palp with the

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broad and asymmetric cymbium and the wide tegular apophysis bearing a distal process directed retro-posteriad. Due to the long-term uncertainty regarding the type species, the genus *Lycosa* currently includes many medium to large wolf spiders that are not congeneric with *L. tarantula*. Indeed, with 224 named species from all zoogeographical regions (World Spider Catalog, 2020), *Lycosa* is undoubtedly a polyphyletic taxon.

To date, 73 lycosid species have been recorded from Iran, of which four belong to *Lycosa* (Zamani et al., 2020; World Spider Catalog, 2020). During the ongoing taxonomic and faunistic studies of the Iranian spiders, we have found a large female belonging to an undescribed wolf spider species that is a true member of *Lycosa*. In the Palaearctic region, *Lycosa* is represented by 64 species (World Spider Catalog, 2020) and currently remains practically unrevised, except for a recent revision of the 12 West Mediterranean species (Planas et al., 2013), being based solely on the molecular data and completely ignoring morphology. Based on the World Spider Catalog (2020), 38 *Lycosa* species have been recorded from the Saharo-Gobian Desert Region of the Palaearctic (sensu Emeljanov, 1974) to date. Eight of them are known only from the original descriptions with no diagnostic illustrations: from South and East Mediterranean countries [*L. affinis* Lucas, 1846, *L. articulata* Costa, 1875, *L. cingara* (C.L. Koch, 1847), *L. intermedialis* Roewer, 1955, *L. nilotica* Audouin, 1826, *L. sylvatica* (Roewer, 1951)] and from Yarkand [*L. approximata* (Pickard-Cambridge, 1885), *L. sabulosa* (Pickard-Cambridge, 1885)]. For the remaining 30 species, at least female copulatory organs were illustrated, allowing us to undertake a comparison with the new species from Iran. The present paper is devoted to the description of a new *Lycosa* species having a distinct shape of the copulatory organs and hence being easily distinguishable from all the congeners.

Material and methods

The specimen was photographed using an Olympus Camedia E-520 camera attached to an Olympus SZX16 stereomicroscope at the Zoological Museum of University of Turku, Finland. Digital images were prepared using CombineZP image stacking software. Illustrations of the endogyne were made after clearing in a 10% KOH aqueous solution. The length of leg segments was measured on the lateral side and listed as follows: total length (femur, patella, tibia, metatarsus, tarsus). All measurements are given in millimetres. For description of spination, the following abbreviations are used in the text: d – dorsal; p – prolateral; r – retrolateral; v – ventral. The distribution map was created using the SimpleMappr website (www.simplemappr.net). The holotype has been deposited in the Muséum d'histoire naturelle, Genève, Switzerland (MHNG; curator: Dr. Peter J. Schwendinger).

Taxonomy

Order **Aranei**

Family **Lycosidae**

Genus ***Lycosa*** Latreille, 1804

***Lycosa macrophthalma* sp. nov.**
(Figs 1–16, 28, 35–36)

Holotype. Female, **Iran**, *Isfahan Prov*., Ghomishloo National Park, 32°49′03.7″N 51°13′59.8″E, XI.2017, B. Zadhoush leg. (MHNG).

Diagnosis. In the conformation of endogyne, *Lycosa macrophthalma* **sp. nov.** is most similar to *L. tarantula*, *L. praegrandis* C.L. Koch, 1836 and *L. aragogi* Nadolny et Zamani, 2017 (Figs 10–12, 32–35), but differs in the shape of the epigyne, particularly in having the anterior hoods (*Eh*) and protrusion (*Ep*) between hood edges and a clearly marked septum (Figs 8, 13–15, 28), compared to no hoods in *L. tarantula* and *L. praegrandis* (Figs 17, 23) and the presence of an incision between hood edges and absence of protrusions on the sides of septum in *L. aragogi* (Figs. 27).

