S7. *Ecological data on marronoid spider species*

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Below we give a description of the current state of knowledge and new observations on the ecology of the species used in our study, to justify our coding of ecological characters. Species are phylogenetically ordered. Families of Austral marronoid spiders are in need of revision, therefore we do not give family names here. If no further references are given, the data follows the observations we made during specimen collection and while keeping the spiders in captivity for the kinematic analyses. Ecological data in the literature is generally sparse for Austral marronoids and most of our observations represent previously unknown details of the natural history of this group.

Amaurobius fenestralis (STRÖM, 1768) – Web 1, Stratum 1

This common middle European representative of core Amaurobiidae is typically found under the loose bark of dead trees, where it builds a loose irregular web including cribellar lines. The web typically consists of one or more finely woven extensive silken tunnels, tubes or sheets laid under the loose bark (Fig. S1.A,E) extending into a loose mesh of non-sticky lines and cribellar capture threads (Fig. S1.A,B,D). This mesh may extend onto the outer surface of the tree trunk and be of variable shape and size. Cribellar lines seem not arranged in a regular manner and may include long straight suspended sections (Fig. S1.B,C,F). Cribellar lines may also be present in the tunnel part of the web.

Fig. S1. Web of *Amaurobius fenestralis*. ***A.*** Part of web at standing dead fir tree, loose bark removed in lower part. The web consists of fine woven sheets (sometimes tunnel-like) in the space between the bark and the core wood and a loose mesh extending to the outside surface of the tree trunk. This mesh includes cribellar capture threads (arrow). ***B.*** Detail of cribellar capture threads (arrows). ***C.*** Detail of cribellar capture threads (arrows) spun in captivity. ***D.*** Detail of web opening from under the bark to the outside (arrowhead). ***E.*** Detail of sheet on the inner side of the bark (after bark removal). ***F.*** Detail of cribellar capture threads (arrows) spun in captivity.

Agelena labyrinthica (CLERCK, 1757) – Web 1, Stratum 1

This species builds a typical agelenid funnel web consisting of a tubular retreat in vegetation or litter extending into a wide funnel and planar sheet in the vegetation (Fig. S2.A). *A. labyrinthica* typically builds its web in high grass and shrubs. The sheet is densely but irregularly woven (Fig. S2.A inset) and serves as a platform to capture prey that hits or lands onto the silk. According to Bellmann (2010) the sheet may reach dimensions of 50 cm in diameter.

Tegenaria ferruginea (PANZER, 1804) – Web 1, Stratum 1

This species builds an extensive horizontal funnel web (Fig. S2.B) similar to that of *E. atrica*, also often synathropically in or at sheds, attics, stone walls or other buildings. In natural habitats it is found in rock walls or rotten logs (Bellmann, 2010).

Fig. S2. Webs of Ageleninae. ***A.*** Web of *Agelena labyrinthica* in low vegetation. The arrow points to the opening of the tubular retreat. The inset shows a detail of funnel structure built in captivity (photo by Wolfgang Schlegel, reproduced with kind permission). ***B.*** Web of *Tegenaria ferruginea* in old brickstone wall. The arrow points to the opening of the tubular retreat. The inset shows the spider sitting on the funnel entrance.

Eratigena atrica (C. L. Koch, 1843) – Web 1, Stratum 1

This synanthropic species builds extensive funnel webs often in corners inside sheds or cellars, with its tubular retreat in a narrow space such as a crevice, a crack in a wall or similar.

Coelotes terrestris (WIDER, 1834) – Web 1, Stratum 0

This sturdy agelenid builds a small but dense sheet or funnel web, often connected to a tubular retreat in moss, litter, rotten wood or soil (Fig. S3.A). Sheets are added over time, so that old webs often include several parallel layers of silken sheets with tunnel like spaces in between, giving old webs a labyrinthic structure (Fig. S3.B,C). Tretzel (1961) described that the sheets ('tapetum') are used as a platform to capture prey (mostly beetles) and side chambers are used to deposit the litter of eaten prey. The tubular retreat typically has a length of 10 cm and a width of 1 cm, according to Bellmann (2010).

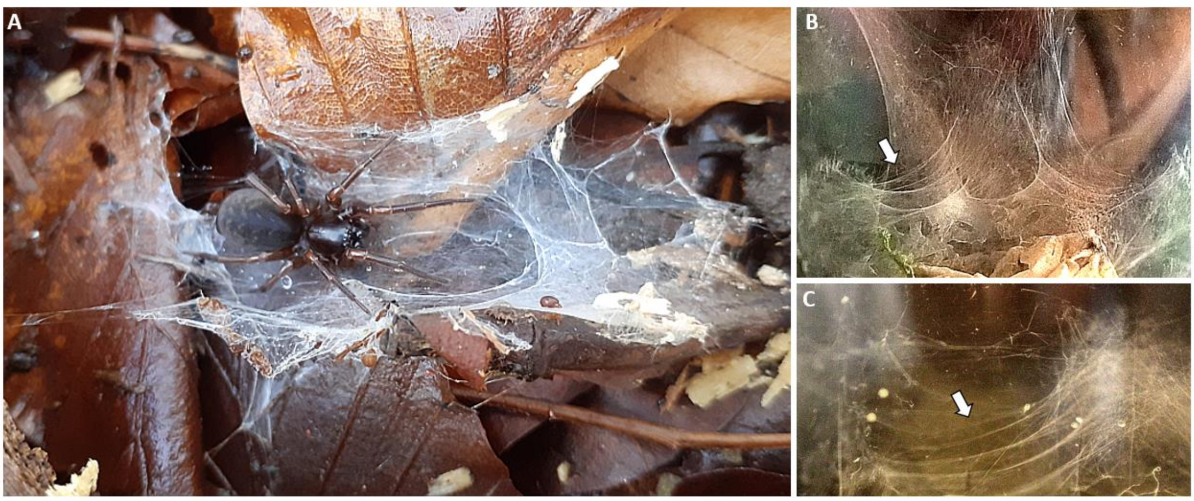

Fig. S3. Web of *Coelotes terrestris*. ***A.*** Web in leaf litter, after removal of piece of dead wood. ***B & C.*** Detail of web structure built in captivity. The arrow indicates parallel layers of silk sheets that accumulate over time.

Histopona torpida (C. L. KOCH, 1837) – Web 1, Stratum 0

This species builds a small funnel web at the ground, such as in moss or cavities between stones and logs. The sheet is thin and finely woven, so that it is barely visible (in contrast to other agelenids). A similar web was constructed in captivity.

Hahnia helveola SIMON, 1875 – Web 1, Stratum 0

Little is known about the webs of Hahniidae (but see (Eberhard, 2018; Opell and Beatty, 1976)). The specimen used in this study was found hanging underneath a small planar sheet amongst moss and litter in an old rotten tree stump. The web was lacking an obvious tubular retreat, which is similar to the observations reported for other species of *Hahnia* (Bellmann, 2010).

Scotospilus ampullarius (HICKMAN, 1948) – Web 0, Stratum 0

Multiple individuals of this species were collected from a single tree on the campus of Macquarie University (Australia) over the course of three years. The spiders were always found under loose bark peeling off the tree with no obvious web structure associated. One individual was found running with a captured oonopid spider in its fangs. In captivity these spiders barely spun silk (apart from draglines that accumulated over time) and captured offered food (*Drosophila* sp.) without the help of silk. Hickman (1947) noted on another species of this genus, *S. bicolor* that they were found in small sheet webs under loose bark, resting under the sheet that was lacking a retreat. Whether this species also uses the web for hunting or simply as a retreat remains unclear.

Cicurina cicur (FABRICIUS, 1793) – Web 1, Stratum 0

Spiders of this species were found in irregular sheet webs lacking a tubular retreat. The webs were found under rotten logs and pieces of rotten wood, or under stones and in moss. In captivity the spiders built sheet webs consisting of parallel layers of silk sheets, sometimes with tubular structures in between. The spider was typically hanging underneath the sheet and rapidly running towards prey (*Drosophila* spp.) hitting the sheet.

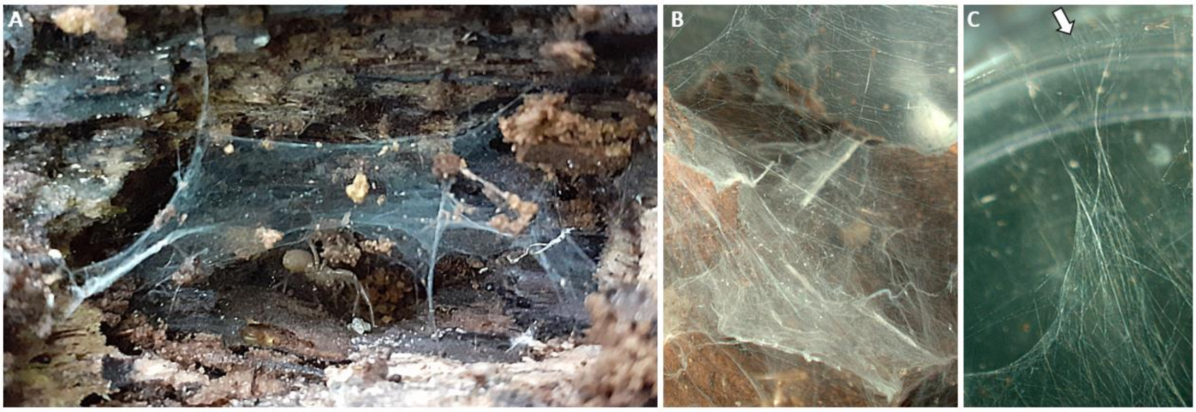

Fig. S4. Web of *Coelotes terrestris*. ***A.*** Web in rotten log. ***B & C.*** Details of sheet built in captivity. The arrow indicates branching attachments of sheet suspension.

Dictyna uncinata THORELL, 1856 – Web 1, Stratum 1

D. uncinata typically constructs its web on the underside of large leaves in trees or bushes (Bellmann, 2010). Details of the web structure are not known for this species, to our knowledge, and webs produced in captivity were not representative. However, the structure of similar dictynid ‘leaf surface webs’ have been described from *Mallos* and *Emblyna* in detail by Eberhard (2019). Here dusting techniques revealed the arrangement of the fine cribellar capture threads in the more or less planar sheet spanned across the curved leaves. The cribellar sheet elements showed a squared/ladder-like arrangement of the cribellar lines, where the cribellar strands are not split and alternately follow or span across long parallel non-sticky lines. One of us (JO Wolff) observed similar structures in *Nigma walckenaeri*, suggesting that this is a common web structure in leaf dwelling dictynids. However, as *D. uncinata* has been reported to typically build its web on the underside of the leaves (where the surface is usually convex and not concave), the web likely has more a three-dimensional structure as described for other *Dictyna* species.

