

On *Paraplectanoides crassipes* Keyserling (Araneae: Araneidae)

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Summary

Paraplectanoides crassipes Keyserling occurs in Tasmania and New South Wales. It makes an oval silk nest on the ground under fallen branches and recumbent shrubs in lightly wooded areas. The nest encloses a system of radial threads and hub beneath which the spider rests. The males feed on collembola as do the early instars of the female. The larger instars and adult of the female feed on cockroaches. There is marked sexual dimorphism, the male being a dwarf. Males reared in the laboratory passed through four juvenile stages and reached maturity in 9-12 months. Females passed through nine or ten juvenile stages and became adult in about three years. A mature female from the field survived in the laboratory for over six years. The longevity may therefore be over nine years. Mating takes place in the nest. The female is able to store sperms for at least six years, over 90% of the eggs produced at the end of that period being fertile. The chelicerae are provided with flanges on fang and paturon. There are two blade-like promarginal teeth and four conical retro-marginal teeth. The tracheal system is confined to the abdomen and the median pair of tubes are branched. The hitherto unknown male is described and some additional features of the female given.

Introduction

Paraplectanoides crassipes Keyserling (1886) is the type species of the genus. The original description and figures are based on the female and are adequate for identification. However, a number of important features are omitted. Little is recorded concerning the habits of the spider. Mascord (1970) states that it builds a small orb web in low herbage, but admits that he is unfamiliar with the habits of the spider. The statement that it makes an orb web is only partially correct.

In the present paper an account of the habits, longevity and life-history of the spider is given, the hitherto unknown male described and Keyserling's

description of the female amplified. Observations are based on specimens found in the field and on others reared in the laboratory.

Methods

The live, specimens maintained in the laboratory were kept singly in separate plastic or glass jars. Each container was fitted with a lid having a central aperture covered with closely woven cloth. Grass-stalks or slender twigs were placed in the jars in such a way as to leave a central cavity in which the spider might make its nest. It often happened that the spider attached the top of the nest to the lid of the jar and when the lid was removed a hole was torn in the nest. However, the damage was usually repaired by the spider and did not appear to cause any serious disturbance to the animal. Moreover, it facilitated observing the behaviour of the spider.

Where possible observations were also made in the field. However, the location of the nest and the minute size of the male rendered it impossible to watch the mating behaviour under natural conditions. In the laboratory a binocular dissecting microscope was used when necessary.

Exuviae cast by immature instars were mounted on slides in the usual way. All measurements were made by means of an eyepiece micrometer.

Egg-sacs, soon after they were made, were removed from the containers and placed in other vessels, where the eggs could be examined or allowed to hatch.

Occurrence

The species occurs in New South Wales and Tasmania. In the latter locality it favours warm dry lightly wooded situations such as East Risdon and the Queen's Domain, near Hobart. The spider is rare and during the past 50 years I have found only 18 mature females and one mature male in the field. It always occurs close to the ground and generally under prostrate shrubs such as the Native Cranberry (*Astroloma humifusum* R.Br.) or beneath dry fallen branches of *Casuarina* trees. Less frequently it is found under loose stones, where there is sufficient space for its nest.

Longevity

Unlike most Araneidae, which have a life span of about one year, the female of *Paraplectanoides crassipes* may live for six years or longer. A mature female found on 18 June 1968 lived in captivity until 4 July 1974, that is for a little over six years. In rearing specimens from eggs under laboratory conditions, it was found that the female required over three years to reach maturity (Table 1). If the same is true under natural conditions, the specimen mentioned must have lived for at least nine years.

Males do not live as long as females. Of two specimens hatched on 5 January 1973 and reared in the laboratory, one, which had mated on 7 March 1974, lived till 6 May 1974 or for 486 days, the other, which had not mated, lived until 5 July 1974, or for 546 days.