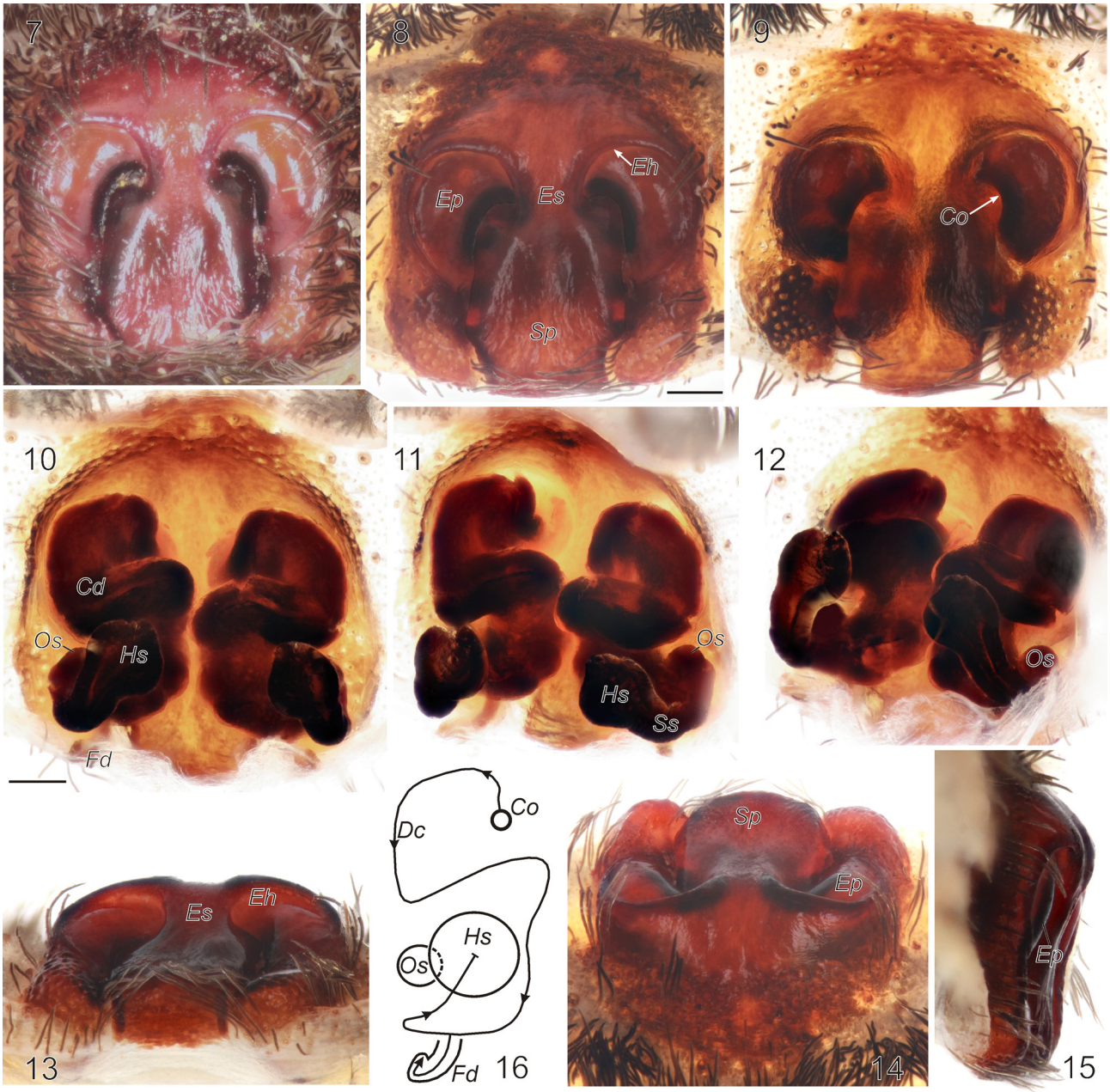
Description. Female. Habitus as in Figs 1–6. Total length 18.7; carapace length 9.5, width 6.4. Length of legs: I 23.8 (7.0, 3.5, 5.6, 5.1, 2.6); II 22.3 (6.4, 3.3, 5.0, 5.1, 2.5); III 22.6 (6.0, 3.0, 4.5, 6.1, 3.0); IV 29.9 (8.0, 3.2, 6.4, 8.9, 3.4). Carapace with slightly marked gradual descend of thoracic region, eye field not elevated (Fig. 6). Carapace brown, covered with white setae forming marginal stripes which are well visible in the preserved specimen (Fig. 3) and poorly distinguishable in vivo (Fig. 1). Sternum and labium dark brown, covered with black setae (Fig. 4). Chelicerae brown, proximally

Figs 1–6. *Lycosa macrophthalma* **sp. nov.**, holotype female. **1–2**, live specimen, general appearance and in threat pose; **3–5**, habitus in dorsal, ventral, and frontal views; **6**, prosoma, lateral view. Scale bars: 2 mm. Photos 1 and 2 by Alireza Zamani.