Here the cribellar sheet elements are arranged in various angles depending on the web substrate (such as umbels) (Bellmann, 2010; Blackledge and Wenzel, 2001; Eberhard, 2021). Such webs may have a small tubular retreat in the centre, sometimes associated with a hollow plant structure (like a dry seed capsule) drawn inside the web. Further elements in dictynid webs are runways of non-sticky lines and not sticky sheet elements (i.e. without apparent cribellar silk) (Eberhard, 2021).

Viridictyna cf. *kikkawai* FORSTER, 1970 – Web 1, Stratum 1

The New Zealand dictynids of the genera *Viridictyna* and *Paradictyna* typically build small leaf surface webs, i.e. loose, more or less planar sheets spanning across concave leaf surfaces in trees and shrubs. We observed the spiders sitting on the leaf surface underneath the sheet. We could not observe cribellar capture threads in the loose sheets, at least no ladder elements, however a photo published by Dr Erin Powell on Twitter showed the typical ladder-elements (see above for *D. uncinata*) in the vicinity of the web inhabited by a *Paradictyna* sp. female and two of its juveniles. Forster (1970) regarded these spiders 'cursorial' and interpreted the loose web as a 'brooding retreat' as he found egg sacs in the web. However, we never observed these spiders outside of their webs and the presence of prey remnants attached to the silk indicate that they are web-based hunters. The presence of egg sacs within the capture web is not unusual for web-builders. Egg sacs are directly attached to the leaf surface underneath the sheet (Forster, 1970).

Argyroneta aquatica (CLERCK, 1757) – Web 0, Stratum 1

This species is famous for being the only known spider that fulfils its complete life cycle in an aquatic environment. For this purpose, it constructs a dome shaped web between water plants in standing or slow flowing fresh water systems under which it traps air (Seymour and Hetz, 2011). The dome is a thin sheet of fine non-sticky silk (De Bakker et al., 2006). This 'diving bell' is used as an air filled retreat in which the spider feeds, moults and reproduces (Bellmann, 2010). Prey, such as aquatic insects and small crustaceans are usually caught actively, and the web seems of little relevance for prey immobilization though might play a role in signalling (Schütz and Taborsky, 2003). Hence, we coded this species as non-web building, and interpret its special diving-bell 'web' as a retreat. We code the character 'stratum' in this species as 'above ground' (1) as the spider typically moves along plants, silk lines and freely in the water, but less often on the ground.

Toxops montanus HICKMAN, 1940 – Web 0, Stratum 0

T. montanus is a species endemic of the Tasmanian highlands, where it can be found in alpine and sup-alpine habitats. According to Hickman (1939) who described different aspects of the biology of these spiders, the species is common on low bushes. However, we never found this spider in vegetation above the ground (incl. the type location), but only in the litter under shrubs. This was also observed by others (R. Raven, personal communication, and collection notes on several specimens in the collection of the Australian Museum). This species clearly builds no web and swiftly caught offered small prey (*Drosophila* spp.) in captivity.

Hapona otagoa (FORSTER, 1964) – Web 0, Stratum 1

Hapona spp. are cursorial hunters on low vegetation, according to Forster (1970). This is supported by our own observations: We found these spiders on herbaceous plants and on bushes in rainforests with no associated web structures. However, one individual of *H.* cf. *muscicola* surprisingly built an extensive sheet across pieces of moss in captivity. Whether this was simply a malformed retreat, an assembly of draglines, or indeed some type of web remains to be studied. In the absence of any other information, we think it is best to code this species as web-less.

Laestrygones sp. HICKMAN,1940 – Web 0, Stratum 1

Spiders belonging to this genus have been found in bushes and in tussocks (Forster, 1970; Hickman, 1969), and occasionally in litter and pitfall traps (collection notes on several specimens in the collection of the Australian Museum). Throughout multiple field trips we only found a single spider belonging to this genus, which was beaten from the lower branch of a tree in a rain forest. Nothing is known about the habits of these spiders and it was not possible to keep the spider alive in captivity. If compared to the other small Toxopinae, it is most likely that these spiders are cursorial hunters.

Lamina parana FORSTER, 1970 – Web 0, Stratum 1

These small green-coloured New Zealand toxopids are cursorial hunters according to Forster (1970), however he seemed to have never observed their hunting behaviour as he reported that their prey is unknown. *Lamina* spp. live in the vegetation and are typically collected by beating the lower branches of shrubs and trees in montane forests. We did not observe the hunting behaviour of these spiders, but they typically actively explored their microhabitats. In captivity, some individuals constructed a small, loose sheet of non-sticky silk spanning across leaves (Fig. S5.A). This construction apparently served as a retreat. It is unclear if it also plays a role in prey capture. In the absence of any other information, we treat this species as non-web building.

Myro maculatus SIMON, 1903 – Web 0, Stratum 0

Spiders of this genus are interesting for their distribution across the Antarctic Ocean from New Zealand and Tasmania to Marion Island south of Africa (Forster, 1964; Pugh, 2004). In New Zealand and Tasmania these spiders are only found on pebble beaches including the spray zone (Forster, 1970). Goyen (1890) in his original description of *M. marinus* reported that the spiders occur between the low and high tide water mark (similar to *Desis* spp.). However, Forster (1970) noted that he never found the spider below the high tide line, which is supported by our own observations on *M. maculatus* in Southern Tasmania and *M. marinus* on the South Island of New Zealand. The spiders were found roaming after nightfall, but there were no observations of captured prey. Outside of their active period, the spiders were found under stones with no retreat structures associated.

Ommatauxesis macrops SIMON, 1903 – Web 0, Stratum 0

This is a Tasmanian member of Myroniae, that, in contrast to most other species belonging to this sub-family, are not found in coastal habitats, but instead in the litter under shrubs in montane forests. In captivity these spiders did not spin webs and captured prey (*Drosophila* sp.) without the help of silk.

Fig. S5. Webs of Myroinae. ***A.*** Loose retreat (arrow) of *Lamina parana*, spun in captivity. ***B & C.*** Tubular tangle web of *Otagoa nova*. ***D.*** Loose retreat (arrow) of *Gasparia littoralis*, spun in captivity. ***E.*** Opening of tubular tangle web of *Otagoa wiltoni*.

Otagoa wiltoni FORSTER, 1970 – Web 1, Stratum 1

Otagoa spp. are New Zealand Myroniae that are restricted to the spray zone of coastal habitats (Forster, 1970). We observed and collected *O. nova* and *O. wiltoni* at several locations on the South Island. Both species were found in crevices of coastal cliffs (up to a height of 2 metres). The spiders were found in loose webs of a tubular shape (Figs. S5.B,C). Lines extending from the tube could serve as signal or tripping lines. Spiders became active after nightfall. Although single specimens of *O. wiltoni* were found roaming, the majority were observed displaying a lie-in-wait hunting strategy at the entrance of their webs (Fig. S5.E). Although no prey capture was observed, due to this lie-in-wait ambush behaviour, we assume that the web has some supporting function in prey capture.

Gasparia littoralis FORSTER, 1970 – Web 0, Stratum 0

Gasparia is a speciose myroin genus from New Zealand including both coastal and inland species from different types of habitats (Forster, 1970). As is typical for other Myroninae, *G. littoralis* is restricted to coastal habitats, where it occurs amongst stones and at the base of cliffs above the seashore. We found this species roaming after nightfall, but did not observe prey capture. In captivity, the spiders built loose sheet like retreats (Fig. S5.D).

Otira FORSTER & WILTON, 1973 sp. – Web 0, Stratum 0

Spiders belonging to this genus are small ground dwelling spiders found in the rainforest on the West coast of New Zealand (Forster and Wilton, 1973). Nothing is known about their habits. We only found a single spider belonging to this genus, which was sieved from moss and litter, and did not build any silken structure in captivity. In the absence of any other information this species was treated as non-web building.

Pakeha media FORSTER & WILTON, 1973 – Web 0, Stratum 0

We found this species under rotten logs, with no silk structures associated. In captivity it did not construct any web. In the absence of any other information this species was treated as non-web building.

Storenosoma terraneum DAVIES, 1986 – Web 0, Stratum 0

We collected and observed multiple individuals of *S. terraneum*, *S. altum* and *S. forsteri*. The spiders were found under rotten logs and in litter with no apparent silk structures associated. In captivity they captured offered prey (nymphs of *Acheta domesticus*) without the help of silk, using the spinated front legs. Some individuals built a sac-like retreat (Fig. S6.A,B), in which they also moulted.

Tanganoides greeni (DAVIES, 2003) – Web 1, Stratum 0

These spiders were found under logs, usually under small irregular silken sheets (Fig. S6.D). It was not observed if these webs were used as prey capture devices, or if they merely serve protective function. Due to the extent and web-like character of the sheets, in the absence of further data, we coded this species as web-building.

Fig. S6. Webs of Cycloctenidae. ***A & B.*** Silken retreat of *Storenosoma terraneum*, built in captivity. ***C.*** Web of *Tasmarubrius pioneer* under rotten log. ***D.*** Web of *Tanganoides greeni* under rotten log.

Tasmarubrius pioneer DAVIES, 1998 – Web 1, Stratum 0

Similar to *Tanganoides greeni*, *Tasmarubrius pioneer* was found under rotten logs, often in association with irregular sheet webs (Fig. S6.C). The coding follows the same reasoning as the previous species.

Oztira affinis (HICKMAN, 1981) – Web 0, Stratum 0

This Tasmanian species was extracted from litter in rain forests. In captivity, it did not construct any silken structures. In the absence of any other information this species was treated as non-web building.

Cycloctenus cf. *westlandicus* FORSTER, 1964 – Web 0, Stratum 1

The medium to large sized *Cycloctenus* species are common nocturnal cursorial hunters in temperate rain forests of New Zealand, Tasmania and (less common) mainland Australia. They are typically found using a lie-in-wait ambush strategy on moss covered tree trunks, logs and rocks after nightfall and swiftly run off if disturbed. In captivity, these spiders never constructed any silken constructs apart from few draglines and readily captured prey (juvenile *Acheta domesticus*) without the help of silk.

Toxopsiella dugdalei FORSTER, 1964 – Web 0, Stratum 0

These spiders overall have a similar habitus (albeit with shorter, less laterigrade legs) and hunting style as the larger *Cycloctenus* spp., but seem to be more restricted to ground habitats (Forster, 1979). One individual of *Toxopsiella* sp. in captivity built a flimsy sheet serving as retreat.

Plectophanes BRYANT, 1935 sp. – Web 0, Stratum 1

These cycloctenids have an interesting ecology: They are ambush hunters that utilize hollow twigs and abandoned insect bore holes in tree trunks and standing rotten logs as a retreat (Forster, 1967; Forster, 1979). After nightfall they emerge to the opening of the hole, where they sit in a typical ambush position with the front legs placed around the opening ready to strike (Forster, 1967). The elongated carapace and the placement of the eyes on a frontal projection of the carapace are apparent adaptations to this hunting strategy and suggest that visual cues play an important part in prey recognition (Forster, 1967; Forster, 1979). Further research is needed to clarify if these spiders also use signalling substrate lines to enhance prey recognition, but thus far there are no reports of any silk structures associated with the retreat and in captivity these spiders produced barely any lines.