Web and nest

The web and nest are made close to the ground in the situations where the spider occurs. In making the web the spider first spins a few intersecting horizontal threads, which are attached to adjacent twigs and other objects. At the point where the threads intersect a small hub of meshed silk is spun. At this stage the web resembles that of those orb-weaving spiders that spin horizontal snares. Beyond this stage, however, the structure is very different. No spiral is con-

structed but a nest is built completely enclosing the radial threads and hub (Fig. 1). The wall of the nest is formed of a mesh-work of silk to which leaves, twigs, grass etc. are attached. The shape is generally ovoid, but may conform to the space available. Under favourable conditions the nest of a mature female may be 8.0 cm long, 5.0 cm wide and 5.0 cm high. A small opening in the wall leads to the interior. The radii and hub are usually nearer to the top of the nest than to the bottom. No viscid droplets occur on any of the threads and no web is made outside the nest. The spider rests on the underside of the hub.

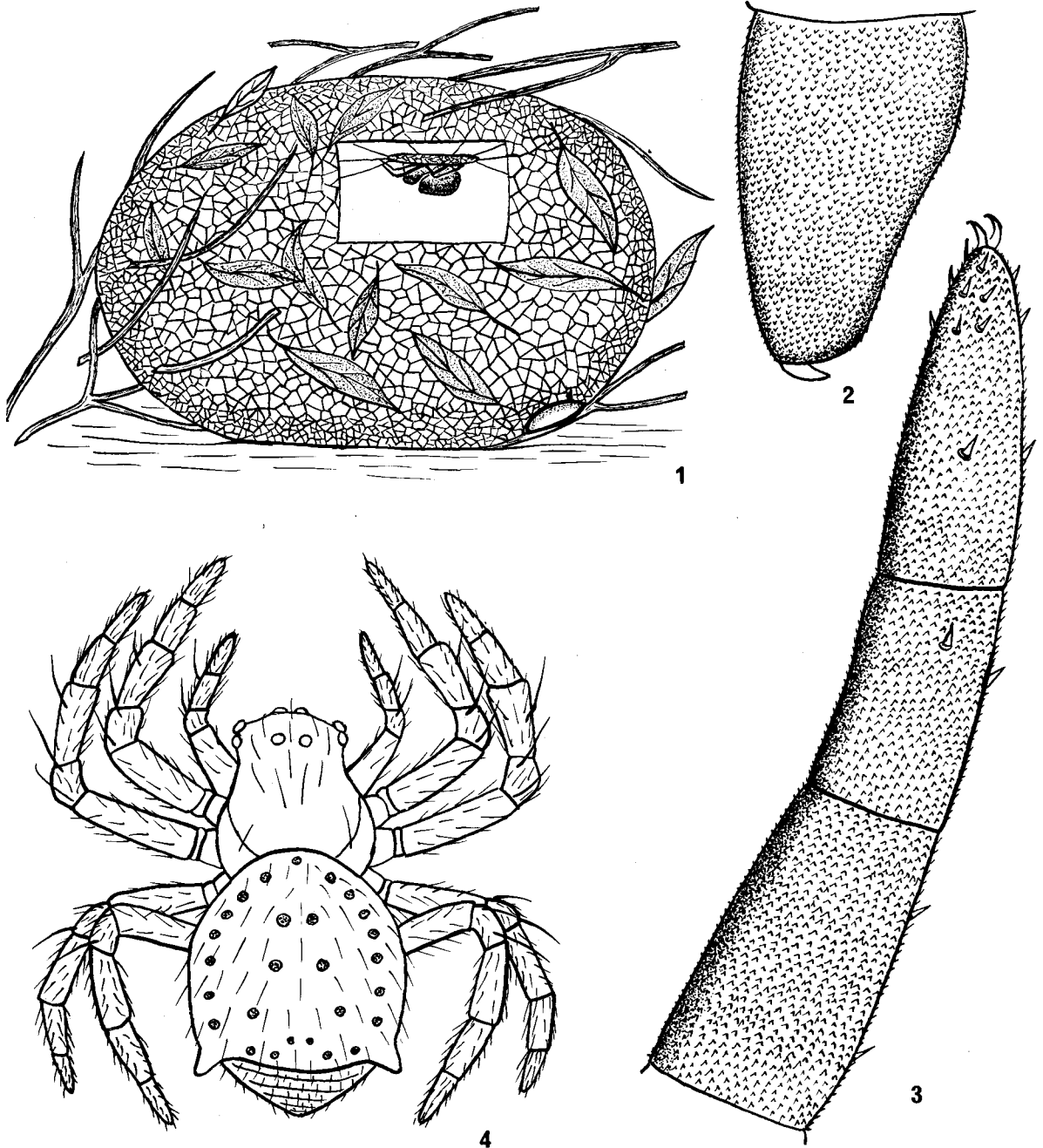
The web and nest made by the male are similar to those of the female but very much smaller.