Table 1. *Lycosa macrophthalma* **sp. nov.**, leg spination.

	Femur	Patella	Tibia	Metatarsus
I	d 1-1-1, r 1-1-1, p 2	p 1	p 1-1, v 2-2-2	v 2-2-3
II	d 1-1-1, r 1-1-1, p 1-1-1	p 1	p 2-1, v 2-2-2	p 1-1, v 2-2-3
III	d 1-1-1, r 1-1-1, p 1-1-1	p 1, r 1	d 1-1, p 1-1, r 1-1, v 2-2-2	p 1-1-1, r 1-1-1, v 2-2-3
IV	d 1-1-1, r 1, p 1-1	p 1, r 1	d 1-1, p 1-1, r 1-1, v 2-2-2	p 1-1-1, r 1-1-1, v 2-2-3

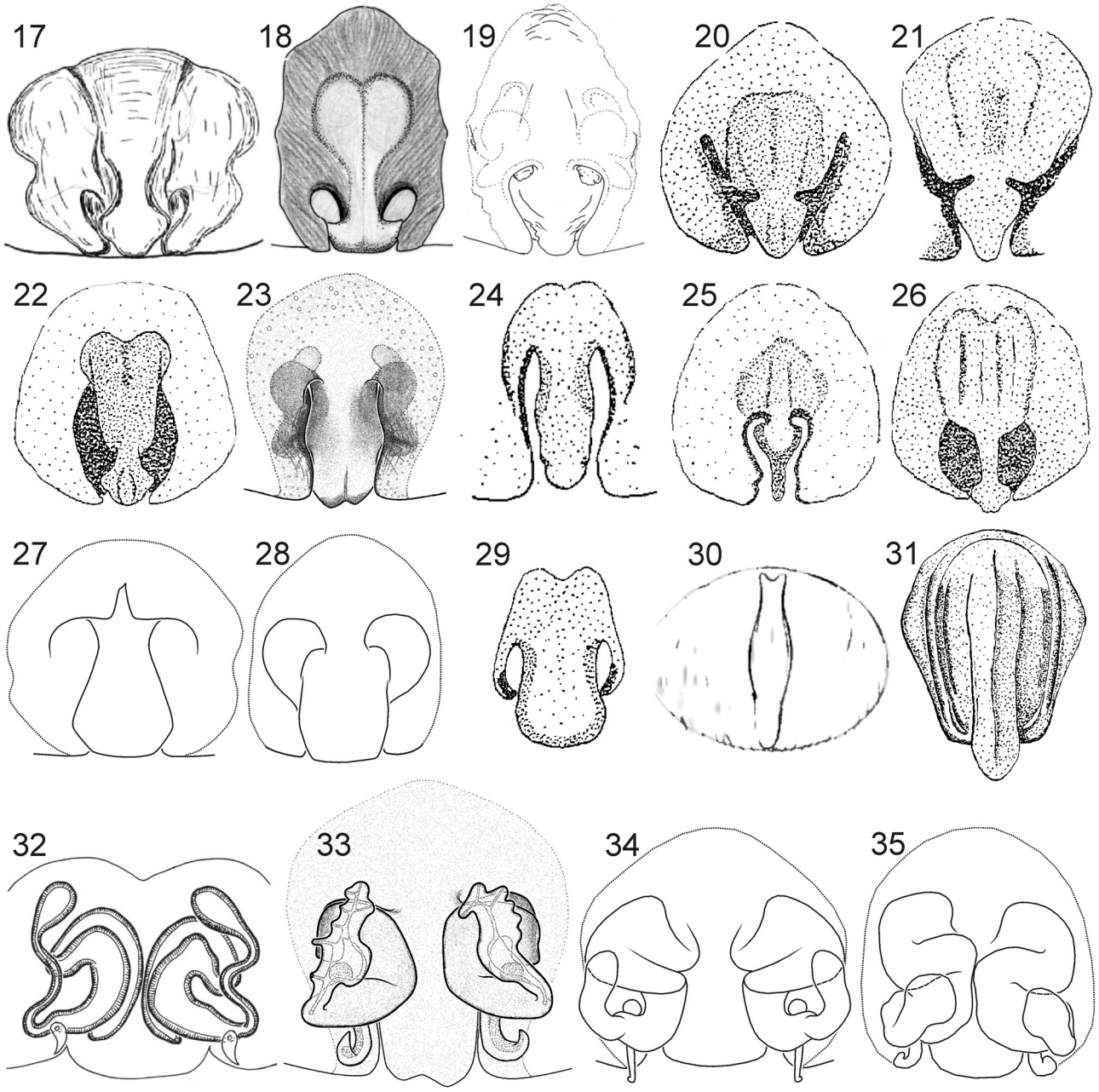
covered with white setae, distally with black setae (Figs. 2, 5). Palps light brown, with white setae. Legs yellow, covered with white setae. Black setae forming spots on all patellae (distally on ventral and prolateral sides) and tibiae (proximally on lateral and ventral sides) (Figs 1–2). Metatarsi and tarsi: I–IV with spinules, I–II with well-developed and III–IV with poorly developed scopula. Leg spination (see Table 1). Abdomen yellow, dorsally with light brown lanceolate cardiac mark and three triangular spots of white and black setae; ventrally with area of black setae tapering to-