Paravoca aff. *otagoensis* FORSTER & WILTON, 1973 – Web 0, Stratum 0

We found these spiders under rotten logs with no apparent silk structures associated. In captivity they did not construct any silken structures. In the absence of any other information this species was treated as non-web building.

Huara chapmanae FORSTER & WILTON, 1973 – Web 1, Stratum 1

According to Forster & Wilton (1973) spiders of this genus "construct weak and rather formless sheet webs on the ground amongst debris" and occur in a variety of habitats. *H. chapmanae* was collected from moss at tree trunks, litter and under logs (Forster and Wilton, 1973). We found this species in moss, on herbs and ferns. Overall it seems to occur regularly in above ground habitats. In captivity one individual built a loose substrate bound sheet, but its utilization as a prey capture device could not be observed. In the absence of any other information this species was treated as web building.

Huka pallida FORSTER & WILTON, 1973 – Web 0, Stratum 0

These tiny unpigmented spiders are found in moss and detritus on the forest floor and seem to be cursorial hunters (Forster and Wilton, 1973). We did not notice any silk structures associated with these tiny spiders in the field nor in captivity, and hence follow the proposal by Forster & Wilton (1973).

Porotaka detrita FORSTER & WILTON, 1973 – Web 0, Stratum 0

Similar to *Huka* spp., *Porotaka* spp. are tiny spiders living in moss and fine structured litter (Forster and Wilton, 1973). In captivity these spiders did not produce any obvious silken structures, but prey capture could not be observed. In the absence of any other information this species was treated as non-web building.

Tuapoka cavata FORSTER & WILTON, 1973 – Web 1, Stratum 0

Similar to *Huka* spp., *Tuapoka* spp. are tiny cribellar spiders found in moss and litter (Forster and Wilton, 1973). Nothing is reported about their habits. Several individuals of *T. ovalis* constructed tiny sheet webs in between the leaves of moss in captivity on or under which they resided. Prey capture could not be observed due to the tiny size of these spiders. We could not make observations for *T. cavata*, which is a more pigmented and slightly bigger species. In the absence of further information, we assumed a foraging ecology similar to *T. ovalis* and coded this species as web building.

Mahura musca FORSTER & WILTON, 1973 – Web 0, Stratum 0

Mahura spp. are small spiders commonly found in moss and litter in the forests of New Zealand. The genus is interesting as it contains both cribellar and ecribellar species. Forster and Wilton (1973) noted that these spiders apparently do not construct a web, however without giving observational details. Eberhard and Peirera (1993) remarked on an unidentified species of *Mahura* that was building a sheet web and described the ultrastructure of its cribellar threads. However, in their work the identity of the species is doubtful as the specimen was collected in Australia, from which no species of this genus are described.

Individuals of *M. turris*, an ecribellar species similar to *M. musca*, that we kept for several days in captivity did not produce any apparent silken structures. In contrast, several individuals of *M. spinosa*, a cribellar species, constructed three-dimensional webs between the leaves of moss in captivity (Fig. S7.D). Due to the small size of these spiders, we could not observe details of the web or the mode of prey capture, but the web was much larger than the spider and did not have the characteristics of a simple retreat. In the absence of further information we assume that ecribellar spiders of this genus are primary cursorial hunters and the cribellar species are web builders.

Mahura sorenseni FORSTER & WILTON, 1973 – Web 1, Stratum 0

This is a cribellar species, for which we assume a similar ecology as observed for *M. spinosa* (see details above).

Fig. S7. Webs of the Orepukia group of Cycloctenidae. ***A.*** Web of *O. sorenseni* under rotten log. ***B.*** Brood chamber of *O. sorenseni* in soil (after removal of a stone), the yellow mass in the middle is the egg sac. ***C.*** Web of *O. sorenseni* under rotten log. ***D.*** Web of *Mahura spinosa*, produced in captivity.

Orepukia alta FORSTER & WILTON, 1973 – Web 1, Stratum 0

Spiders belonging to the genus *Orepukia* are very common on the South Island of New Zealand (Forster and Wilton, 1973). They are typically found under logs and stones and in litter and debris, where they construct a small formless sheet web (Fig. S7.A-C).

Aorangia aff. *otira* FORSTER & WILTON, 1973 – Web 1, Stratum 1

Aorangia spp. construct dense horizontal ecribellar sheet webs in the vegetation and in banks, with a loose open funnel retreat (Fig. S8). Forster & Wilton (1973) noted that the webs are typically found between logs and stones on the ground and that the presence of both sexes in pitfall traps suggests that they may be facultative web builders. However, at least for the species *A. poppelwelli* and *A.* aff. *otira*, we never observed occurrences on the ground nor did we observe these spiders wandering outside of their web. We therefore coded *Aorangia* aff. *otira* as web builder that typically occurs above the ground.

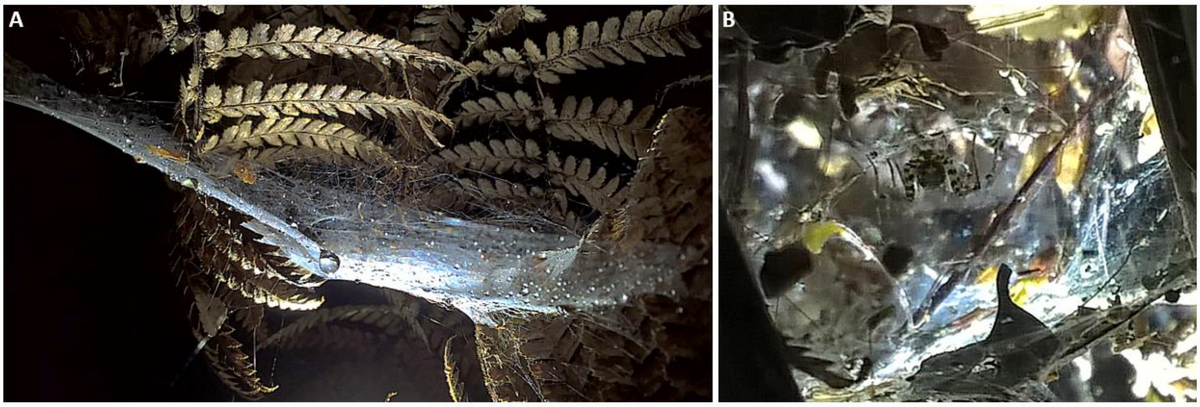

Fig. S8. Web of *Aorangia* sp. ***A.*** Web between dead tree fern fronds. ***B.*** Detail of loose tubular retreat at the web base.

Wiltona filicicola (FORSTER & WILTON, 1973) – Web 0, Stratum 1

This small spider was swept from vegetation and seems to be a cursorial hunter as it did not construct any silken structures in captivity. This is supported by Forster & Wilton (1973), who remark that this species is an active hunter on low foliage.

Fig. S9. Webs of *Neoramia* spp. ***A.*** Web of *N. charybdis* at tree trunk, with central tunnel-like retreat in cavity flanked by long cribellar capture threads (arrows). ***B.*** Tubular part of web of *N. janus* under rotten log (after overturning log). ***C.*** Web of *Neoramia* sp. in dead fronds of tree fern, cribellar capture threads are marked with arrows. ***D.*** Entrance of web of *N. janus* in litter with cribellar threads (opening of silk tube under stone). ***E.*** Detail of cribellar capture threads of *Neoramia* sp. in alpine vegetation.

Neoramia janus (Bryant, 1935) – Web 1, Stratum 0

Neoramia is a speciose and very common genus in New Zealand. Its species occur in various habitats and construct a variety of webs and snares, usually comprised of a tubular retreat and a loose sheet (Forster and Wilton, 1973). In the arboreal species, the retreat is usually in crevices, under loose bark or in decayed plant material and the sheet includes long straight cribellar lines with thick puffs (Figs. S9.A,C,E). In contrast, *N. janus* is typically found on the ground, where it constructs its retreat in litter, under stones and rotten logs, from which a substrate-bound irregular mesh-like cribellar sheet extends (Figs. S9.B,D).

Oramia littoralis Forster & Wilton, 1973 – Web 1, Stratum 0

This species typically occurs in coastal habitats in the spray zone of coastal habitats and constructs a formless sheet web amongst stones (Forster and Wilton, 1973). The single individual we found during this study, was collected from a loose cribellar web at the edge of the open stone area of the beach at the base of grass tussocks and soil.

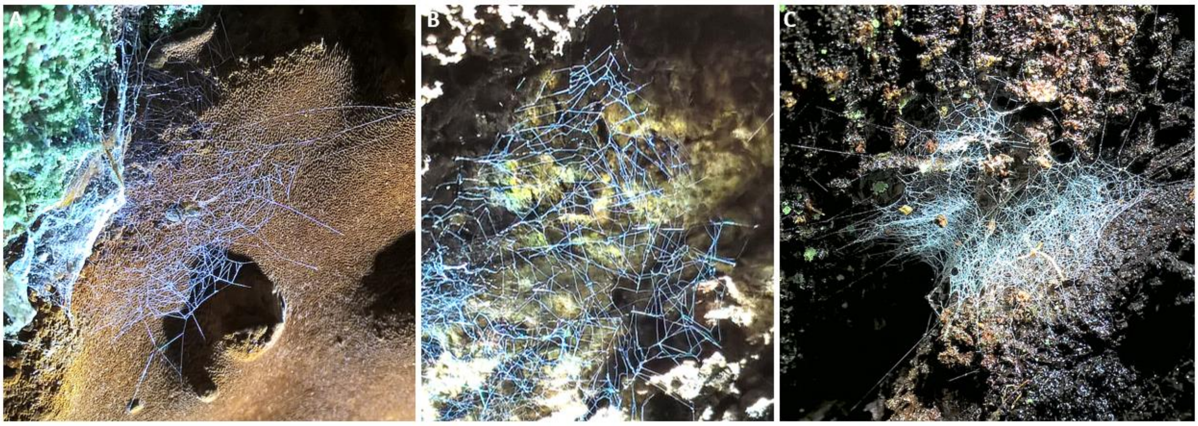

Fig. S10. Webs of *Dunstanoides* spp. ***A & B.*** Web of *D. hesperis* at tree trunk, with short cribellar capture threads. ***C.*** Web of *D. hinawa* at tree trunk.

Dunstanoides hesperis (Forster & Wilton, 1973) – Web 1, Stratum 1

According to Forster & Wilton (1973) spiders belonging to this genus are found on the ground, under bark and in shrubs and construct a formless sheet web. However, at least for *D. hesperis* and *D. hinawa*, our observations indicate that these spiders prefer flat vertical or overhanging substrate surfaces, such as tree trunks, rock surfaces and soil banks, where they build a regular disc-like web. The sheet is usually spun across a depression in the substrate surface and includes a central hub-like disc under which the spider resides and from which radial lines stretch towards an outer frame of the sheet or further extending as strained guying lines attached to the substrate (Fig. S10). Split cribellar lines are suspended in spiral or zig-zagging patterns between these 'radii'. These overall characteristics make the web look 'orb like', although the structure is often less clear as in true orb webs (e.g. of Uloboridae). Due to the small size of the webs (1-3 cm in diameter) and their occurrence in confined spaces we could not clarify if a central tubular retreat is attached to the 'hub' as found in the comparable webs of *Neolana* and *Stiphidion* spp.