Food of the spider

From the second to the sixth instar the food appears to consist entirely of collembola. In captivity the young spiders accept no other prey. From the sixth instar to maturity the spider feeds on cockroaches. In the field the nests are usually littered with the remains of the black cockroach, *Platyzosteria melanaria* Erichson. On entering the nest the insect runs about over the wall. The spider moves out from the hub along one of the radial threads and captures the insect by the head. The prey is then carried back to the hub, where it is bound with silk in the usual araneid manner. If more than one insect is caught, the

	Female 1	Female 2	Male 1	Male 2
Hatched	20 Jan. 1971	20 Jan. 1971	5 Jan. 1973	5 Jan. 1973
Ecdysis 1	30 Jan. 1971	31 Jan. 1971	18 Jan. 1973	18 Jan. 1973
Ecdysis 2	2 May 1971	2 Jan. 1972	25 Feb. 1973	8 Apl. 1973
Ecdysis 3	13 Feb. 1972	9 Mch. 1972	26 Mch. 1973	28 Oct. 1973
Ecdysis 4	31 Dec. 1972	18 Apl. 1972	9 Oct. 1973	26 Dec. 1973
Ecdysis 5	2 Feb. 1973	9 Jan. 1973	—	—
Ecdysis 6	5 Apl. 1973	2 Apl. 1973	—	—
Ecdysis 7	30 Nov. 1973	2 Oct. 1973	—	—
Ecdysis 8	29 Dec. 1973	24 Nov. 1973	—	—
Ecdysis 9	12 Feb. 1974	26 Dec. 1973	—	—
Ecdysis 10	—	28 Jan. 1974	—	—
Age in days at maturity	1119	1104	277	355

Table 1. *Paraplectanoides crassipes* Keys. Dates of hatching and ecdyses of two females from eggs laid on 8 December 1970 and of two males from eggs laid on 24 November 1972.



Figs. 1-4: *Paraplectanoides crassipes* Keyserling. 1 nest of female with opening cut in the side to show hub and radial threads; 2 chelicera of first instar; 3 end segments of front leg of first instar; 4 second instar.

others are bound and suspended from the hub until the spider is ready to feed on them.

The sperm web

A male raised to maturity in the laboratory made a sperm web on 19 October 1973, ten days after the final ecdysis. The web was spun between two adjacent radial threads in the male's nest (Fig. 6). Its length, measured along the radial threads, was 0.74 mm and its width between the radial threads 0.57 mm increasing to 0.97 mm. The web was about 2.3 mm from the hub, a loose mesh-work of threads intervening. The sperm droplet was deposited on the middle of the margin of the widest part of the web. Sperm induction was not observed but the whole of the droplet was not taken up.