Figs 7–16. Epigyne and endogyne of *Lycosa macrophthalma* **sp. nov.**, holotype. **7–9**, intact, dissected, and macerated epigyne, ventral view; **10–12**, macerated endogyne in dorsal, dorso-latero-anterior and dorso-latero-posterior views; **13–15**, epigyne in posterior, anterior and lateral views; **16**, general conformation of endogyne. *Cd* – copulatory duct; *Co* – copulatory opening; *Dc* – spermatheca duct trajectory; *Eh* – hood; *Ep* – protrusion; *Es* – stalk of septum; *Fd* – fertilization duct; *Hs* – head of spermatheca; *Os* – anterior outgrowth at base of spermatheca; *Sp* – septum; *Ss* – stalk of spermatheca. Scale bars: 0.2 mm.

ward spinnerets (Fig. 4). Epigyne and endogyne as in Figs 7–16, 28, 35. Septum rectangular, with stalk (*Es*); hood edges (*Eh*) rounded; area between hoods and septum protuberant (*Ep*) (Figs 8, 13–15); copulatory openings situated near anterior side of septum (Fig. 9); spermathecal head (*Hs*) spherical, 1.8 times wider than stalk (*Ss*), with a large pore; spherical anterior outgrowth at spermathecal base (*Os*); copulatory duct (*Cd*) massive, zigzag-shaped, situated in front of head of spermatheca (Figs 10–12, 35).

Male. Unknown.



Figs 17–35. Female copulatory organs of *Lycosa* species from the West Palaearctic. **17**, **32**, *L. tarantula*; **18**, *L. fasciiventris*; **19**, *L. piochardi*; **20**, *L. vachoni*; **21**, *L. baulnyi*; **22**, *L. munieri*; **23**, **33**, *L. praegrandis*; **24**, *L. abnormis*; **25**, *L. oculata*; **26**, *L. bedeli*; **27**, **34**, *L. aragogi*; **28**, **35**, *L. macrophthalma* **sp. nov.**; **29**, *L. suboculata*; **30**, *L. hispanica*; **31**, *L. bonneti*. Epigynes in ventral view (17–31); endogynes in dorsal view (32–35). After Simon (1937) (17); after Barrientos (2004) (18); after Nentwig et al. (2019) (19); after Guy (1966) (20–22, 24–26, 29); after Simon (1876) (30); after Guy & Carricaburu (1967) (31); after Logunov (2010) (32). Specimens from the Crimea (23, 33).