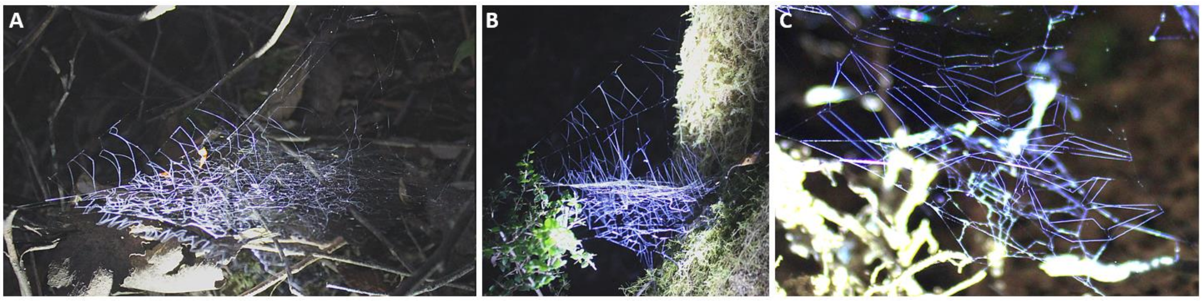

Fig. S11. Webs of undescribed genus of Tasmanian cribellar Stiphidiidae. ***A & B.*** Typical suspended sheet with cribellar capture threads and cribellar tangle lines. The spider rests in a silken tube in the substrate (moss, litter or crevices in bark of tree trunk) connected to the sheet (not visible here). ***C.*** Detail of arrangement of cribellar capture threads in the horizontal sheet.

Stiphidiidae spec crib TAS – Web 1, Stratum 1

This is an undescribed genus of cribellar stiphidiids that are common in the rainforests of Tasmania. These spiders build cribellar sheet webs against tree trunks and amongst coarse debris on the ground. The webs share the following characteristics with the webs of Borralinae (see further below). The horizontal sheet extends from a substrate based tubular retreat made of ecribellar silk and is suspended between substrate structures. In the sheet, the cribellar lines are split and suspended in a zig-zagging manner between parallel straight threads (‘runway’ lines) or between the outer frame lines of the sheet. The sheet is kept in shape by additional upper guying lines. Vertical cribellar tangle lines are suspended in a zig-zagging manner between those upper guying lines and the structural (‘runway’) lines of the sheet. These tangle lines are usually not split. The occurrence of this elaborated web type outside the Borralinae may suggest that it is ancestral to the Australian clade, if not the whole family. Accordingly, the below described webs of *Stiphidion* spp., *Tjurunga* spp. and the Taurongia group would represent modifications from or reductions of this original web shape.

Tjurunga LEHTINEN, 1967 sp. 2 – Web 1, Stratum 1

The genus *Tjurunga* is unusual for the family Stiphidiidae in being ecribellar (Lehtinen, 1967). These spiders are not uncommon in alpine habitats of Tasmania and construct extensive sheet webs. The webs of *Tjurunga* sp. 2 were found in Pandani trees, and were comprised of a very sparse retreat between the leaf bases extending into a more or less horizontal, irregularly meshed sheet along or between the leaves, suspended in upper and lower vertical tangle lines (Figs. S12.A-C). The tangle lines keep the sheet strained and where the lower tangle lines attach to the sheet it is locally strained leading to pointy depressions (e.g. see Figs. S12.A-B). These characteristics are very similar to the webs of Porteriinae (Desidae; see further below) and represent an interesting convergence. The spider moves on the underside of the web in a hanging fashion.

Fig. S12. Webs of *Tjurunga* spp.. ***A & B.*** Web of *Tjurunga* sp. 2 in Pandani tree. ***C.*** Detail of web of *Tjurunga* sp. 2, the spider retreats in between the leaf blade bases with little silk deposition. ***D.*** Web of *Tjurunga* sp. 3 at ground between tree roots.

Tjurunga LEHTINEN, 1967 sp. 3 – Web 1, Stratum 0

This species is apparently related to the previous one, but in contrast, its webs were found in banks and between tree roots in rain forests (Fig. S12.D). Due to the occurrence in confined spaces details of the web structure could not be observed.

Taurongia HOGG, 1901 sp. 3 – Web 1, Stratum 0

The Taurongia group is a taxonomically poorly documented group of stiphidiids with a robust habitus that occur in ground habitats in the rain forests of Tasmania and mainland Australian’s East coast.

Taurongia spp. build irregular sheet webs extending from a burrow retreat in the substrate (Gray, 2005) (e.g. Fig. S13.B). The spider moves on the underside of the web (Fig. S13.A). We collected *Taurongia* sp. 3 during the breeding season and found the females in brood chambers under rotten logs with the walls consisting of a mesh of cribellar silk and attached debris (Fig. S13.C).

Taurongia HOGG, 1901 sp. 4 – Web 1, Stratum 0

Taurongia sp. 4 was collected from inside rotten logs. The webs consisted of a substrate-bound irregular mesh of cribellar silk (Fig. S13.D). Found brood chambers were comparable to those of the previous species (Fig. S13.E).

Taurongia HOGG, 1901 sp. 5 – Web 1, Stratum 0

The ecology of this species is similar to the other species of this genus.

Fig. S13. Webs of undescribed Tasmanian *Taurongia* species. ***A.*** Sparse horizontal sheet web of *Taurongia* sp. 1, built in captivity. ***B.*** Web of *Taurongia* sp. 1 in soil of creek bank, consisting of silken tubes in soil extending into a sparse sheet. ***C.*** Brood chamber of *Taurongia* sp. 3 under rotten wood at ground. ***D.*** Web of *Taurongia* sp. 4 in rotten log. ***E.*** Brood chamber of *Taurongia* sp. 4 in rotten log.

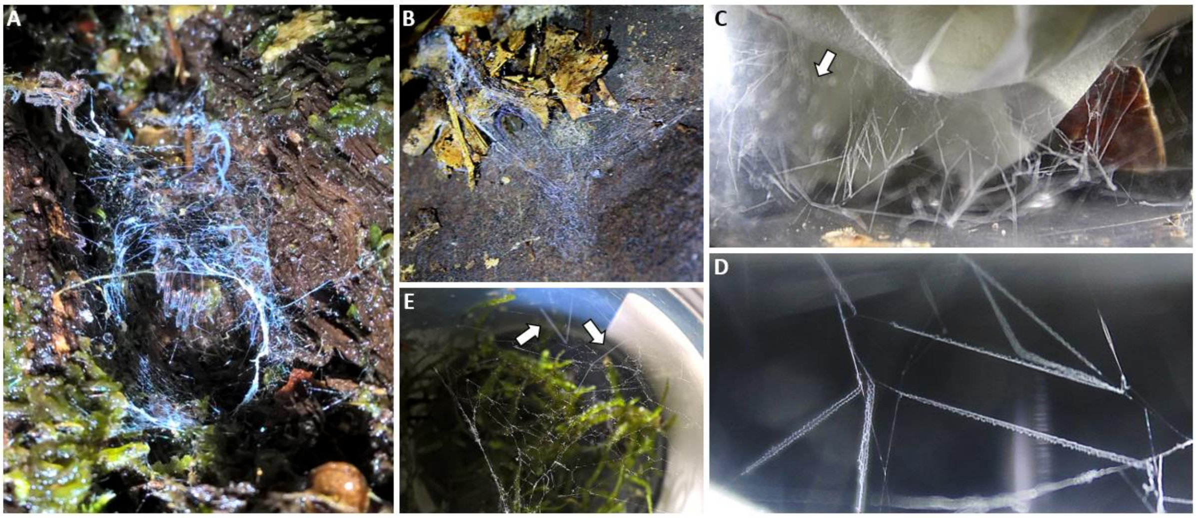

Fig. S14. Webs of undescribed species from Taurongia group from New South Wales. ***A.*** Tubular web of spec. 3 under rotten log. ***B.*** Funnel web of spec. 3 under stone (collapsed after stone turned over). ***C.*** Tubular web of spec. 5 constructed in narrow space in captivity, with cribellar tangle web; the arrow points to the circular opening indicating the tubular character of the web. ***D.*** Detail of cribellar threads of the web shown in *C*. ***E.*** Sheet web spun by spec. 3 in captivity; arrows point to fresh cribellar capture threads integrated into the sheet.

Taurongia group spec 1 – Web 1, Stratum 0

Representatives of an undescribed genus apparently belonging to the Taurongia group were collected from ground habitats in moist highland forests of New South Wales. The collected specimen representing Spec 1 was found under a rotten log guarding an egg sac. We assume that the ecology of this species is similar to that of the other members of this group.

Taurongia group spec 2 – Web 1, Stratum 0

The collected specimen representing Spec 2 was sieved from leaf litter. We assume that the ecology of this species is similar to that of the other members of this group.

Taurongia group spec 3 – Web 1, Stratum 0

Individuals of Taurongia group spec 3 were found under logs and stones, sitting in loose tubular retreats (Figs. S14.A-B). The retreats extended into an irregular sheet including cribellar threads. In captivity, the construction of new cribellar lines could be observed – these were laid out in short zig-zagging patterns with ecribellar sections in between (Fig. S14.E). In an individual of a related species ("Spec 5"), more details of the web structure could be observed in captivity: Cribellar elements were spanned across confined spaces surrounding the retreat (Fig. S14.C). The cribellar lines were not split and suspended in short sections between non-sticky vertical tangle lines (Fig. S14.D).

