

THE WOLF SPIDERS OF AUSTRALIA (ARANEAE: LYCOSIDAE): 2.
THE ARENARIS GROUP

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ABSTRACT

Four species of Australian lycosid spiders are defined as the 'arenaris group' due to the presence of a distinct tubercle on the outer curve of the fang of mature males. *Lycosa celaenica* is a synonym of *L. arenaris*, *L. segregis* is a synonym of *L. pullastra*, *L. furcillata* is assigned to this group of species, and *L. lapidosa* is described as new.

In an attempt to arrange the Australian Lycosidae into a more natural classification, all species in which a distinct tubercle is present on the outer curve of the fang of mature males were placed together as forming a natural group of species. An analysis of this group indicates that the species are indeed related as some similarities can be observed in the shape of the epigynum, the structure of the male palp, and the internal genitalia of mature females. In addition to the morphological similarities, all species are found to occur in similar habitats such as river beds and in grassed areas near swamps or on watered lawns. A burrow consisting of an open shallow pit, or a webbed retreat among grasses or stones, is constructed by most species, rather than a well excavated burrow with a flap, door, or turret, as is frequently found in other members of the genus.

The function of the tubercle on the fang of mature males is unknown. As this tubercle is not present on the fangs of the female or immature males, it may be associated with courtship, and used to ward off the fangs of the female prior to copulation. *Lycosa pullastra* has been observed during courtship and copulation, but at no time were the fangs employed in any manner to suggest the function of the tubercle. The mature males frequently cluster around a sexually mature female during the breeding season, as the population density is normally very high. Little intra-specific mortality occurs between males despite frequent contact; the encounter is usually brief, although at times quite violent, and it is suggested that the tubercles on the fangs prevent a high mortality between courting males.

The family Lycosidae is currently under review by the writer. This contribution is part 2 of a series of papers on Australian Wolf Spiders. An introduction to the study is given by McKay (1973).

Lycosa arenaris Hogg, 1905
(Figure 1, a-m)

Lycosa pulvere-sparsa: Hogg, 1896, p. 351, MacDonnell Ranges, Palm Creek, Bagot's Creek, Paisley Bluff, Central Australia, [Not *Lycosa pulvere-sparsa*].

Lycosa arenaris Hogg, 1905, pp. 586-8, fig. 88, MacDonnell Ranges, (Northern Territory); Rainbow, 1911, p. 265; Bonnet, 1957, p. 2634.

Lycosa celaenica Rainbow, 1917, p. 488, pl. 32, figs. 10 and 11, Farina, South Australia; Bonnet, 1957, p. 2637; McKay, 1973, p. 379.

Varacosa arenaris: Roewer, 1954, p. 305; McKay, 1973, p. 381.

MATERIAL EXAMINED

SYNTYPES: 2, SAM, labelled '*Lycosa arenaris* Hogg, MacDonnell RNG. Horn Exp.' in ink, '*Lycosa arenaris* H. R. Hogg. 2 females Types. MacDonnell Range, Horn Exp.' in pencil, and 'F. 206' in pencil. A lectotype is here designated from this series.

LECTOTYPE: SAM ♀ M with a well developed epigynum, in a tube with the original labels.

PARALECTOTYPE: SAM ♀ P with the epigynum partly formed but in a penultimate condition, in the same tube as the lectotype.

HOLOTYPE OF *LYCOSA CELAENICA*: SAM, ♀ M, with abdomen detached labelled '*Lycosa caelonica* Rainb. Farina, Mus. Exp. Int. 1916 T' in ink (mis-spelt, = *Lycosa celaenica*), 'Farina to Spring, Mus. Exped. Interior 1916' in pencil, a small faded printed label 'TYPE' and '*Lycosa caelonica* Rainb. Farina to Spring TYPE' in pencil on a fourth label. This specimen fits the description of *L. celaenica* well except that the carapace is 5.9 mm long and 4.3 mm wide (Rainbow has '5.8 mm broad, 4.3 mm long', but this would not be possible for a *Lycosa*). The epigynum of the holotype is shown in Fig. 1, g.

OTHER MATERIAL: Western Australia: Avon River at Northam, 14.xii.1962, BYM, 4 ♀ M, 1 ♂ M, WAM 71-1000-4, 1 ♂ M, WAM 71.988; Behn River at Old Argyle Downs station, 9.x.1971, RJM, 1 ♀ M, 72-76, 24.x.1971, 2 ♀ M, 1 ♂ M, WAM 72-77-9; Broome Hill 15 miles east, 3.ii.1961, BYM, 5 ♀ M, 3 ♂ M, WAM 71-1546-53; Desperate Bay near Snag Island, 27.ii.1971, RJM, B. Ryle, 1 ♀ M, WAM 71-891; Fitzgerald River, 12.vii.1970, RJM, 4 ♀ M, 8 ♂ M, 4J, WAM 71-1904-19; Fortesque River, 22.ii.1962, BYM, 2 ♀ M, 1 ♂ M, 2J, WAM 71-1554-8; Hooley Station at Kylan Pool, Sept. 1969, RJM, 1J, WAM 71-946; Hotham River 71 mile peg Albany Highway, 27.x.1961, BYM, 1 ♀ M, 2J, WAM 71-989-91; Kojonup 17 miles east, 3.xi.1961, BYM, 6 ♀ M, 3 ♂ M, WAM 71-1537-45; Maitland River, 23.ii.1962, A. R. Main, 4 ♀ M, 2 ♂ M, 1J, WAM 71-1513-20; Maitland River 30 miles south, 22.ii.1962, A. R. Main, 4J, WAM 71-1521-4; Millstream Station, Fortesque River, 23, 25.ix.1969, RJM, 3 ♀ M, WAM 71-942-4, 1 ♀ M, WAM 70-210; Mount Herbert at pool, 20.v.1961, BYM, 1 ♀ M, WAM 71-1562; Mugumba Creek, 26.ii.1963, A. R. Main, 1 ♀ M, WAM 71-1559; Murchison River at the Loop, 26.i.1969, RJM, JG, P. Snowball, 3 ♀ M, 1 ♂ M, WAM 69-335-40; Murchison River, 20.ii.1962, BYM, 8 ♀ M, 4J, WAM 71-1525-36, 27.i.1969, RJM, JG, 1 ♀ M, WAM 71-1564, 8.vi.1970, W. K. Youngson, 1 ♀ M, 70-166; Ongerup 85 miles east, 4.xi.1961, BYM, 1 ♀ M, WAM 71-1560; Ord River, 3.x.1971, RJM, 1 ♀ M, WAM 72-166, 21.x.1971, RJM, 2 ♀ M, WAM 71-153-4; Perth 80 miles east, 4.xi.1961, BYM 2 ♀ M, 6 ♂ M, WAM 71-992-9; Rudall River, 4.v.1971, RJM, R. W. George, 4 ♀ M, 2 ♂ M, 4J, WAM 71-1241-50; Susetta River, 12.vii.1970, RJM, 2 ♀ M, WAM 70-218-9; Twirtup Creek, Fitzgerald River, 15.vii.1970, AB, 6 ♀ M, 2 ♂ M, WAM 70-312-19; Wittenoom Gorge Pool, 30.ix.1969, RJM, R. Dear, 2 ♀ M, WAM 69-1043-4; Yannarie River, 13.v.1972, RJM, 1 ♀ M, QM W3854.

South Australia: Clayton Bore 33 miles north of Maree, 25.viii.1970, HB, W. D. L. Ride, 9 ♀ M, WAM 71-564-72; Kalamurina Homestead near Lake Eyre, 9.i.1902, Professor J. W. Gregory, 2 ♀ M, NM.

Victoria: Snowy and Broadbent Rivers, xii.1947, C. W. Brazenor, 1 ♀ M with young, NM.