Remarks. The epigyne of *L. macrophthalma* **sp. nov.** is similar to that of 14 species from the West Palaearctic (Figs 17–31): *L. abnormis* Guy, 1966, *L. aragogi*, *L. baulnyi* Simon, 1876, *L. bedeli* Simon, 1876, *L. bonneti* Guy et Carricaburu, 1967, *L. fasciiventris* Dufour, 1835, *L. hispanica* (Walckenaer, 1837), *L. munieri* Simon, 1876, *L. oculata* Simon, 1876, *L. piochardi* Simon, 1876, *L. praegrandis*, *L. suboculata* Guy, 1966, *L. tarantula*, and *L. vachoni* Guy, 1966. The habitus and the conformation of the epigyne in these species correspond to the diagnostic characters of the

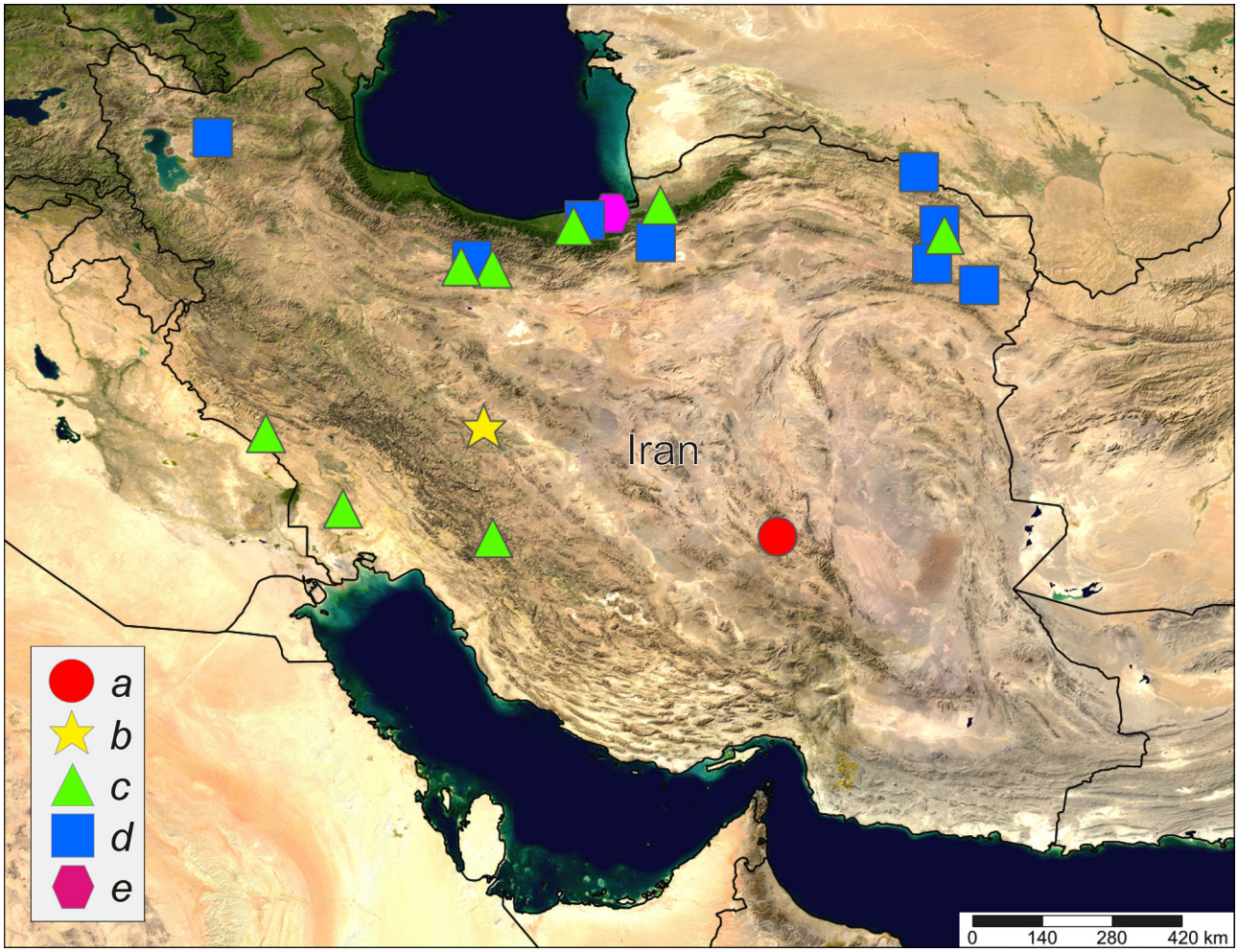


Fig. 36. Collecting localities of *Lycosa* spp. in Iran: *L. aragogi* (*a*), *L. macrophthalma* **sp. nov.** (*b*), *L. praegrandis* (*c*), *L. singoriensis* (*d*), and *L. tarantula* (*e*) (Zamani et al., 2020; present data).

genus *Lycosa* (sensu Zyuzin & Logunov, 2000): large spiders with a well-developed long anterior part of the epigyne and the tongue-shaped epigynal septum. Other 16 illustrated species of *Lycosa* recorded from the Saharo-Gobian Desert Region (for the references with species descriptions see World Spider Catalog, 2020) are medium to large spiders having various epigynal conformations, as follows: 1) the anchor-shaped septum being similar to those of *Hogna* Simon, 1885 [*L. cretacea* Simon, 1898, *L. interstitialis* (Strand, 1906), *L. magnifica* Hu, 2001, *L. nigricans* Butt, Anwar et Tahir, 2006, *L. rufisterna* Schenkel, 1953] and *Trochosa* C.L. Koch, 1847 [*L. maculata* Butt, Anwar et Tahir, 2006], or to the species that actually belong to the genus *Allohogna* Roewer, 1955 but formally are still considered in *Lycosa* (see Logunov, 2010; World Spider Catalog, 2020: note under *Lycosa*) [*L. gobiensis* Schenkel, 1936, *L. singoriensis* (Laxmann, 1770), *L. shansia* (Hogg, 1912)]; 2) the epigyne conformation corresponding to the *Pardosa nebulosa* (Thorell, 1872) species-group [*L. terrestris* Butt, Anwar et Tahir, 2006]; 3) the