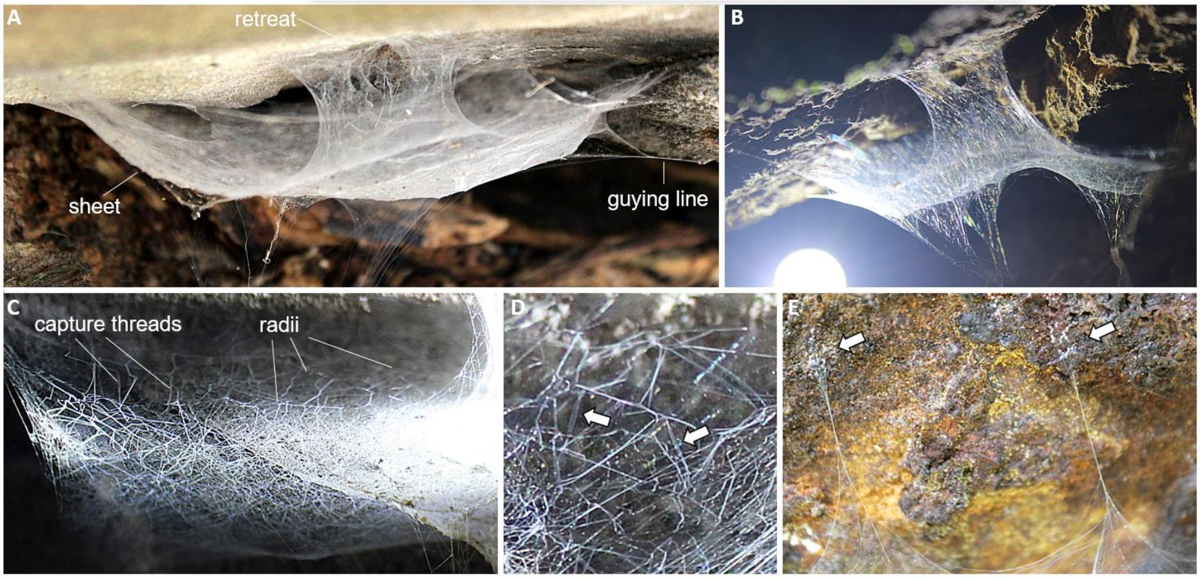

Fig. S15. Webs of *Stiphidion* spp. ***A.*** Web of *S. facetum* on overhanging rock surface, as seen from side. The spider rests in a cylindrical retreat equipped with lateral entrance holes and covered by the dense sheet that is held in shape by few bundled guying lines. ***B.*** Web of *S. adornatum*, as seen from side. ***C.*** Detail of the inner sheet surface in a web of *S. facetum*. Note the radially arranged structural lines between which the cribellar capture lines are spanned. ***D.*** Detail of cribellar threads in the inner sheet of a web of *S. facetum*; the arrows indicate fresh cribellar threads. ***E.*** Detail of guying lines. The arrows point to clustered attachment discs (anchors) of the bundled lines.

Stiphidion facetum SIMON, 1902 – Web 1, Stratum 1

Stiphidion spp. are common in Australia's woodlands and known for their typical "sombrero hat"-shaped webs that have been described and illustrated by several authors (Forster and Wilton, 1973; Griswold et al., 2005; Hickman, 1967; Hose et al., 2002). The webs are built against overhanging surfaces, commonly rock faces in damp places, but wood surfaces are also utilized. The web is densely woven and consists of a central cylinder with typically four entrances and a domed sheet that is held in shape by radially arranged guying lines (Fig. S15.A). Due to its dense structure and composition of several layers the fine structure of the sheet is difficult to see. It includes radial lines extending from the central cylinder. The cribellar capture threads are occasionally split and are laid out across the radii in a spiral like or zig-zagging manner (Figs. S15.C-D). The guying lines consist of many bundled threads and are attached by an accumulation of anchor points (Fig. S15.E). The spider rests on the substrate surface inside the central cylinder. If prey gets into the web and falls onto the sheet the spider leaves the cylinder through one of the entrance holes to retrieve the prey from the sheet.

Stiphidion adornatum DAVIES, 1988 – Web 1, Stratum 0

The webs of this species were generally similar to those of the larger *S. facetum*, but were almost exclusively found under stones and logs on the ground (Fig. S15.B).

Procambridgea ourimbah DAVIES, 2001 – Web 1, Stratum 0

Procambridgea spp. are small Australian stiphidiids that build small horizontal sheet webs in cavities in or under rotten logs (Davies and Lambkin, 2001) (Fig. S16.A). The sheet is suspended with guying lines (Fig. S16.C) and usually connected to a tubular retreat of variable length (Fig. S16.B). The spider moves under the sheet in a hanging fashion (Fig. S16.D).

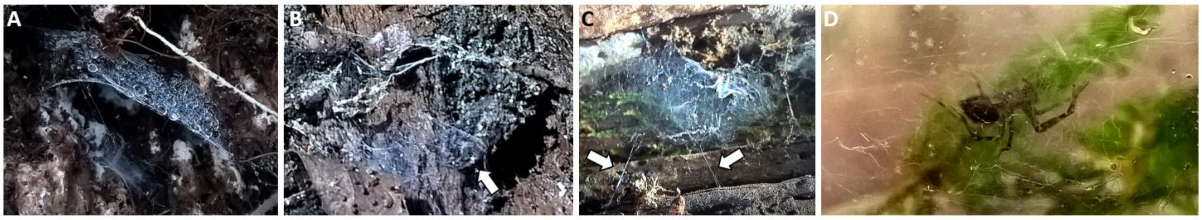

Fig. S16. Webs of *Procambridgea* spp. ***A.*** Little sheet of web of *P. ourimbah* in rotten log. ***B.*** Tubular retreat (arrow) of web of *P. ourimbah* in rotten log. ***C.*** Web of *P. monteithi* in rotten log; note the guying lines (arrows) that anchor the little sheet across a depression in the substrate. ***D.*** Detail of sheet constructed by *P. monteithi* in captivity.

Borrala dorrigo GRAY & SMITH, 2004 – Web 1, Stratum 0

Borrala is the type genus of a circumscribed sub-family of Stiphidiidae, the Borralinae (Gray and Smith, 2008). These spiders occur in the rain forests of Australia and Papua New Guinea, and construct suspended cribellar sheet webs connected to a shallow tunnel retreat in the substrate (Gray and Smith, 2008). Across all representatives of Borralinae investigated by us, the webs were highly stereotypic and characterized by a unique combination of traits, not found elsewhere. Webs were almost exclusively found built against fallen logs of large trees in moist forests or against the trunks of old trees, with the exception of *Therlinya wiangaree*, whose webs were built against earth banks (see below). The retreat was a tapering funnel (e.g. Figs. S18.D, S19.A,B) leading into a denser silken tube in a crevice or in loose material inside the log (e.g. Fig. S17.B, S18.B). The sheet was usually of an elongated rectangular or fan shape and suspended horizontally or semi-horizontally between the log and nearby projecting objects (e.g. fallen branches, plants, twigs or pieces of rotten wood) (e.g., Figs. S18.A,D, S19.A, S20.A). Some species also tended to suspend the sheet across depressions in the decayed logs (i.e., if logs were hollow, broken apart or collapsed in the middle) (e.g. S19.D). The sheet consisted of the non-sticky frame of threads and parallel runway lines, across which the split cribellar lines were laid out in a zig-zagging manner. Zig-zag elements were produced either between neighbouring runway lines (similar to Matachiinae or some Dictynidae) (e.g. S18.A inset) or between the frame of the sheet (the latter of which sometimes leads to a semi-orb web appearance) (e.g. Fig. S18.F). In addition, above the sheet there were transverse guying lines (usually anchored at the side of the log, where the retreat was based). Between these guying lines and the runway lines of the sheet vertical cribellar tangle lines were suspended (e.g. Figs. S19.A,D, S20.A). Generally, these long cribellar tangle lines were also laid in a zig-zagging manner, but in contrast to the cribellar lines in the sheet, they were not split (e.g. Figs. S18.E, S.19.C). These web characteristics could be more or less pronounced and could best be observed in freshly produced webs. Webs with clumped and dirty cribellar threads and clean fresh ones indicated that the spiders build these complex webs successively over a longer period and might renew or rebuild parts of it in temporal intervals. The spider usually rested hanging inside the funnel entrance (Fig. S19.E), and quickly retreated further into the tube if disturbed. The tube was open at the rear end and when trying to break loose parts of the rotten wood to catch the spider, it sometimes retreated further into the loose substrate or dropped itself after emergence from the rear tunnel opening. When prey (such as small flies and midges) hit the web, the spider quickly rushes towards the prey, moving on the underside of the sheet, and bites the prey through the sheet.

The webs of *Boralla dorrigo* were found in fallen apart, decaying logs on the ground, and were generally less expansive as in the other observed species of Borralinae (Fig. S17).

Fig. S17. Web of *Borrala dorrigo*. ***A.*** Web in decaying log, consisting of cribellar tangle lines suspending the horizontal sheet (with cribellar capture threads) and leading into the tubular retreat via a funnel-like structure. ***B.*** Detail of the funnel leading into the tubular retreat in a crevice.

Pillara karuah GRAY & SMITH, 2004 – Web 1, Stratum 1

Pillara spp. were locally abundant, making it possible to observe the webs in high detail. While webs of *P. griswoldi* were only found on fallen logs (Fig. S18.C), the webs of *Pillara karuah* were not restricted to this niche and also occurred higher up at the trunks of old trees (up to a height of 1 metre). In the latter case the retreat was based under loose bark (Fig. S18.B), and the sheet was often elongated and suspended high above the ground (Fig. S18.A). In *P. griswoldi* the retreat was placed inside the rotten wood, preferably at slightly overhanging sites so that the funnel was sheltered from rain and falling debris (Fig. S18.C,D). Other species of this genus were reported to build their webs against rotten logs, earth banks or in litter (Gray and Smith, 2004).

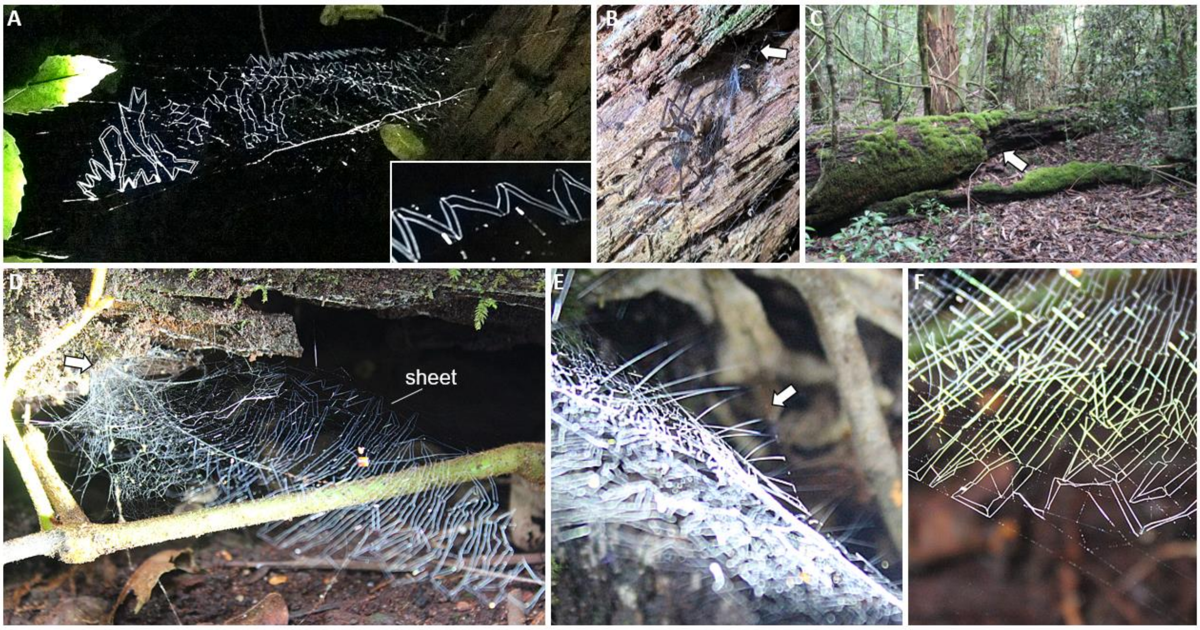

Fig. S18. Webs of *Pillara* spp. ***A.*** Web of *P. karuah* extending from (living) tree trunk. Inset shows detail of arrangement of cribellar capture threads in sheet. ***B.*** Detail of the funnel leading into the tubular retreat in a crevice under loose bark. ***C.*** Typical microhabitat of *P. griswoldi*. The arrow indicates typical position of web. ***D.*** Web of *P. griswoldi* extending from rotten log. The web consists of the more or less horizontal planar sheet with cribellar capture threads, guying lines with cribellar tangle lines, and the funnel (arrow) leading to a tubular retreat in a crevice between the decaying wood. ***E.*** Detail of guying line (arrow) with cribellar tangle. ***F.*** Detail of sheet with cribellar capture threads.