Mating

Mating takes place within the nest of the female. A male, which became mature on 26 December 1973, was placed in the nest of a virgin female on 7 March 1974 and the mating behaviour observed for about three hours. At first the male moved about the wall of the nest for a short time and then along a radial thread to the hub of the web. Meanwhile the female had adopted a vertical position, head downwards, below the hub. The male now moved onto the ventral surface of the female's abdomen and tapped the epigastric region with his palpi. He then left the female and moved out on the web a short distance from the hub. However, in a few minutes he returned to the female and continued tapping on the epigastrium, especially the epigynum, as if searching for the spermathecal apertures. When these were found copulation took place, the male facing downward and applying left and right palpi alternately. This procedure continued for about three minutes, after which the male left the female and moved out onto the web. In a short while he returned to the female again and copulation was repeated. This behaviour occurred four times during the first hour, the female remaining quite passive. At the end of this time she changed her position and, making peculiar to-and-fro swaying movements of her body, moved away from the hub to the side of the nest. During the next 80 minutes the male either rested or moved about near the hub.

Eventually he again approached the female, which was still at the side of the nest, and copulation occurred a fifth time. He then left the female and retired to the other side of the nest. Here he spent some time drawing the tarsi of the first two pairs of legs between the chelicerae and rubbing them together and on the palpi. Meanwhile the female had returned to the underside of the hub. Finally repeating the to-and-fro swaying movements of her body she approached the male, which moved away hurriedly. The behaviour of the female seemed to imply that further advances by the male would not be received. The male was therefore removed from the nest.

Mating in the field was not observed. However, the only male found in the open, was collected from the nest of a female at East Risdon on 12 July 1944.

Once having mated the female showed no inclination to mate again.

Storage of sperms by female

The adult female found on 18 June 1968 was kept in the laboratory isolated from all males for six years. During this time she made five egg-sacs, one each year except 1969 and 1974. Most of the eggs were fertile and numerous young spiders emerged from the sacs. In order to preclude the possibility of the female mating with a male from her own progeny, each egg-sac was removed from the nest shortly after the eggs were laid. The last egg-sac was made on 2 December 1973. It contained 273 eggs, of which 249 or 91.2% were fertile and gave rise to young. The female had therefore stored sperms for at least five and a half years from the last mating.

Egg-sac, eggs and incubation

The spider usually makes only one egg-sac in the year. However, a female reared in the laboratory and given abundant food made two, one on 18 November 1974 and the other on 18 January 1975. The egg-sac is always made in the nest. It is about 16.0 mm in diameter and almost spherical, the upper surface being slightly flat. It is attached to the underside of the hub of the web. The wall of the sac is composed of white wool-like silk. The female clings to its lower surface or side.

The eggs are pale yellow and about 0.89 mm in diameter. In two egg-sacs found in separate nests at

East Risdon on 2 December 1943 there were 1032 eggs in one and 1033 in the other. A female reared in the laboratory and mated with a male on 7 March 1974 made her first egg-sac on 18 November 1974. It contained 977 eggs.

The duration of incubation varies from 33 to 50 days depending on the ambient temperature.

Immature stages

Two males and two females were raised from the egg to maturity in the laboratory. The males passed through four juvenile instars and reached maturity in a little less than a year. One of the females passed through nine and the other through ten juvenile instars. Each required about three years to reach maturity. The duration of the separate instars showed marked variations in both sexes (Table 1).

Seven to eleven days before hatching a pair of egg-teeth on the pedipalps of the embryo may be seen through the transparent chorion. As soon as the latter is ruptured the embryonic cuticle is cast. First the chelicerae and palps become free, followed by the front pair of legs. The cuticle covering the carapace and dorsal side of the abdomen, followed by that of the second, third and fourth pairs of legs, is then shed. Finally the skin of the ventral side of the body, book-lungs, spinnerets and anal tubercle is moulted. The whole process occupies about 20 minutes, after which the spiderling becomes free in the egg-sac and the embryonic cuticle remains in the abandoned chorion. The newly hatched spider is now in the first instar.

The first instar corresponds to that designated by Holm (1940) as the first postembryonic stage. The body is 1.25 mm long and is colourless, except abdomen, which is yellowish. After 24 hours anterior median eyes become faintly pigmented, other eyes pearly white. Carapace convex and more or less oval. Integument of body and appendages with numerous minute spinules. Chelicerae without teeth but with a short stout fang (Fig. 2). Legs and palpi devoid of trichobothria and other setae, except for a few short spines on tibiae, metatarsi and tarsi (Fig. 3). Two smooth strongly curved claws on legs and one on palpi. Abdomen ovoid and without setae. Spinnerets partly developed but non-functional. After hatching the first instar moves about in the egg-sac flexing and

unflexing its legs. The first postembryonic ecdysis occurs within the egg-sac.