Misidentified as *Lycosa pulveresparsa* by Hogg (1896): Central Australia, W. A. Horn, 2 ♀ M, BM 1897.1.18. 11-12; Palm Creek, Central Australia, Horn Expedition, 2 ♀ M, Hogg Coll., BM 1924, III.1.1977-8. Hogg's (1896) record of *L. pulveresparsa* from Central Australia is in error, and was not rectified in his 1905 description of *L. arenaris*.

DESCRIPTION

Modified from Hogg: Female. Carapace yellow-brown with mixed black and white hairs on the cephalic part, and more posteriorly a wide white area constricted in the middle

and extending on to the middle of the rear slope where it narrows abruptly as a thin white line; margin of carapace with a thin, frequently broken, sub-marginal white line; mandibles dark brown with pale brown hair; labium, maxillae, and sternum yellow-brown. Abdomen

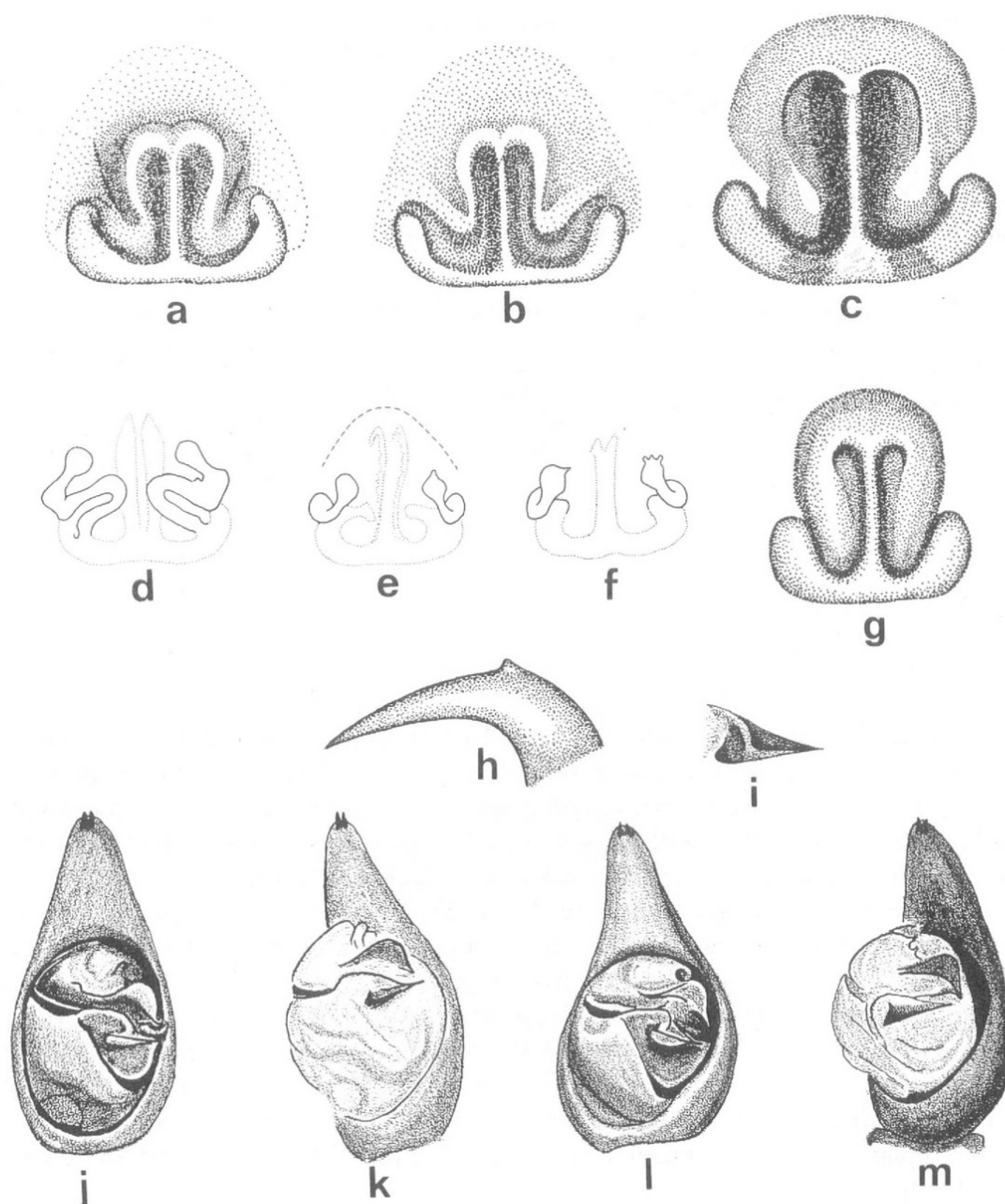


FIG. 1: *Lycosa arenaris* a-c, epigyna of WAM 69-340, WAM 69-335, and WAM 70-210; d-f, internal genitalia of WAM 70-312, WAM 70-313, and WAM 72-77; g, epigynum of holotype of *L. celsaenica*; h, fang of mature male; i, median apophysis of male palp; j-k, unexpanded and expanded male palpal organ of WAM 71-988; l-m, unexpanded and expanded palpal organ of WAM 70-314.

dull brown, irregularly spotted with small patches of whitish hairs above; venter dull brown, the centre area rather paler than the sides. Legs and palpi yellowish with brown hairs and darker brown erect bristles; a ring of paler yellow around femur, middle of tibia, and metatarsal joints.

Anterior of carapace high and narrow with the clypeus about equal to or less than a diameter of the AM. Anterior row of eyes procurved, the AM larger than the AL and further apart than from the AL, PM less than a diameter apart.

Three equal sized retromarginal cheliceral teeth. Labium almost as wide as long. The epigynum is generally broader than long with a narrow median guide, and a wide transverse guide curled around the base of the lateral margin. Three epigyna are illustrated (Fig. 1, a-c). Legs slender, two spines above on tibiae III and IV, none on the first or second pairs; on the underside the spines are long and stout.

TABLE 1: MEASUREMENTS OF LEG SEGMENTS OF *L. arenaris* IN MM FROM HOGG

Leg	Coxa	Trochanter and Femur	Patella and Tibia	Metatarsus and Tarsus
1	2½	5	5½	5
2	2	4½	5	5
3	2	4½	4½	5½
4	2½	6	6	8
Palp	1½	3	2½	1½

VARIATION: The venter of the abdomen of mature males and females may be of a uniform yellowish-brown without markings, light brown with vague darker bars or spots, or honey-brown with transverse, longitudinal, or criss-cross smoky-grey markings. Legs uniform brown, mottled, or with brown rings. The mature male has a tubercle on the outer surface of the fang (Fig. 1, h), penultimate males lack the tubercle.

The eye measurements were found to vary in the ten specimens examined, each measurement is given below in Table 2 as a per cent of the total width of the first eye row. Hogg (1905, p. 587) describes the front row of eyes as straight, although his figure illustrates the anterior row as quite procurved; all specimens examined by me had the anterior row of eyes procurved, and the distance AM:AM always wider than the distance AM:AL (not equidistant as described by Hogg). The clypeus is not twice the diameter of the AM as described by Hogg, but about equal to or much less than the diameter of the AM.

The epigyna and the internal genitalia of three Western Australian females are illustrated (Fig. 1, a-f).