triangular epigyne being similar to that of some members of *Allocosa* Banks, 1900 [*L. chaperi* Simon, 1885, *L. choudhuryi* Tikader et Malhotra, 1980, *L. trichopus* (Roewer, 1960)]; and 4) the peculiar septal shapes that are dissimilar to that of *L. tarantula* [*L. asiatica* Sytshevskaja, 1980, *L. kempi* Gravely, 1924, *L. mackenziei* Gravely, 1924].

Lycosa macrophthalma **sp. nov.**, *L. aragogi*, *L. piochardi*, *L. praegrandis*, and *L. tarantula* have a similar structure of the endogyne, with the massive, curved copulatory duct (*Cd*) and an outgrowth at the base of spermatheca (*Os*) (cf. Figs 10–12, 32–35; Logunov, 2010: Fig. 27; Nadolny

& Zamani, 2017: Fig. 2 [marked as "massive fold" and "gland"]; Nentwig et al., 2019: Fig. 6e). In our opinion, such conformation (Fig. 16) is a good diagnostic character of the genus *Lycosa* sensu stricto.

It is noteworthy that the diameter of posterior median eyes in this new species is relatively large: carapace width/eye diameter ratio in *L. macrophthalma* **sp. nov.** is 5.7 (*vs.* in *L. praegrandis*: from Iran – 6.7, from the Crimea – 9.5, and from Rostov Province of Russia – 8.3). Somatic characters (gradually descending carapace profile, the presence of scopula and spinules on tarsi) of *L. macrophthalma* **sp. nov.** correspond to the structural and functional features of the burrowing wolf spiders, as argued by Zyuzin (1990).

Etymology. The specific epithet is derived from the Greek μακρός (large) and ὀφθαλμός (eye), referring to the uniquely large posterior median eyes in the new species.

Distribution. Known only from the type locality in Isfahan Province, central Iran (Fig. 36). Both currently known Iranian endemic species of this genus were found in mountains of the Central Iranian Range (or Sahand-Bazman Volcanic and Plutonic Belt). It is noteworthy that the single record of *L. tarantula* from Iran (Ghahari & Tabari, 2012) is highly doubtful and most probably refers to *L. praegrandis*.

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