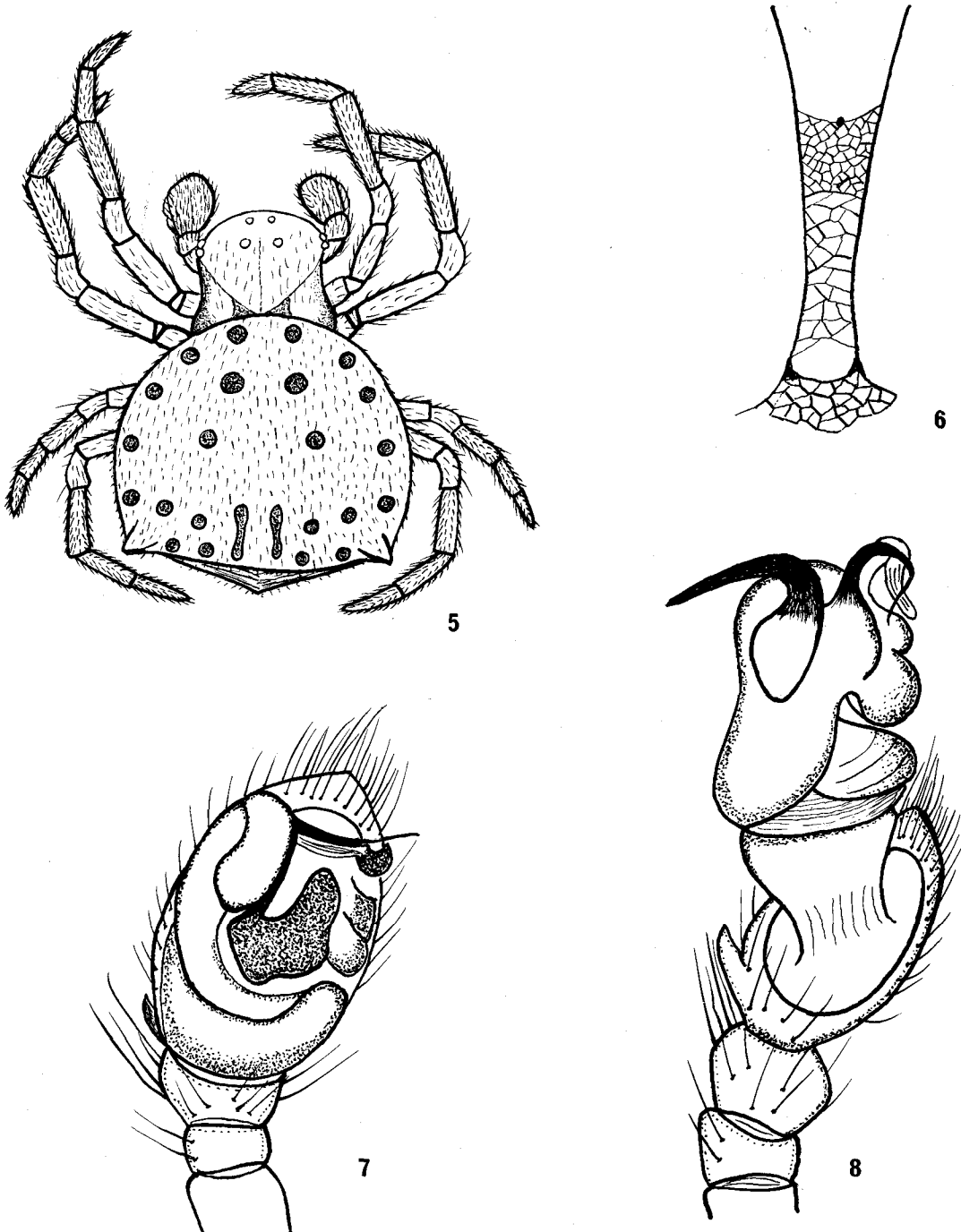
The second instar (Fig. 4) or second postembryonic stage remains in the egg-sac 6-20 days before escaping through the wool-like wall of the sac. Its body and appendages are dark brown almost black in colour with a lighter band round the leg joints. The chelicerae resemble those of the adult (Fig. 9), but have only two lancet-like teeth on promargin and two conical teeth on retromargin. Maxillae with a serrula of 15 teeth. One trichobothrium on basal half of tibiae of first and second legs, two on tibiae of third and fourth; none on other segments. A drum on each tarsus. Upper tarsal claws with three teeth, lower claw with one. Palpi with one trichobothrium on each tibia; claw with one tooth. Dorsal surface of abdomen with a conical projection on each side and a sharply defined margin within which is a row of small sclerites or sigilla. Sides and posterior surface wrinkled.