The male palpal organ is figured in the unexpanded (Fig. 1, j, l) and partly expanded condition (Fig. 1, k, m) to show variation in the shape of the median apophysis illustrated separately in Figure 1, i. Above the tip of the somewhat triangular blade of the median apophysis is the rather scoop-shaped membraneous secondary conductor in which the embolus lies in the unexpanded state. An unusual and very distinctive embolic guide (see

TABLE 2: EYE DIAMETERS AND INTERSPACES OF *Lycosa arenaris* CONVERTED TO PERCENT OF THE TOTAL WIDTH OF THE FIRST ROW OF EYES

Regd No.	Sex	C.L.	AM	AL	PM	PL	AM:AM	AM:AL	PM:PM	AM:PM
WAM 72.77	♀ M	5.4	24	18	42	35	10	5	21	8
WAM 72.78	♀ M	4.9	24	18	44	36	12	4	24	11
WAM 72.79	♂ M	3.4	26	18	47	41	10	3	20	5
WAM 70.319	♂ M	5.0	24	17	46	41	6	3	22	9
WAM 70.210	♀ M	6.0	24	18	44	34	10	6	24	11
QM W3854	♀ M	5.9	23	17	46	36	8	4	21	9
WAM 70.312	♀ M	6.2	25	19	47	40	6	3	21	8
WAM 70.313	♀ M	5.6	23	18	44	36	8	4	21	10
WAM 70.314	♀ M	5.1	24	19	47	37	9	4	22	11
WAM 70.315	♀ M	5.0	25	17	47	38	10	6	19	8

Wallace, 1942, Fig. 1, a) is present as a well sclerotized, curved, medially expanded, plate-like structure. Figure 4 illustrates the terminology employed in the description of the epigynum and male palpal organ.

SIZE RANGE: Mature females C.L. 4.1 to 6.8 mm. Mature males C.L. 4.0 to 6.3 mm.

DIAGNOSIS: *Lycosa arenaris* differs from other members of the *arenaris* group in having the epigynum with a narrow median guide and a wide transverse guide, expanded terminally, and extending up the sides of the epigynal plate. The mature male has a curved plate-like embolic guide.

LIFE HISTORY

Mature males and females may be collected throughout the year, but are more numerous during the summer months. Females with egg cocoons and carrying young were collected during September at the Fortesque River, and were common in January at the Murchison River. One female carrying young was collected during December in Victoria (NM, C. W. Brazenor).

This species may be found in considerable numbers in suitable habitat, and although the spiders make frequent contact, little intra-specific mortality appears to occur. If disturbed, this species will run onto the surface of the water, and make rapid progress with the legs held in a horizontal manner. One specimen from the Fitzgerald River was quite unharmed after complete submersion in an inverted jar of water for 20 minutes. At the Murchison River this species was observed, on occasions, to occupy masses of floating aquatic plants, and would retreat below the surface of the water to escape capture.

During the day *Lycosa arenaris* will actively prey on diptera of many kinds, the free-living young of about 2 to 5 mm in total length are particularly adept at capturing sand flies (Ceratopogonidae), midges (Chironomidae) and mosquitoes (Culicidae), and are therefore to be considered important predators of these insects.

HABITAT

Wet sand, sand-silt, or coarse gravel on the wet or damp banks of rivers, streams,

creeks, or pools in the arid or semi-arid areas of Australia. Most specimens are to be found at the edge of the water on wet substrates, and are rarely found on the dry sand of the river bed.

BURROW

An open, rather shallow burrow that extends down to, or almost to, the water-table in wet sand, within 2 feet of the water's edge. The mature females may seek the slightly drier sand or loam when carrying egg-cocoons or young. The spider is frequently to be found at the entrance of the burrow during the day. Burrows may be little more than shallow vertical or horizontal pits in wet sand; in the moist or damp soils the burrows may extend some 10 cm into the slope of the bank.

DISTRIBUTION

Western Australia, South Australia, Northern Territory and Victoria. Not yet recorded from Queensland, and New South Wales.

DISCUSSION

A direct comparison of the holotype of *Lycosa celaenica* with the lectotype of *Lycosa arenaris* shows these two nominal species to be synonymous. The epigynum of the holotype of *Lycosa celaenica* is illustrated in Figure 1g. *Lycosa arenaris* was placed in the genus *Varacosa* by Roewer (1954, p. 305), but using Roewer's key to the genera of the subfamily Lycosinae (Roewer, 1959, pp. 217–25) this species falls into *Allocosa* Banks, 1900, a subgenus of *Lycosa*. In the key to the subgenera of the subfamily given by Guy (1966, pp. 51–3) *Lycosa arenaris* also falls into the subgenus *Allocosa*.

Lycosa pullastra Simon, 1909 (Figure 2, a–p)

Lycosa pullastra Simon, 1909, pp. 184–5, fig. 2, Mundaring Weir (Perth), and Albany, Western Australia; Rainbow, 1911, p. 272; Bonnet, 1957, p. 2660; McKay, 1973, p. 379.

Lycosa segregis Simon, 1909, p. 186, fig. 4, Fremantle, Western Australia; Rainbow, 1911, p. 272; Bonnet, 1957, p. 2663; McKay, 1973, p. 379.

Hogna pullastra: Roewer, 1954, p. 253.

Hogna segregis: Roewer, 1954, p. 253.

MATERIAL EXAMINED

Western Australia: Australind at estuary foreshore, 22.x.1969, RJM, R. W. George, 1 ♀ M, 1 ♀ P, 3 ♂ M, WAM 71-363–7; Amelia Heights near Perth, 28.x.1970, M. Shepherd, 1 ♀ M, WAM 71-460; Applecross near Perth, 1963, G. M. Riley, 1 ♀ M, WAM 69-869; Attadale near Perth, 15.x.1960, BYM, 1 ♀ M, WAM 71-1496, 20.viii.1960, BYM, 1 ♀ M, WAM 71-1497, 4.ix.1960, BYM, 1 ♂ M, WAM 71-1499; Bibra Lake, BYM, 18.x.1960, 1 ♀ M, WAM 71-1455, 4.xi.1961, 4 ♀ M, 1 ♂ M, WAM 71-1456–60; 17.ix.1960, 6 ♀ M, 7 ♂ M, 2 ♂ P, 2J, WAM 71-1461–77, 11.xi.1960, 1 ♀ M, WAM 71-1478, 1.x.1960, 1 ♀ M, WAM 71-1479, 11.xi.1960, 1 ♀ M, WAM 71-1480, 4.xi.1961, 2 ♀ M, WAM 71-1481–2, 8.iii.1960, 2 ♀ M, WAM 71-1483–4; Boyup Brook 20 miles south east, 3.xi.1961, BYM, 1 ♂ M, WAM 71-1509; Brentwood Swamp, 23.iv.1969, RJM, 1 ♀ M, WAM 69-855, 6.xii.1970, RJM, 3 ♀ M, 3 ♂ M, WAM 71-158–63, 1 ♀ M, WAM 71-533; Bunbury, 22.x.1969, RJM, R. W. George, 1J, WAM