Jamberoo johnnoblei GRAY & SMITH, 2008 – Web 1, Stratum 1

Presence of this larger representative of borraline spiders was easily noticed by its large (diameter up to 40 cm), delicate sheet web. The webs were found built against or in rotten logs or against the trunks of old trees in a montane moist forest, and against overhanging moss and fern covered rock faces in a canyon. Gray and Smith (2008) found the webs of this species built in or against logs.

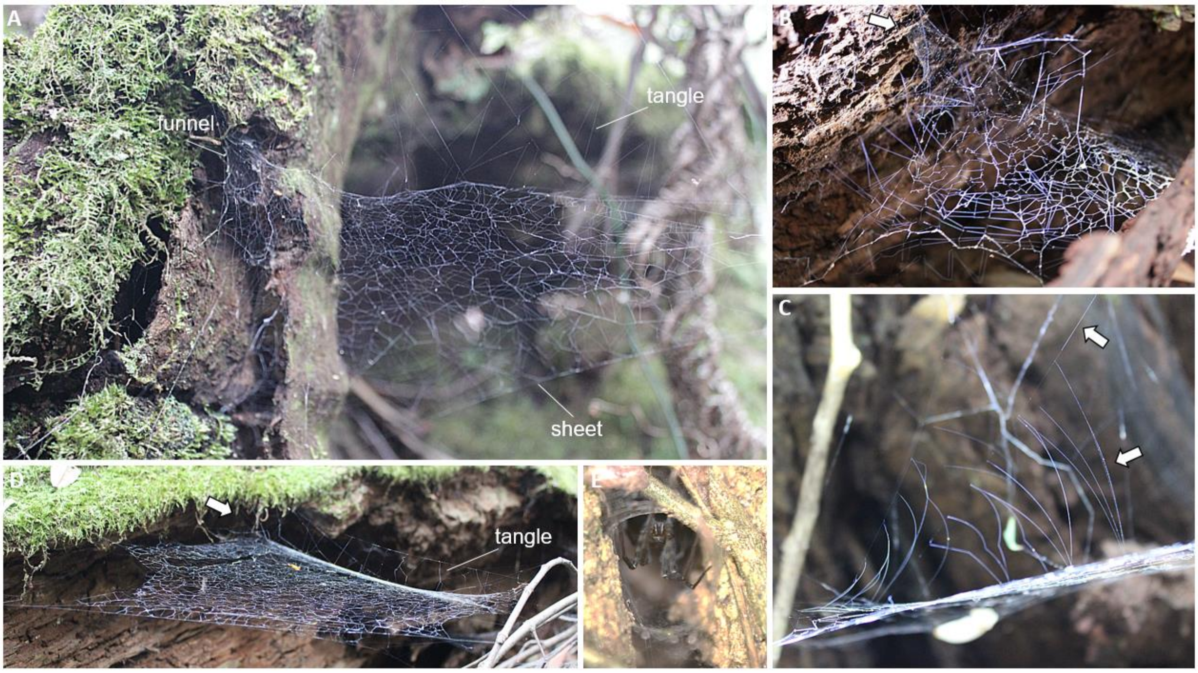

Fig. S19. Web of *Jamberoo johnnoblei*. ***A.*** Typical web consisting of the horizontal planar sheet with cribellar capture threads connected to the funnel leading into the tubular retreat in a crevice in decaying wood or under loose bark. The web is suspended by transverse guying lines to which cribellar tangle lines are attached. ***B.*** Web in hollow log; the arrow points to the funnel. ***C.*** Detail of the cribellar tangle over the planar sheet. Note the cribellar silk which is discernible by its thicker fluffy structure. The cribellar lines are either suspended between the non-sticky guying lines and frame threads of the sheet (typical) or laid along the guying line (arrows). ***D.*** Web in rotten log; the arrow points to the funnel. ***E.*** Detail of the tubular retreat as seen through the funnel. The spider usually rests in a hanging position as it moves in the sheet; accordingly the funnel opens to the underside of the sheet (e.g. see A).

Fig. S20. Web of *Therlinya wiangaree*. ***A.*** Typical web consisting of the horizontal planar sheet with cribellar capture threads that is suspended under guying lines with attached cribellar tangle lines, and which is connected to a funnel leading to a tubular retreat in soil (not visible here). ***B.*** Typical microhabitat in banks of dry creek bed. The arrow marks a typical place of a web that may be suspended between overhanging plants such as fern fronds. ***C.*** Detail of the funnel; the arrow points to the entrance of the tubular retreat in an empty insect hole in the soil.

Therlinya wiangaree GRAY & SMITH, 2002 – Web 1, Stratum 1

According to Gray and Smith (2002), *Therlinya* species construct their webs in a variation of sheltered microhabitats, predominantly against earth banks, rotten logs and rocks. We found the webs of *T.*

wiangaree in the steep banks of a dried out creek bed. The retreats were based in the soil (Fig. S20.C), but it is unclear whether the spiders dug the burrows themselves or used naturally occurring cracks or the empty burrows built by insects. Higher up sites were preferred where the overhanging vegetation and litter cover provided shelter (Fig. S20.B). The sheets were then suspended between the bank face and the overhanging plants (Fig. S20.A).

Couranga diehappy GRAY & SMITH, 2008 – Web 1, Stratum 0

We found two individuals of this species, both of which had constructed their webs between the base of a tree and stones. Gray and Smith (2008) predominantly found the webs of this species built against earth banks, but also logs. Webs of other species of this genus were found built against rotten logs, earth banks and rocks (Gray and Smith, 2008).

Desis marina (HECTOR, 1877) – Web 0, Stratum 0

Desis spp. are famous for being a genus of true marine spiders, which is exceptional for all Araneae (Lamoral, 1968). Even though they are not necessarily completing their whole reproductive cycle in the aquatic environment, such as *Argyroneta aquatica* (see above), they have adaptations to resist long periods of submergence (McQueen and McLay, 1983) and some species such as *D. bobmarleyi* have been found in coral reefs that are nearly permanently submerged (Baehr et al., 2017). The genus is one of few Desidae that occurs outside Australia and New Zealand and can be found in coastal habitats around the Pacific and Indian ocean, which indicates trans-oceanic dispersal capabilities.
D. marina is one of the best studied species of this genus and occurs in the intertidal zone of rocky coasts around New Zealand (Forster, 1970). The spider builds a silk lined retreat in the holdfasts of kelp, in rock cavities and empty seashells, in which it retreats during periods of submergence (Forster, 1970; McLay and Hayward, 1987). At low tide, if it is dark, it can be found running over the emerged rocky plateaus, actively hunting prey, such as amphipods and kelp flies (Lamoral, 1968).

Fig. S21. Webs of *Badumna* spp. ***A.*** Typical web of *B. longinqua* in vegetation consisting of sheets of non-sticky lines between which cribellar capture threads are suspended and the retreat (arrow) consisting of more densely spun sheet of non-sticky lines. ***B.*** Detail of central part of the web with retreat. ***C.*** Web of *B. longinqua* in shrub; the arrow points to the retreat. ***D.*** Detail of aerial sheet of *B. longinqua* with cribellar capture threads in typical zig-zag arrangement. ***E.*** Web of *B. insignis* in sandstone cliff; the arrow points to the retreat in centre. ***F.*** Detail of freshly spun sheet of a immature *B. insignis* with semi-radially arranged cribellar capture threads.

Badumna longinqua (L. Koch, 1867) – Web 1, Stratum 1

B. longinqua is the most common species of Desidae, and can be found synanthropically in Australia and (as neozoon) in New Zealand and many countries across the globe (Forster, 1970; Kielhorn and Rödel, 2011; Simó et al., 2011). It constructs cribellar space webs, preferably in plants and foliage (Hickman, 1967). The web consists of a sparse retreat in a sheltered place, such as between leaf bases or in a cavity of the plant stem, and multiple planar web elements (i.e., aerial sheets) suspended between plant structures at various angles (Figs. S21.A-C) (Griswold et al., 2005). The sheets consist of parallel frame threads between which the cribellar capture lines are suspended in a characteristic zig-zagging pattern (Fig. S21.D). Cribellar threads are split. One strand is then connected to the frame lines via a short ecribellar suspension line at its turning point, while the other strand is directly attached to the frame line and runs along it for a short section. This pattern is alternated. Similar thread suspension patterns seem common in many cribellar marronoids and have been frequently modified. The larger species *B. insignis* is also found in both natural habitats and synanthropically. In contrast to *B. longinqua*, it usually builds its web directly onto substrates (such as tree trunks, window frames, walls and rock faces), with the retreat in a crevice or hole (Fig. S21.E). This results in more planar webs, which may have some radial structure, and with the cribellar threads occasionally laid out in a semi-spiral (Fig. S21.F).

Lathyarcha sp. SIMON, 1908 – Web 1, Stratum 0

This undescribed species of *Lathyarcha* was collected from webs built in crumpled dried pieces of kelp and amongst stones on a rocky beach. The web consisted of a dense retreat in a sheltered place (e.g. in substrate cavity or amongst debris under stones) and planar aerial sheets (Fig. S22.A-B). The sheets consisted of multiple parallel frame (or runway) lines between which the cribellar capture threads were suspended in a zig-zagging manner. In contrast to *Badumna* spp., the cribellar lines were usually not split and ran along the ecribellar lines for a short section between turns (Fig. S22.A inset).