Soon after escaping from egg-sac the young spider spins a small web and nest.

The third instar resembles the second in form and colour. However, there are two trichobothria on the tibia of each leg and one on that of each palp. At this stage the palpi of the males become distinctly swollen and the sexes thus readily distinguishable.

The fourth instar does not differ much from the third, but has three trichobothria on tibiae of first, second and third legs, with four on those of the fourth. Two occur on palpal tibiae. In males the fourth instar is the final juvenile stage.

In the fifth to tenth instars the female gradually assumes the form and colouration of the adult. Setae on carapace and chelicerae become short and more numerous. Spines on the legs and palpi are more strongly developed. By the sixth instar the carapace and chelicerae are bright reddish brown; likewise the palpi and front two pairs of legs, except their end segments, which remain dark brown. The sternum, two hind pairs of legs and ventral surface of the abdomen also remain dark brown or black. The tubercles on the sternum are now reddish brown. Dorsal surface of abdomen is light brown and more coriaceous with sigilla well marked; the posterior margin has yellowish serrations extending into the light brown dorsal area. Serrula on maxillae now has about



Figs. 5-8: *Paraplectanoides crassipes* Keyserling. 5 male; 6 sperm web between two radii in nest of male; 7 right palp with genital bulb contracted; 8 right palp with genital bulb expanded.

27 teeth. Fourth pair of legs have become longer than the first pair. The two conical projections on the abdomen are retained to the last juvenile instar, but disappear after the final ecdysis.

Comparative measurements of the juvenile instars of a female are shown in Table 2.

Description of adult male

The male (Fig. 5) is a dwarf compared with the female. Its body-length is 2.0 mm and it has the same colouration as the second instar. Chelicerae vertical, conical, without lateral condyle and of the same form as in adult female (Fig. 9). Maxillae strongly converging, with small scopula and a serrula having about 30 teeth. Labium wider than long and rounded in front. Sternum shield-shaped with three small tubercles on each side.

Legs 1-4 are 2.32, 2.28, 1.79 and 2.17 mm long; clothed with barbed hairs but without spines. Three trichobothria on tibiae of first three pairs, four on those of fourth pair; none on other segments. Upper claws with three teeth, lower claw with one.

Palpi 1.09 mm long. One trichobothrium on tibiae. Cymbium spoon-shaped with a short paracymbium (Fig. 8). Embolus slender and curved. In the unexpanded bulb (Fig. 7) it rests in a groove on the surface of a membranous conductor. Lateral sub-terminal apophysis large and hook-shaped.

Abdomen with dorsal surface covered by a coriaceous shield with sigilla as shown in Fig. 5. Sides wrinkled. Epigastrium and a large plate in front of spinnerets sclerotized.

The preceding description is based on the male allotype found in the nest of a female at East Risdon

about 4 kilometres north east of Hobart, Tasmania on 12 July 1944, and on two males reared in the laboratory. The allotype is lodged in the Australian Museum, Sydney.