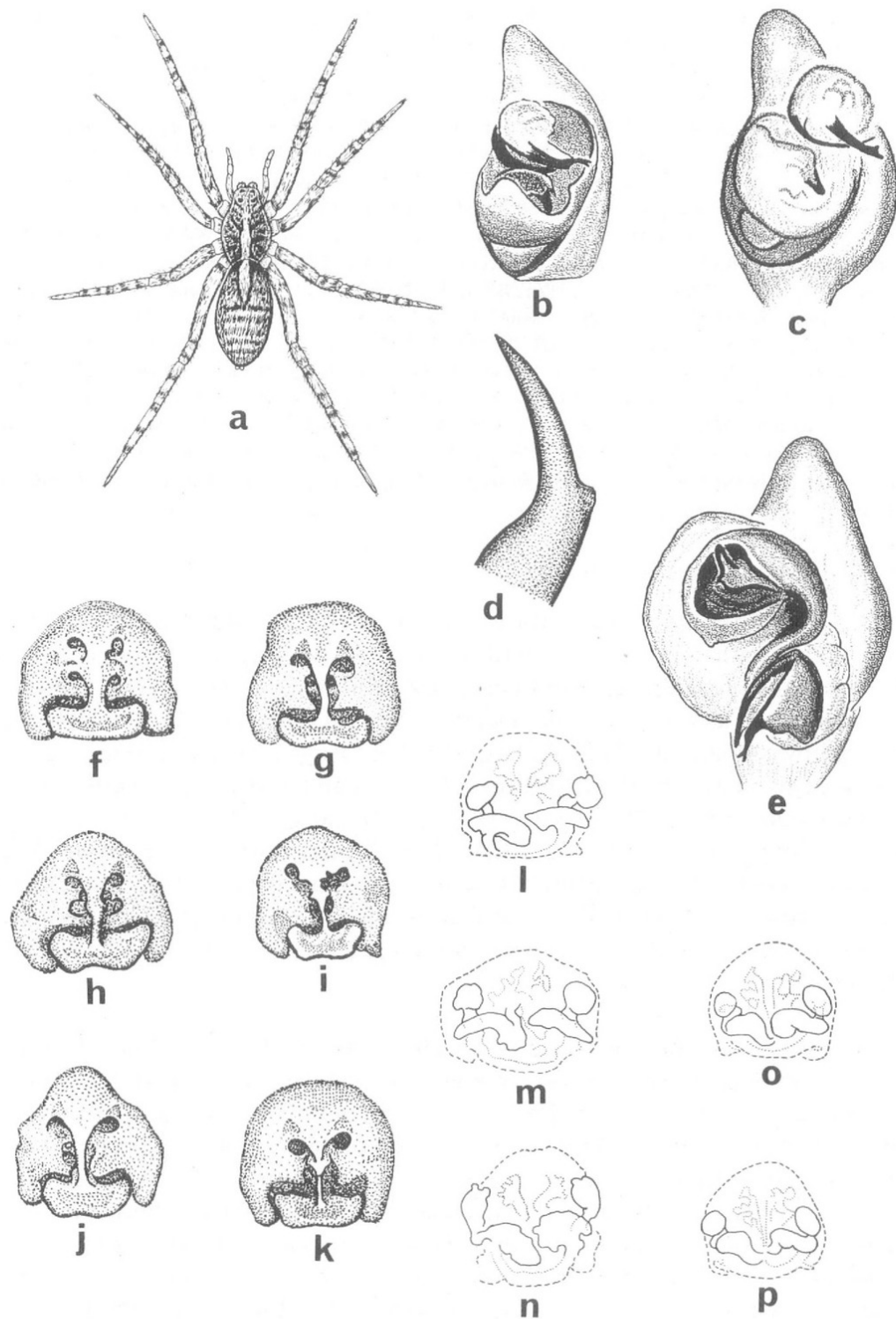


FIG. 2: *Lycosa pullastra* a, mature female WAM 70-3; b, male palpal organ of WAM 71-78; c, expanded male palpal organ of WAM 71-1492; d, cheliceral fang of mature male; e, expanded male palpal organ of WAM 71-77; f-k, epigyna of WAM 71-1461-6; l-p, internal genitalia of WAM 71-109, WAM 71-110, WAM 71-111, WAM 71-979, WAM 71-980.

71-355; City Beach near Perth, 16.ix.1968, I. Elliot, 1 ♀ M, WAM 69-856, 5 ♂ M, WAM 71-974-8; Collie, 16.x.1961, BYM, 1 ♀ M, WAM 71-1485, 3.viii.1961, BYM, 1 ♀ M, 1 ♂ P, WAM 71-1490-1, 18.x.1961, BYM, 1 ♂ M, WAM 71-1492; Collie 27 miles east, 26.x.1961, BYM, 2 ♀ M, 1 ♀ P, 1 ♂ M, WAM 71-1486-9; Cottesloe, 17.xi.1970, RJM, 1 ♀ M, 5J, WAM 71-152-7, 27.vii.1970, RJM, 3 ♂ M, WAM 71-545-7; Darkan, 13.ii.1969, RJM, 1 ♀ M, WAM 69-429; Eagle Bay near Cape Naturaliste turnoff, 22.x.1969, RJM, R. W. George, 1 ♂ M, WAM 71-550; Elliker, 16.ii.1969, RJM, R. W. George, 1 ♂ M, WAM 71-1508; Fitzgerald River, 11.vii.1970, JG, RH, 1 ♀ M, WAM 71-494; Harvey, 10.ix.1961, BYM, 2 ♂ M, WAM 71-1506-7; Jarrahwod, viii.1969, Miss V. Godridge, 1 ♀ M, WAM 71-500; Lake Grassmere, 16.ii.1969, RJM, 1 ♀ M, WAM 69-133; Lake Jandakot, 19.iv.1970, RJM, RH, 1 ♀ P, 1 ♂ M, WAM 71-458-9; Melville, 25.i.1960, BYM, 2 ♀ M, 2 ♂ M, 1 ♂ P, WAM 71-1501-5; Moodiarrup 4 miles south, 15.ii.1969, RJM, 1 ♀ M, WAM 69-522, 1 ♀ M, WAM 69-867; Nornalup, 16.ii.1969, RJM, 2 ♀ M, 3 ♂ M, 3J, WAM 71-444-51; Pinjarra, 10.ix.1961, BYM, 1 ♂ M, WAM 71-1500; Rossmoyne near Canning River, RJM, 149 specimens, WAM 69-47, 69-436-9, 69-845, 69-865, 69-868, 69-1040, 70-3, 70-244, 70-247-50, 71-77-86, 71-88-9, 71-90-6, 71-97-8, 71-106, 71-107-40, 71-143-6, 71-151, 71-245-58, 71-263-8, 71-270-1, 71-389-90, 71-391, 71-437-42, 71-513, 71-538, 71-540-3, 71-544, 71-563, 71-674-81, 71-682, 71-731-8, 71-739, 71-812-18, 71-894-97, 71-972-3, 71-983, 71-1493, 71-1494-5; Rottnest, 20.i.1954, BYM, 1 ♀ M, 3 ♂ M, WAM 71-979-82; Scarborough, 4.viii.1968, RJM, 1 ♀ M, WAM 71-269; Two People Bay, 7.ii.1970, J. Bannister, 3 ♀ M, WAM 71-489-91; Pemberton, at The Colonels, 19.ii.1969, RJM, 1 ♀ M, WAM 69-131, 1 ♀ M, WAM 69-132; Wanneroo, at Lake Badgerup, 12.iv.1969, RH, 1 ♀ M, WAM 69-872; Walpole at Coalmine Beach, 16.ii.1969, RJM, 2 ♀ M, WAM 69-520-1.

DESCRIPTION (After Simon, 1909)

Male. Cephalothorax black, with a narrow complete golden band in the middle; cheliceral and mouth parts black; sternum black. Abdomen black, slightly paler and reddish-tinged in the middle; marked nearer the front with a short yellow median band, fading posteriorly, and with a few small white points on both sides. Under surface golden, becoming yellowish, and faintly dark. Legs dark and ringed without order.

Anterior row of eyes moderately curved forward and almost equidistant. AM at least a third larger than the AL:PM separated by three-quarters of a diameter.

Female. Epigynum scarcely wider than long, the depression at the front moderately narrow but enlarged at the corner on both sides, and divided by a thick, black, strong wall becoming narrower and triangular; the depression is protected by a posterior reddish curtain that is transverse, finely striated, and with a moderately thin semicircular edge on both sides.