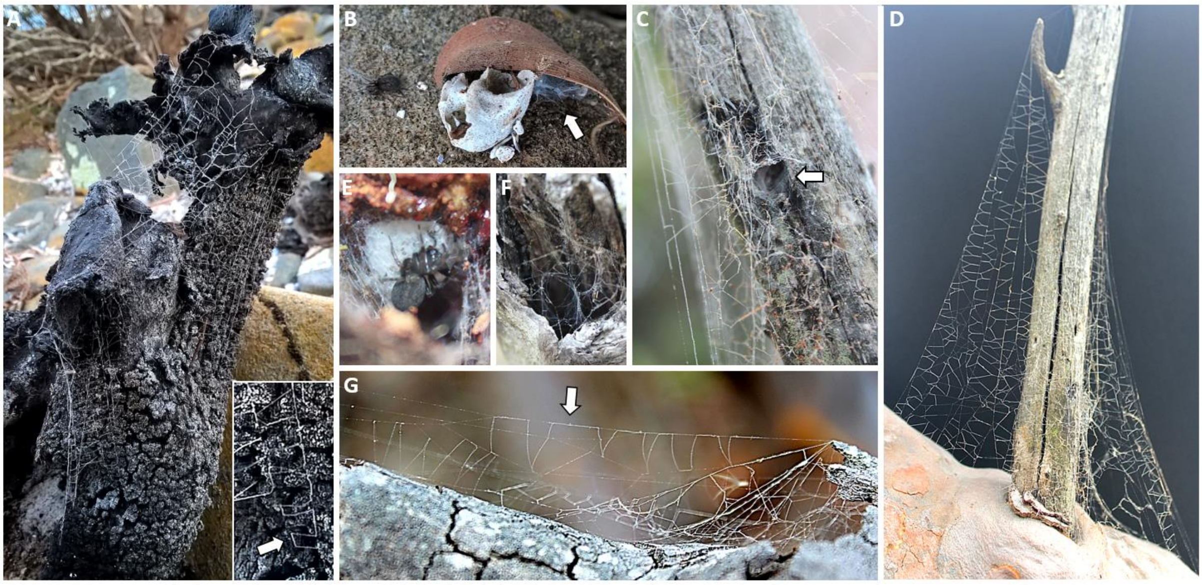

Fig. S22. Webs of undescribed *Lathyarcha* spp. ***A.*** Web of *Lathyarcha* sp. in dried kelp at beach. The inset shows a detail of the sheet with cribellar capture threads; note that in contrast to *Badumna* spp. (see S21.D), the cribellar silk is directly attached to the frame thread and partly runs along the non-sticky line (arrow). ***B.*** Detail of retreat (arrow) of *Lathyarcha* sp. under stone between shell and dry leaf. ***C.*** Central part of web of aff. *Lathyarcha* sp. on dead branch; the arrow points to the retreat in crevice. ***D.*** Web of aff. *Lathyarcha* sp. on dead branch. ***E.*** Detail of retreat in web of aff. *Lathyarcha* sp. with female guarding an egg sac. ***F.*** Detail of retreat in web of aff. *Lathyarcha* sp. in hollow branch. ***G.*** Detail of sheet with cribellar capture threads of web of aff. *Lathyarcha* sp.; note that the cribellar silk partially runs along the frame thread (as in A).

Lathyarcha sp. 5 – Web 1, Stratum 0

This undescribed species of Matachiinae was sifted from litter in a montane rain forest. Nothing is known about its habits. As all other related species are web builders, in the absence of any other information, we decided to code this species as web builder.

aff. *Lathyarcha* SIMON, 1908 sp. – Web 1, Stratum 1

This undescribed species was collected from webs spun against the branches of eucalypt and banksia trees in coastal heathland. As similar to the aforementioned matachiine species, webs built by this species consisted of a sparse retreat in a cavity or crack in the wood substrate and planar sheet spun across projecting substrate structures (Fig. S22.C,D,F). As in *Lathyarcha* sp., the sheets consisted of multiple parallel lines between which the cribellar capture lines were suspended in a zig-zagging manner. In contrast to *Badumna* spp., the cribellar threads were only occasionally split and usually not connected to ecribellar suspension lines. Instead, the cribellar threads often ran along the frame lines for some short sections (similar to *Lathyarcha* sp.), and sometimes even for longer distances (Figs. S22.C,G). Web sacs were deposited in the retreat, sparsely wrapped in silk, attached to the substrate, and guarded by the female (Fig. S22.E).

Forsterina LEHTINEN, 1967 sp. – Web 1, Stratum 1

Forsterina is a genus in need of revision and may include species with different ecology (H. Smith, pers. comm.). The species studied here was collected from tangle webs constructed in rock cavities, or between roots and vines growing over a big rock (Fig. S23.A,B). The webs resembled a sparse tunnel surrounded by a loose tangle of ecribellar and cribellar lines. The spider was resting upside down at the end of the tunnel (Fig. S23.C). Cribellar threads were entire and spun across ecribellar structure lines (Fig. S23.D).

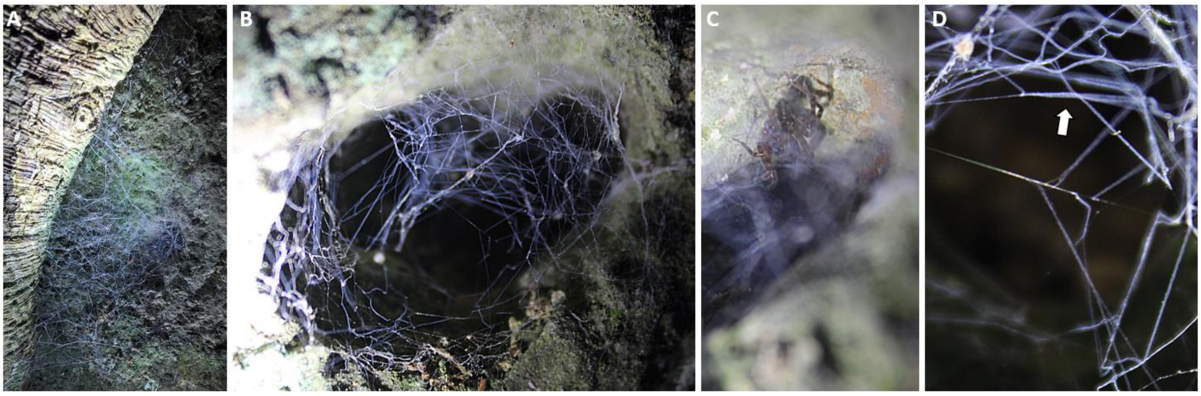

Fig. S23. Web of *Forsterina* sp. ***A.*** Cribellar tube web spun between rock and vine. ***B.*** Web in rock cavity. ***C.*** Same as *B* illuminating the spider resting in the rear corner of the web. ***D.*** Detail of cribellar capture threads (arrow) in the web shown in *B*.

Namandia group ecrib spec 4 – Web 0, Stratum 1

A common element of the desid fauna of Australian temperate rain forests belong to a complex of undescribed species and genera seemingly related to the only described species *Namandia periscelis*. This Namandia group is in heavy need of taxonomic treatment (H. Smith, pers. comm.). We collected material from multiple species belonging to this group, which can be broadly separated into medium sized ecribellar spiders, and larger cribellar species (see below). The investigated ecribellar Namandia group species were beaten from the lower branches of trees, shrubs and tree fern fronds, or hand collected by visual searching after nightfall, when the spiders were found sitting or walking on foliage (Fig. S24.A). In such situations no silk structures other than single draglines were found in association with the spiders. One individual of an ecribellar Namandia group species was observed at night hanging from a dragline in a tree fern (we made a similar observation for *Goyenia* sp.). It was unclear if this was part of a special hunting strategy or resulting from escape behaviour. In captivity, these spiders readily accepted offered prey (*Drosophila* sp.) and caught it by seizing them with their front legs. However, over time many draglines tended to accumulate in the jars, and the spiders occasionally rested and walked in a hanging fashion in the resulting tangle (Fig. S24.B). Prey getting entangled in these silk assemblies were approached by the spider too. It is thus not entirely clear, if these irregular silk assemblies could even be constructed by the spider as a type of snare. However, based on our field observations we think it is safe to assume that these spiders are predominantly cursorial hunters. Some ecribellar Namandia group species laid eggs in captivity. In these instances, they built a sac-like brooding retreat in which they guarded the clutch (Fig. S24.C).

Namandia group crib spec 5 – Web 0, Stratum 1

The cribellar species of the Namandia group (unofficially called 'Neodesis' or 'Neonamandia' by some peers) are larger than the ecribellar species and usually found on or under the loose bark of trees in rain forests (as in the New Zealand matachiine *Nuisiana arboris*, see below). They build a loose silk retreat in crevices of the bark or in moss growing on the bark. Sometimes we observed silk lines around this retreat (Fig. S24.D). Photographs published on *flickr* show spiders likely belonging to this genus in a lie-and-wait ambush posture at the entrance of a loose retreat under bark. It is possible that the observed lines attached to the retreat ('vestigial web') serves as a signalling device to aid in prey capture. However, we have also frequently observed these spiders freely sitting on the trunks at night, where they may wait for passing prey (Fig. S24.F). In captivity, the spiders directly grabbed offered prey (fruit flies *Drosophila* sp. and cricket nymphs *Acheta domesticus*). However, often prey got entangled in the silken assemblies in the jars that developed over time, which made it easy for the spider to subdue the prey. This aid by the vestigial web or silk retreat in prey capture is likely not representative of the prey capture behaviour in natural habitats. We therefore decided to code this species as non-web-building.

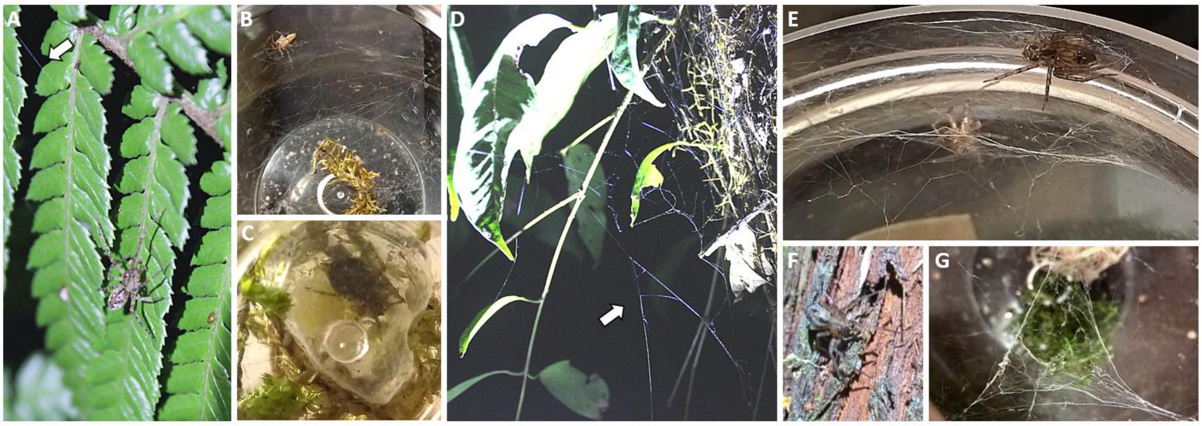

Fig. S24. Silk constructs of undescribed species of the Namandia group. ***A.*** *Namandia* sp. observed in the field hunting on tree fern at night; the arrow points to the dragline left behind. ***B.*** Irregular tangle of non-sticky lines constructed by *Namandia* sp. 4 in captivity. ***C.*** Brood retreat constructed in captivity with the female guarding egg sac inside. ***D.*** Vestigial web of crib spec 5 observed in the field. The spider was resting under loose bark to which the silk was attached. ***E.*** Sheet-like retreat of crib spec 3 constructed in captivity. ***F.*** Crib spec 3 observed in the field hunting on tree trunk at night. ***G.*** Vestigial web constructed by crib spec 7 in captivity. The whitish lines are bundles of silk and probably not cribellar threads.