Supplementary notes on adult female

The description given by Keyserling (1886) omits a number of the following features. The body-length of the mature female varies from 9.3 – 12.3 mm. Chelicerae (Fig. 9) are about 2.0 mm long, conical, with a short curved flange on inner side of paturon near base; no lateral condyle; furrow oblique with two wide blade-like teeth on promargin and four conical teeth on retromargin. Fang well curved with a curved prolateral flange.

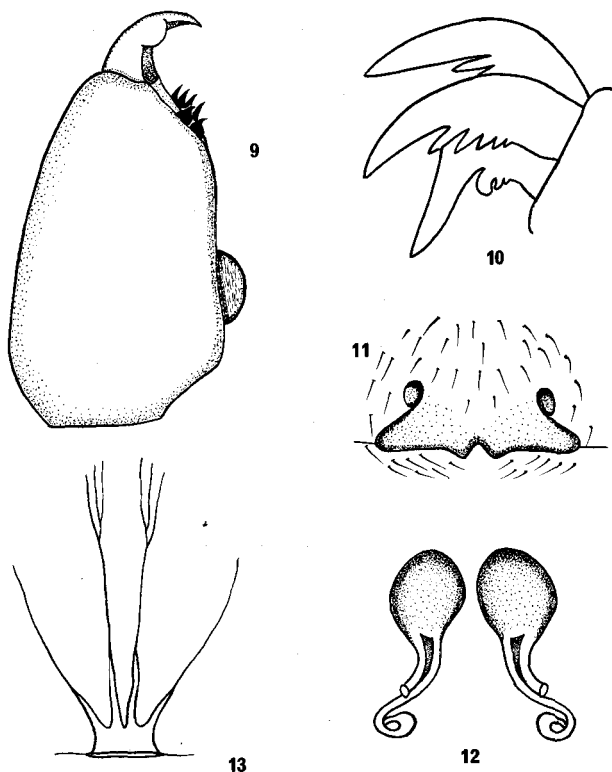
Legs 1-4 in the largest specimen are 10.29, 9.99, 8.40 and 12.35 mm long; clothed with barbed hairs and numerous spines. Trichobothria as in male. Upper claws of first three pairs of legs with five teeth, lower claw with three (Fig. 10); upper claws of hind legs with four teeth, lower claw with two. Auxiliary foot claws present on all legs.

Abdomen round with a coriaceous dorsal surface but lacking the pair of conical tubercles found in males and immature females. Epigynum as in Fig. 11. In transparent preparations the spermathecae are seen as two large pyriform vesicles (Fig. 12). Between afferent and efferent ducts near their junction with the spermathecae is a dark sclerotized ridge.

Tracheal system is confined to the abdomen. The spiracle is close in front of the colulus and leads into a shallow atrium from which an inner and an outer pair of tracheal tubes arise. The inner pair pass straight forward and give rise to three branches near

	Juvenile instars									
	1	2	3	4	5	6	7	8	9	10
Body	1.25	1.25	1.48	2.00	2.34	2.85	3.25	5.30	6.62	8.80
Carapace	0.57	0.57	0.68	0.80	0.97	1.40	1.71	2.28	3.14	4.20
Abdomen	0.68	0.85	1.14	1.60	1.86	2.20	2.39	3.87	4.62	6.80
Leg 1	0.96	1.29	1.54	1.78	2.26	2.79	3.66	4.97	6.75	7.82
Leg 2	0.92	1.26	1.46	1.66	2.11	2.61	3.45	4.73	6.46	7.49
Leg 3	0.81	1.00	1.18	1.36	1.71	2.16	2.84	3.88	5.41	6.47
Leg 4	0.88	1.23	1.46	1.72	2.22	2.88	3.81	5.23	7.31	9.02
Palp	0.47	0.56	0.67	0.73	1.02	1.18	1.59	2.25	2.99	3.55

Table 2. *Paraplectanoides crassipes* Keys. Length measurements of juvenile instars of a female in mm.