VARIATION: Many specimens are of an olive-green to brown colour. The abdomen may have a yellowish or orange-green area anteriorly on the dorsal surface in addition to the yellowish to orange-green longitudinal stripe; the venter of the abdomen may be uniform green-brown with or without darker markings or blotches. Legs olive-green to brownish with darker rings or blotches. The coloration of the species may vary according to habitat, and those taken on black mud or rotting vegetation may be quite dark. The size of the eyes and their interspaces may vary and frequently overlap the dimensions of *Lycosa segregis* as described by Simon. At first, *L. segregis* was thought to be a separate species but it soon became apparent that the two nominal species were synonymous after a large number of specimens of both forms and many intermediate examples were collected from a single locality at Rossmoyne. One mature female WAM 69-865, lacked both AL eyes. The first row of eyes is usually shorter than the second row but specimens with both rows of equal width, and a few in which the first row exceeded the

second, were found. The ratios of the 14 specimens in Table 3 were as follows: 54:56, 57:56, 57:58, 50:52, 44:45, 40:43, 54:55, 48:48, 53:54, 45:58, 57:55, 56:55, 45:48, 43:46. Table 3 shows the dimensions and interspaces of the eyes expressed as a per cent of the total width of the first eye row. The eyes of lycosid spiders are difficult to measure accurately even when using an ocular micrometer under high power. I have taken the diameter of an eye to include the dark surround where the eye emerges from the carapace, and have measured the interspaces as the least width between the raised surface of the eye as above. In a number of cases the combined eye diameters and interspaces as per cent of the first row of eyes frequently exceeds 100 per cent by up to 10 per cent. This error appears unavoidable and is in part due to the slightly curved face of the spider. A number of repeat measurements on the same specimen indicates a human error of up to 5 per cent. The anterior row of eyes is measured under the ocular micrometer and is not calculated from the addition of the diameters and interspaces of the separate eyes (which would make the combined eye diameters and interspaces as per cent of the first eye row total 100 per cent).

TABLE 3: EYE DIAMETERS AND INTERSPACES OF *L. pullastra* CONVERTED TO PERCENT OF THE TOTAL WIDTH OF THE FIRST ROW OF EYES

Regd No.	Sex	C.L.	AM	AL	PM	PL	AM:AM	AM:AL	PM:PM	AM:PM
WAM 71.109	♀ M	5.0	24	17	43	35	9	1.9	26	13
WAM 71.110	♀ M	5.2	25	19	39	33	8	2.3	25	12
WAM 71.111	♀ M	5.6	23	19	40	33	9	3.5	26	14
WAM 71.112	♀ M	4.6	24	20	41	34	10	3.0	29	13
WAM 71.979	♀ M	4.2	22	18	44	36	9	4.5	24	13
WAM 71.980	♂ M	3.8	23	15	45	37	10	4.0	23	11
WAM 71.1455	♀ M	5.6	22	18	37	33	7	4.6	30	15
WAM 71.1493	♀ M	4.3	23	19	42	35	8	4.2	23	10
WAM 71.1497	♀ M	5.0	24	19	43	34	9	3.8	21	13
WAM 71.1498	♂ M	4.3	22	18	43	35	11	3.3	27	10
WAM 71.1501	♀ M	5.7	24	19	33	32	10	1.8	31	16
WAM 71.1502	♀ M	5.0	23	21	41	32	9	3.9	23	11
WAM 71.1503	♂ M	4.2	26	20	45	36	9	2.2	24	10
WAM 71.1504	♂ M	4.2	25	20	45	35	7	2.8	25	9

The number of cheliceral teeth in Lycosid spiders is frequently used as a generic character, but in *Lycosa pullastra* (and *Lycosa meracula*) the retromarginal cheliceral teeth are quite variable (see Table 4). The promarginal teeth number 3 + 3.

The male, like that of *Lycosa arenaris*, has a tubercle on the outer curve of the fang (Fig. 2d); this tubercle is lacking in immature or penultimate males.

Some individual variation can be seen in the shape of the epigyna illustrated in Figure 2, f-k, and in the morphology of the internal genitalia, Figure 2, l-p. The male palp has a short median apophysis bearing a conspicuous tubercle, and a long terminally bifurcate embolic guide (Fig. 2, b, c, e). Although the epigynum is quite distinct from that of *Lycosa arenaris*, some similarities can be noted.

TABLE 4: RETROMARGINAL CHELICERAE TEETH OF *Lycosa pullastra* FROM WESTERN AUSTRALIA

Regd No.	Locality	Retromarginal teeth
WAM 69.868	Rossmoyne	3 + 3
WAM 71.97	Rossmoyne	2½ + 2½
WAM 71.107	Rossmoyne	2 + 2½
WAM 71.1494-5	Rossmoyne	2 + 2
WAM 71.1493	Rossmoyne	2½ + ¼
WAM 71.1455	Bibra Lake	3 + 3
WAM 71.1479-80	Bibra Lake	2 + 2
WAM 71.1481	Bibra Lake	2½ + 2½
WAM 71.1485	Collie	2½ + 2½
WAM 71.1491	Collie	2 + 2
WAM 71.1506	Harvey	2 + 2
WAM 71.1507	Harvey	3 + 3
WAM 71.1497	Attadale	2 + 2
WAM 71.1498	Attadale	3 + 3

SIZE RANGE: Mature females C.L. 2.7 to 5.6 mm. Mature males C.L. 3.2 to 4.5 mm.

DIAGNOSIS: *Lycosa pullastra* differs from *L. arenaris* in having the male palpal organ with a terminally bifurcate embolic guide, and the epigynum of complex shape (Fig. 2, f-k). *L. segregis* is regarded as a synonym.

LIFE HISTORY

Mature males may be collected throughout the year but are most abundant from July to February. Courtship commences early in July and reaches a peak in September and October when clusters of males may be found actively courting mature females; by November courtship declines and *Lycosa impedita* males become more common. The mature male *Lycosa pullastra* continues to court females through the summer months and this species has a prolonged breeding season on the watered suburban lawns. The courtship display of the male is elicited as soon as the male makes contact with the female pheromone; a slow drumming or scratching of the palpal cymbium on the ground commences, and the first pair of legs are held stiffly forwards and vibrated vigorously whilst the male moves forwards in a series of slow, deliberate stops and starts, rather unlike the male of *Lycosa impedita* which makes pronounced forward jerky movements. *Lycosa pullastra* males appear to use the anterior outer surface of the cymbium to locate the pheromone and the palps are frequently moved around as if in a sensing fashion. No courtship response from mature males exposed to the female pheromone occurred unless palpal drumming commenced. The male approaches the female whilst courting strongly, and mounts the female from above with both sexes facing opposite directions. The palpal organ is applied to the epigynum and mating takes place with the palpal organs being applied alternately, the left palp across the left side of the female. Mature male *Lycosa pullastra* that had previously

responded to mature females of the same species did not respond to the pheromone of mature *Lycosa impedita* females.

Mature *Lycosa pullastra* females have been found throughout the year but are most common during the summer months. The first females carrying egg-cocoons are to be observed in July and become common during September and October. Females carrying young become common during the months of October and November, and may be found through to April. The female selects a clear space just outside the burrow, or may construct an open web retreat in which to lay the eggs. The ground is prepared, and a disc of silk laid down; the eggs are deposited as a heap in the centre of the disc, and then webbed over. The female pulls the periphery of the egg package up and folds it over the top of the egg mass to produce a rough ball; the egg cocoon is rotated, and reinforced by silk until a rounded cocoon is made and attached to the spinnerets. The operation of laying eggs to the final attachment of the egg cocoon may take over 12 hours. The female carries the cocoon at all times and may expose it to the morning sun by cradling the cocoon between the hind legs whilst remaining head down in the burrow. The eggs take from 17 to 65 days to hatch; the following data was collected from specimens held in the laboratory: 17 days in December, 1968, 28 days in November, 1968, 44 days in March, 1968, and 65 days during July, 1968. The young commence to leave the female 5 to 12 days after hatching, but some may remain up to 22 days on the abdomen. The egg cocoon varies in size from 5.0 to 9.0 mm in diameter; if a second egg-cocoon is laid during the breeding season it is noticeably smaller than the first. Table 5, gives the numbers of eggs laid by some females captured in the field. Between 150 and 169 juveniles have been counted from the dorsal surface of females captured in the field. The free living young do not construct burrows.

TABLE 5: NUMBER OF EGGS IN THE COCOONS OF *Lycosa pullastra*

Month	C.L.	Number of eggs
July	4.6	266
August	4.9	139 + 28 infertile
September	4.1	135
September	4.8	242
September	5.0	296
October	5.0	245
November	3.5	139

Adults prey on a wide variety of small insects especially Diptera and small beetles, but avoid those beetles with hard exoskeletons. A study of the prey of *Lycosa pullastra* was not undertaken.

As this species frequently hunts during the day a series of crude experiments were undertaken to establish the heat tolerance of the males during January, 1971. A shaded plastic container with a diameter of 10 cm was part filled with grass cuttings and fitted with a thermometer near the base; this container was exposed to the sun and the mature specimen introduced. Of the three males tested all appeared normal at a temperature of 40°C for

a period of 10 minutes, but became agitated at a temperature of 43°C, crouched at 44°C, and became uncoordinated at 45°C. All recovered within 1 hour after transfer to a temperature of 32°C. Field temperatures taken adjacent to the spider varied from 11°C to 35°C.

HABITAT

The damp or moist areas near swamps, lakes, streams, rivers, and estuaries of southwestern Australia. *Lycosa pullastra* prefers grassed areas, or a plentiful supply of rotten vegetation, or leaf litter, on moist sand, loam, or clay soils. Specimens were collected by Mr J. Bannister of the WAM on the dry, rotting surface of washed up seaweed banks of Two People Bay. This species, with *Lycosa impedita*, inhabits lawns of Buffalo, Couch, and other grasses throughout the metropolitan area of Perth, and on some well watered suburban lawns may be extremely abundant during the summer months. Such populations may be significantly reduced if the lawn is mowed frequently or if insecticides are applied. If the grass becomes too high *Lycosa pullastra* will be found sheltering near the margins, particularly near paths and gardens, but if lawns are kept low by infrequent mowing the spider will be found over the entire area.

BURROW

Small open retreats among grass roots are constructed by males, penultimate females, and juveniles. The mature female may web the grass roots or stems into a simple tube-like burrow, and then close the entrance with pieces of grass or silk web after the egg cocoon is laid. On occasions, the burrow of the mature female is simply a webbed over hole in the lawn, a webbed retreat below leaves or rotten logs, or a small burrow up to 5 cm dug into a bank or below the edge of a lawn.

DISCUSSION

Roewer (1954, p. 253) placed both *L. pullastra* and *L. segregis* into the genus *Hogna* (AM-AL = AM-AM), but Simon (1909, pp. 184-5) states that the eyes of the first row are almost equidistant. In all specimens examined by me the distance AM-AL is always less than the distance AM-AM. Guy (1966) treats *Hogna* as a subgenus of *Lycosa*. In the key to the subgenera of the subfamily Lycosinae provided by Guy (1966) specimens of *L. pullastra* key down to the subgenera *Allocosa* (of *Lycosa*), *Arctosa* (of *Arctosa*) and *Allohogna* (of *Trochosa*). The use of eye diameters and interspaces as generic characters is once again of limited value when a series of specimens of such variable species is examined. I have placed *Lycosa pullastra* into the 'arenaris group' of species in the genus *Lycosa* as all mature males possess a conspicuous tubercle on the external surface of the cheliceral fang. The burrows and habitat of all species in the 'arenaris group' are similar, and some similarities can be observed in the shape of the epigyna. It remains to be seen if the 'arenaris group' is an assemblage of related species and thus worthy of generic distinction.

DISTRIBUTION

Southwest of Western Australia within the region receiving more than 400 mm annual rainfall.

***Lycosa lapidosa* sp. nov.**

(Figure 3, a-b, e-j)

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum W3865, ♀ M, C.L. 7.8 mm, Black Duck Creek, near Junction View, SE. Queensland, collected by R. J. McKay and V. Davies, 24 January, 1973. In spirit.

PARATYPES: Black Duck Creek, 24.i.1973, RJM, V. Davies, P. Walker, R. Hobson, 6 ♀ M, 4 ♀ P, 5 ♂ M, QM W3864; East Branch, Blackfellows Creek, Junction View, Queensland, 14.iii.1973, RJM, V. Davies, QM W3866; Boolumba Creek, Kennilworth State Forest, Queensland, 29.i.1973, R. Raven, 1 ♀ M, QM W3867; Pike Creek Dam, Texas, Queensland, 8-9.ii.1973, RJM, M. & E. Archer, 6 ♀ M, 3 ♀ P, 2 ♂ M, QM W3868; Clarence River, 30 miles down river from Tabulam, New South Wales, 24.iv.1973, D. Gleeson, 1 ♀ M, QM W3869.

DESCRIPTION

Based on the holotype.

Carapace dull olive-green without a pattern, but becoming mid-brown with very vague radiating darker stripes after preservation in alcohol; face dark olive-green to ash-brown; paturon brown with ash-grey hair; labium and maxillae brown; sternum light brown to olive-brown without a dark mark. Abdomen olive-green to green-brown above; two longitudinal rows of very small faint white spots on the dorsal surface are present in life, but absent after preservation when the abdomen appears dark brown; ventral surface olive-brown, with three longitudinal dark brown bars converging posteriorly, the middle one divided anteriorly (Fig. 3b). Legs uniform pale olive-green to olive-brown above and below.

Anterior row of eyes procurved and about as wide as the second row, AM larger than AL. Ratio of eyes AM:AL:PM:PL = 21:15:37:32; distance AM:AM 9, AM:AL 6, AM:PM 11, AL:PM 13, PM:PM 22. Clypeus to AM 19. Width of first eye row 92; width of second eye row 94.

Chelicerae with three promarginal teeth, the middle one largest; three retromarginal teeth of equal size.

TABLE 6: MEASUREMENT OF LEG SEGMENTS OF *L. lapidosa* IN MM.

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus
1	5.6	2.9	4.8	4.5	3.0
2	5.4	2.7	4.4	4.4	2.7
3	5.0	2.4	4.0	4.8	2.5
4	6.6	2.9	5.7	6.1	3.6
Palp	2.9	1.3	1.8	—	2.0

VARIATION: Juveniles are dull olive-green or green-brown with an ash-grey sheen. Eye measurements are recorded for ten specimens; each measurement is expressed as a