Figs. 9-13: *Paraplectanoides crassipes* Keyserling. 9 ♀ left chelicera from front, setae omitted; 10 tarsal claws of ♀ front leg; 11 epigynum; 12 spermathecae; 13 ♀ tracheae.

the level of the epigastric furrow. The outer pair, which are unbranched, pass outwards and upwards converging on the heart (Fig. 13).

Of the adult females collected in Tasmania during the period 1923-1974 one was found at Glen Dhu near Launceston in the north of the State, fourteen at East Risdon and three at the Queen's Domain near Hobart in the south. In addition two were reared in the laboratory.

Discussion

The life span of probably at least nine years in the case of the female of *Paraplectanoides crassipes* Keys. far exceeds that recorded for any other araneid. Bonnet (1945) states that longevity in Araneidae varies from four to eighteen months. Reed and Witt (1972) have shown that under laboratory conditions some

individuals of both *Araneus diadematus* Clerck and *Argiope aurantia* Lucas may survive 15 months.

The system of radial threads and hub enclosed in the nest of *P. crassipes* seems to be an early stage in the development of the orb-web.

With regard to the storage of sperms by females of spiders Kaston (1948) states, "One mating may provide the female with sufficient sperms to fertilize a considerable number of egg masses over a long period of time". Valerio (1970) has shown that a female of *Achaearanea tepidariorum* (C. L. Koch) in the family Theridiidae was able to store sperms for 80 days and that in egg-sacs made at the end of that period 18.75% of the eggs were fertile. In comparison the female of *P. crassipes* is able to store sperms for at least six years and still produce a much higher percentage of fertile eggs.

The marked sexual dimorphism is not unusual in Araneidae. Dwarf males are known in a number of different genera notably *Nephila*, *Arachnura*, *Celaenia*, *Mastophora*, *Gasteracantha* and others.

The number of immature stages passed through by the female is about the same as that recorded for other araneids of similar size. The time taken to reach maturity, however, is much longer being three to four years.

Few studies of the tracheal system in different araneids have been made. Petrunkevitch (1933) lists twelve species representing ten different genera in which the system has been examined. In no case were the inner tracheal tubes branched. The branching of these tubes in *P. crassipes* may or may not be a specific feature.

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A new genus and species of spider of the family Caponiidae from India

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Spiders of the family Caponiidae have not until now been recorded from India. While examining a spider collection from Maharashtra, I came across a new genus and species of caponiid spider, which is described here. This family is being recorded here for the first time from the Indian sub-continent. The spiders of the family Caponiidae are very rare, small and primitive. So far only six genera are recorded from the world.

I am giving here a key of the known genera of the world and the new genus is also included in this key. These spiders were collected from under the bark of a large tree, *Diospyros malabarica* (Desr.).

All the type specimens will in due course be deposited in the collection of the Zoological Survey of India, Calcutta.

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on caponiid spiders of the world. The illustrations used in this paper are prepared by Shri S. K. Chanda, artist, to whom thanks are also due.

Key to genera of Caponiidae

1. Anterior metatarsi bearing a translucent keel along ventral line and the tarsus with a translucent apophysis at base 2
- Anterior metatarsi bearing no such ventral keel and the tarsus with no such apophysis at base 4
2. Anterior tarsi with paired translucent laminae below paired claws and replacing the unpaired claw *Nops* McLeay
- Anterior tarsi with unpaired claw present, no such paired laminae 3
3. Cephalothorax ovate, a distinct false suture dividing anterior tarsus into two principal segments of which the distal is much shorter, as in *Nops* *Orthonops* Chamberlin
- Cephalothorax broader, subround, and more depressed; anterior tarsi with several false sutures of which the most distinct is toward the proximal end *Tarsonops* Chamberlin
4. Eyes two *Caponina* Simon
- Eyes more than two 5
5. Eyes eight, anterior tarsi without false suture *Caponia* Simon