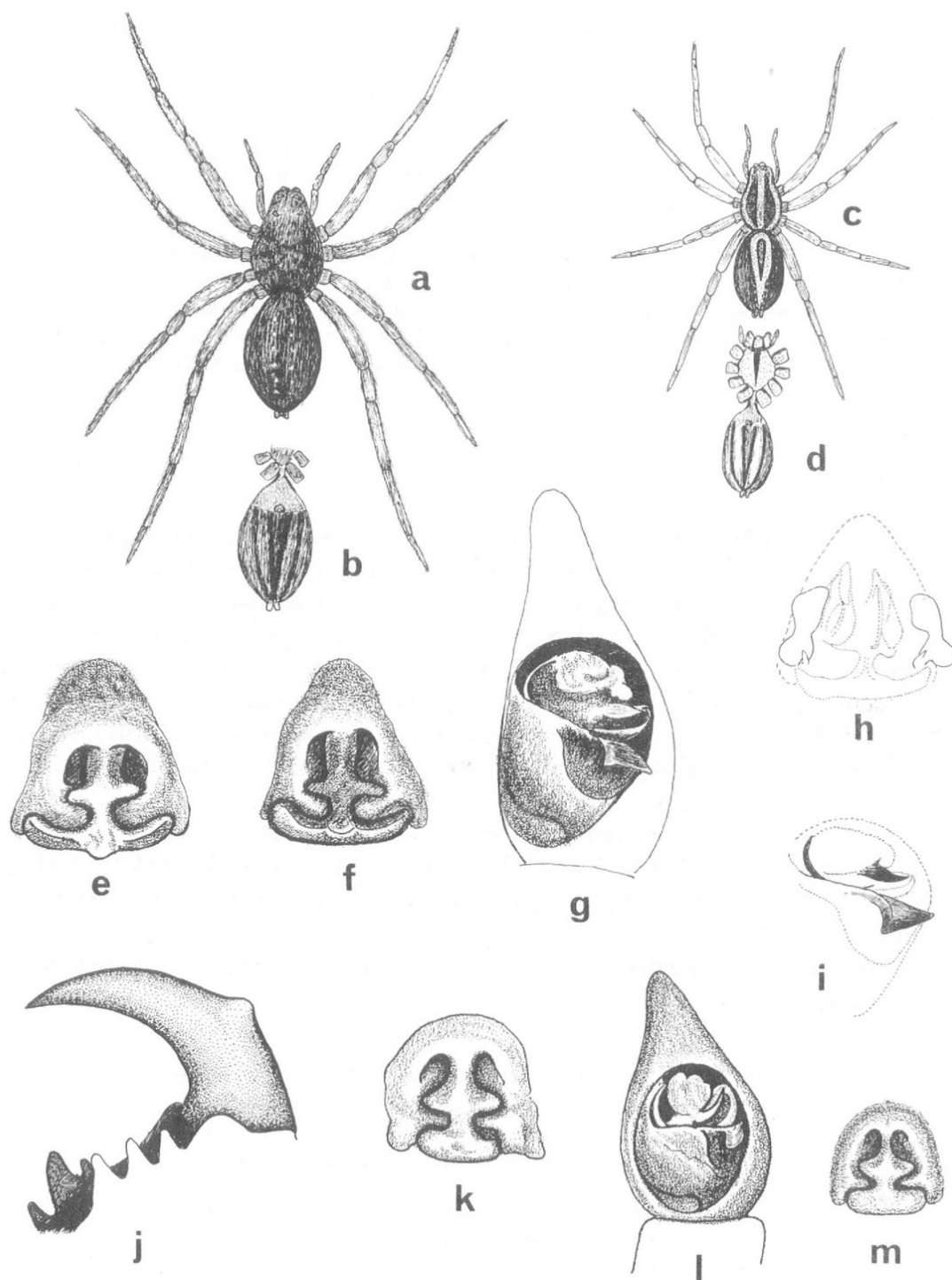


FIG. 3: a-b, e-j, *Lycosa lapidosa*. a, holotype; b, ventral surface of abdomen; e, epigynum of holotype; f, epigynum of QM W3864; g, male palpal organ of QM W3864; h, internal genitalia of mature female QM W3864; i, median apophysis and embolic guide of male palpal organ; j, fang of mature male.

c-d, k-m, *Lycosa furcillata*. c, lectotype; d, ventral surface of abdomen; k, epigynum of lectotype; l, palpal organ of paralectotype male; m, epigynum of QM W3862.

per cent of the total width of the first row of eyes, in Table 7; the first row of eyes may be narrower or wider than the second row, the ratios for the specimens in Table 7 are as follows: 95:96, 97:96, 90:92, 49:50, 92:83, 84:85, 49:52, 93:95, 100:100, 99:99. The epigynum of the holotype and one paratype is illustrated in Figure 3 e, f. The internal genitalia of a paratype female is illustrated (Fig. 3h). Mature males are coloured as above. A conspicuous tubercle on the outer curve of the fang is present in all mature males (Fig. 3j); the palpal organ has a well developed median apophysis and a short pointed embolic guide (Fig. 3i).

SIZE RANGE: Mature females C.L. 7.9 to 8.7 mm. Mature males C.L. 6.5 to 7.9 mm.

DIAGNOSIS: *Lycosa lapidosa* is very similar to *Lycosa furcillata* but lacks a pattern on the carapace, does not have a pale loop-like stripe on the dorsal surface of the abdomen, and the sternum is uniformly coloured. *Lycosa lapidosa* is a much larger species at sexual maturity. *Pirata brisbanae* has a similar pattern on the venter, but differs in coloration, the shape of the epigynum, and the size at sexual maturity.

LIFE HISTORY

Mature females may be collected from January to April in southern Queensland; the mature males have been collected in January and February.

Females with egg cocoons were collected at Black Duck Creek and Pike Dam Creek in January and February. The cocoon measured 7.5–8.5 mm × 9.0–10.2 mm and four cocoons contained from 387 to 486 ova measuring 1.15 mm in diameter.

HABITAT

All specimens were collected on the margins or dry beds of creeks. This species shelters below large water-worn pebbles or rocks, and are most abundant where such rocks are piled into heaps or ridges near the waters edge. A webbed retreat is occasionally built by gravid females and those carrying egg cocoons, but other mature specimens and juveniles merely shelter within the crevices between rocks.

DERIVATION

From the latin 'lapidosus', abounding in stones.

Lycosa furcillata L. Koch, 1867 (Figure 3, c–d, k–m)

Lycosa furcillata L. Koch, 1867, pp. 201–2; L. Koch, 1877, pp. 903–6, pl. 78, Figs. 1, 1a, 1b, 2, 2a, 2b, Bowen, Brisbane, Mackay, Gayndah, Queensland; Sydney, New South Wales; Rainbow, 1911, p. 268; Rack, 1961, p. 37; McKay, 1973, p. 379.

Allocosa furcillata: Roewer, 1954, p. 206.

MATERIAL EXAMINED

SYNTYPES: 3, British Museum (N.H.), BM 1919.9.18. 363-5. The syntype recorded by Rack (1961) was not examined. A lectotype is here designated from this series.

LECTOTYPE: BM 1919.9.18.363, ♀ M, C.L. 6.7 mm, Sydney, epigynum as figured by Koch (1877) and redrawn in Figure 3k.

PARALECTOTYPES: BM 1919.9.18.364, ♀ M, C.L. 5.9 mm, Sydney. BM 1919.9.18.365, ♂ M, C.L. 5.4, Sydney, palpal organ as figured by Koch (1877) and redrawn in Figure 3l. One specimen in the Hamburg Museum (Rack, 1961).

OTHER MATERIAL: Queensland: Samford, near Brisbane. April 1973, D. Joffe, QM W3862, 1 ♀ M, May 1973. QM W3863, 1 ♂ M; Mackay, 28.vii.1973, C.L. Wilton, Otago Museum, New Zealand, 1 ♀ M; Everton Park, Brisbane, 4.iii.1973, RJM, QM W3870, 2 ♀ M.

DESCRIPTION (After Koch, 1877)

Female. Cephalothorax yellowish-brown; a very narrow pale yellow lateral margin with a broad parallel white band from the posterior margin to the anterior corners of the carapace; a broad brownish longitudinal band commences rather narrowly at the posterior margin and reaches the PM, at the anterior end this band is divided by a brown longitudinal stria; three black and white radiating stripes are present on each side of the thorax. Mandibles pitch-black, with yellow-brown hair. Maxillae and labium red brown. Sternum yellow-brown with a broad wedge-shaped black longitudinal spot pointing posteriorly.

Abdomen dark yellow-brown above with brown-yellow hair; a continuous longitudinal lighter stripe which is rounded anteriorly and tapers posteriorly is present on the dorsal surface, in the anterior part of the stripe is a similarly shaped brown spot with the dorsal sigilla within covered by white hair; the posterior half of the longitudinal band is bordered on either side by a row of brown serrations, between each two serrations is a white spot; sides of abdomen brownish-yellow with pale yellow and brown spots. Undersurface of abdomen pale yellowish with three black longitudinal stripes converging posteriorly; the middle stripe containing two yellow spots. Spinnerets yellow-brown. Palpi and legs brownish yellow.

Male. Almost identical in colour and pattern; maxillae are brown-yellow; labium black; the longitudinal wedge-shaped spot on the sternum is smaller; the spots on the longitudinal stripe on the upper side of the abdomen are brownish-yellow and lighter than in the female; the central longitudinal black stripe on the undersurface of the abdomen is split along almost the full length.

Female. Cephalothorax as long as patella plus tibia of the 4th leg. Anterior row of eyes slightly procurved, the eyes equidistant and separated by very narrow interspaces; AM considerable larger than AL and separated by more than a radius from the PM. PM more than a radius apart and about a diameter from the PL.

Male. Cephalothorax is narrower anteriorly than female; eyes similar to female. Mandibles thinner and longer with a denticle on the outside slightly before the middle.

VARIATION: The eye diameters and interspaces of seven specimens are given in Table 8 as a percentage of the total width of the first row of eyes. The anterior eye row is narrower than the second in the ratio 64:71, 58:64, 49:55, 60:66, 64:72, 63:72, 56:65. The clypeus

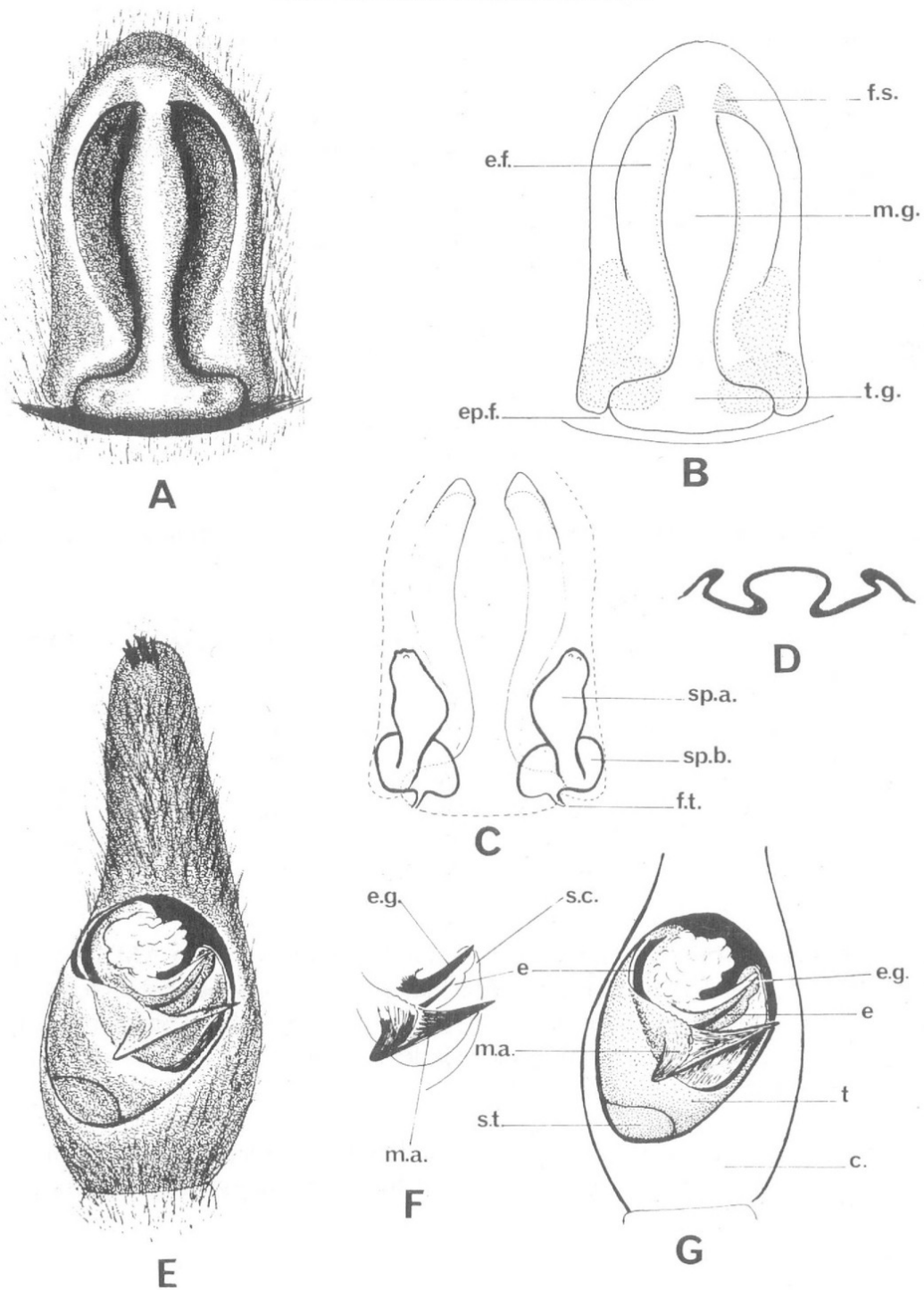


FIG. 4: The genitalia of lycosid spiders; A, external view of epigynum; B, terms used in description of epigynum; C, internal view of dissected epigynum showing spermathecae; D, cross section through B at level e.f.; E, male palpal organ; F-G, terms used in description of palpal organ. Abbreviations: c = cymbium, e = embolus, e.f. = epigynal furrow, ep.f. = epigastric furrow, e.g. = embolic guide or terminal apophysis, f.s. = furrow sac, f.t. = fertilization tube, m.a. = median apophysis or conductor, m.g. = median guide, sp.a. = apical spermatheca, sp.b. = basal spermatheca, s.c. = membranous secondary conductor, s.t. = subtegulum, t = tegulum, t.g. = transverse guide.

TABLE 7: EYE DIAMETERS AND INTERSPACES OF *Lycosa lapidosa* CONVERTED TO PERCENT OF THE TOTAL WIDTH OF THE FIRST ROW OF EYES

Regd No.	Sex	C.L.	AM	AL	PM	PL	AM:AM	AM:AL	PM:PM	AM:PM	AL:PM
QM W3864	♀ M	8.2	23	17	39	36	12	6	24	11	14
QM W3864	♀ M	7.6	24	17	37	35	9	7	25	11	15
QM W3864	♂ M	8.0	27	17	44	37	8	6	22	11	17
QM W3864	♀ M	8.7	23	16	39	33	8	6	26	10	14
QM W3864	♀ M	8.3	24	16	42	36	9	7	25	11	16
QM W3864	♂ M	7.3	27	20	42	35	8	4	25	10	12
QM W3867	♀ M	8.7	24	16	39	33	7	6	24	9	14
QM W3868	♀ M	7.3	26	18	42	34	9	5	23	8	11
QM W3868	♀ M	8.6	25	18	40	33	8	5	22	11	13
QM W3869	♀ M	8.3	24	18	41	33	9	6	23	10	13

TABLE 8: EYE DIAMETERS AND INTERSPACES OF *Lycosa furcillata* CONVERTED TO PERCENT OF THE TOTAL WIDTH OF THE FIRST ROW OF EYES

Regd No.	Sex	C.L.	AM	AL	PM	PL	AM:AM	AM:AL	PM:PM	AM:PM	AL:PM
Lectotype	♀ M	6.7	21	17	45	41	10	6.0	28	12	15
BM 1919.9.18.364	♀ M	5.9	22	17	45	40	8	5.0	23	14	19
BM 1919.9.18.365	♂ M	5.4	23	19	47	40	7	3.5	26	12	18
QM W3862	♀ M	4.6	22	17	45	40	7	5.0	27	12	15
QM W3863	♂ M	4.9	24	18	48	39	6	4.7	23	10	16
QM W3870	♀ M	5.1	21	19	49	42	8	4.8	25	13	16
QM W3870	♀ M	4.4	23	18	48	39	9	5.3	27	15	18

varies in depth from about $\frac{3}{4}$ to a little more than the diameter of an AM. Retromarginal cheliceral teeth 3 + 3. The two mature males have a well developed tubercle on the outer curve of the fang. The epigynum of the lectotype and the female from Samford is illustrated (Fig. 3k, m). The male palpal organ has a well developed curved median apophysis and a curved tapering embolic guide (Fig. 3, l).

DIAGNOSIS: *Lycosa furcillata* is distinguished from all other members of the 'arenaris group' in having a distinctive pale longitudinal stripe on the dorsal surface of the abdomen.

LIFE HISTORY

A mature female collected from a grassed footpath at Mackay on 28 July, 1973, by Mr C. L. Wilton had an egg cocoon with the young emerging. The burrow is unknown; all specimens collected near Brisbane have been found on lawns or pasture grasses.

DISTRIBUTION

Queensland and New South Wales.

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