Paramatachia decorata DALMAS, 1918 – Web 1, Stratum 1

Paramatachia spp. are elongated spiders with short legs adapted to retreat into narrow holes in wood substrates, such as hollow twigs, empty seed capsules and empty insect bore holes (Marples, 1962). The retreat is lined with a small ecribellar silk funnel from which structure lines radiate (e.g. Fig. S25.B,C,G). These 'radii' are then either attached to projecting structures of the substrate (e.g. twigs), or transverse frame threads spanned across substrate structures (Fig. S25). The complete sheet builds more or less on one plane. The cribellar capture threads of *Paramatachia* spp. are entire and attached directly to the radii and frame. Interestingly, the way the cribellar thread are arranged in the web is species dependent. In webs of *P. decorata* the cribellar lines mostly run along the radii and frame, with criss-crossing arrangements only present very close to the retreat funnel (Fig. S25.B). In contrast, in webs of *P. ashtonensis* and *P. tubicola*, the cribellar capture lines exhibited cubic arrangements with alternations of cribellar threads running along and spanning across structure lines (Figs. S25.D-G).

Goyenia cf. *fresa* FORSTER, 1970 – Web 0, Stratum 1

Goyenia spp. are common hunting spiders occurring on foliage in New Zealand's forests and bushlands (Forster, 1970). We frequently collected these spiders by beating branches and foliage, but also observed them sitting and walking on foliage at night. No silk structures other than single draglines were observed associated with these spiders (Fig. S26.A).

Mesudus ÖZDIKMEN, 2007 (*Manawa*) sp. – Web 0, Stratum 1

The single specimen collected of this species was beaten from alpine shrubs together with *Goyenia* spp. No webs were found in association with this spider. In captivity it did not construct any silken structure other than a few draglines. Therefore, we assume that similar to *Goyenia* spp. it is a cursorial spider.

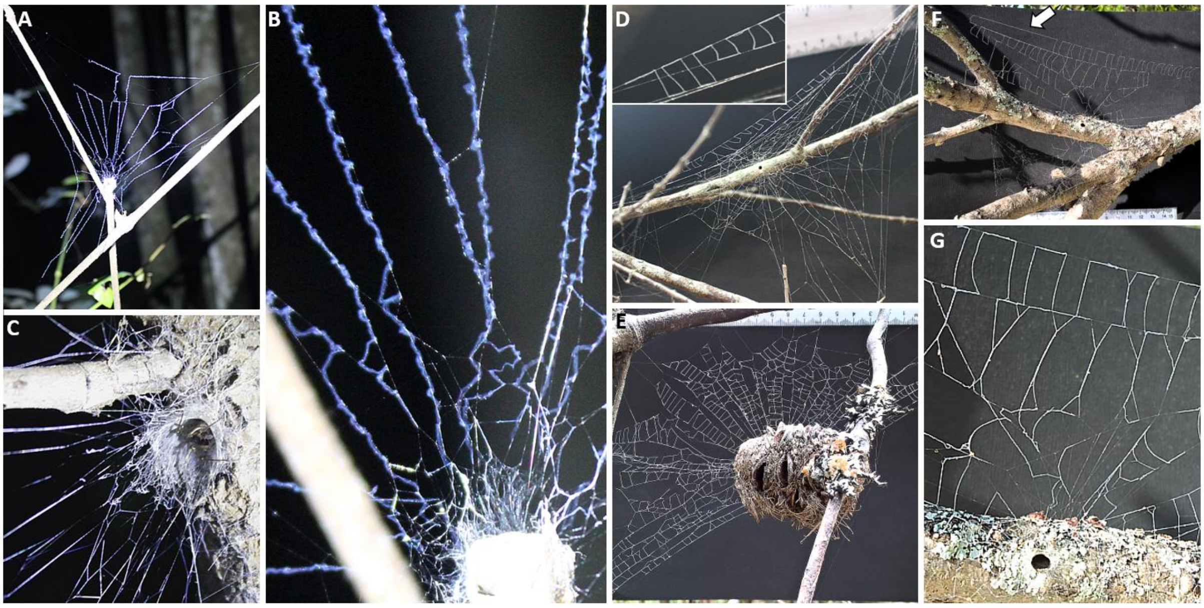

Fig. S25. Webs of *Paramatachia* spp. ***A.*** Web of *P. decorata* with radial cribellar capture threads around central retreat in hollow twig. ***B.*** Detail of structure around the retreat entrance in the web of *P. decorata*, with spiral-like cribellar capture threads laid along radii. ***C.*** Detail of retreat entrance of a web of *P. decorata*, with the spider in a lie-and-wait ambush posture. ***D.*** Web of *P. ashtonensis* with retreat in empty insect bore hole; the inset shows a detail of the ladder-like arrangement of cribellar capture threads. ***E.*** Web of *P. tubicola* with radial arrangement of capture sheet elements and ladder-like arrangement of cribellar capture lines and retreat in empty Banksia seed capsule. ***F.*** Web of *P. tubicola* with retreat in empty insect bore hole. Note that in this web (in contrast to the web shown in *E*, but similar to the web in *D*) the capture sheet elements are oriented transverse to the radii and that in the upper part a cribellar line is laid along a frame thread (similar to *P. decorata*, *A*). ***G.*** Detail of the structure around the retreat in the web shown in *F*. Note the radial arrangement of non-sticky lines, similar to the radii in an orb web.

Nuisiana arboris (MARPLES, 1959) – Web 0, Stratum 1

This larger matachiine spider has been predominantly found under the loose bark of trees and in holes in wood (Forster, 1970; Forster and Wilton, 1973; Marples, 1959; Vink et al., 2011). We, too, found the single specimen used in this study under loose bark of a large tree. Marples (1959) reported that the spiders were found in small webs of a similar structure as the web of *Neoramia charybdis*. *N. charybdis* builds a web consisting of a tubular retreat flanked by straight cribellar capture threads (Fig. S9.A). However, later authors (Forster and Wilton, 1973; Vink et al., 2011) did not observe web structures associated with the spider retreat, which also matches our observations. *N. arboris* has a similar habitus and uses a similar microhabitat as Namandia group crib spec (see above), and both these spiders retain the cribellum. We, hence, assume that *N. arboris* has a highly reduced, facultative web building behaviour as discussed for Namandia group crib spec above, with a vestigial web. Further, it has been reported that egg sacs are guarded in a small brooding web (Vink et al., 2011).

Matachia australis FORSTER, 1970 – Web 1, Stratum 1

Spiders belonging to this New Zealand genus construct webs very similar to the Australian *Paramatachia ashtonensis* and *P. tubicola* (see above) (Forster, 1970; Griswold et al., 2005). Overall the arrangement of cribellar lines seems less regular in *Matachia* and *Notomatchia* than *Paramatachia*, possibly due to a less regular radial pattern of structure lines.

Notomatachia FORSTER, 1970 sp. – Web 1, Stratum 1

Spiders belonging to this genus are similar in ecology as *Matachia* spp. The single specimen collected for this study was found in a ladder-like web with the retreat in moss covering a dead branch of a tree (Fig. S26.B-C).

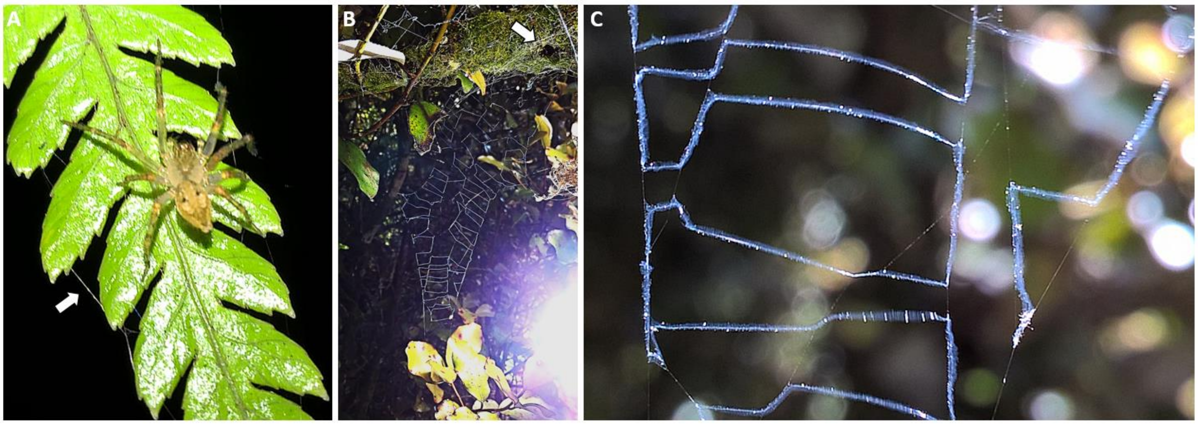

Fig. S26. Silk constructs of New Zealand Matachiinae. ***A.*** *Goyenia* sp. as observed wandering on tree fern at night; the arrow points to draglines left behind. ***B.*** Web of *Notomatachia* sp.; the arrow points to the spider's retreat in moss on branch. ***C.*** Detail of cribellar capture threads in the web shown in *B*.

Panoa cf. *mora* FORSTER, 1970 – Web 1, Stratum 1

According to Forster (1970), *Panoa* spp. construct a ladder-web in low vegetation. However, we collected all individuals by beating shrubs and tree branches. We did not observe the webs of this species. In captivity the spiders constructed an irregular tangle or sheet in which they rested upside down, but a clear web including cribellar threads was not produced, probably due to the lack of space in the jars used to keep the spiders.

Helsonia plata FORSTER, 1970 – Web 0, Stratum 1

The single species of the genus *Helsonia* was collected from *Dracophyllum* bushes (Forster, 1970). Before this study, it was known only from one male specimen. One of us (JOW) was able to further collect a female (description pending) and a juvenile of this species in the type locality and the same microhabitat. The spiders were sitting between the leaf bases of *Dracophyllum* bushes, with no associated silk structures. In captivity, they did not construct any silken structures apart from some draglines. We hence follow Forster's (1970) interpretation that these spiders are cursorial hunters.

Daviesa lubinae (DAVIES, 1993) – Web 0, Stratum 1

This interesting species has previously been difficult to place systematically (Davies, 1993). Our phylogenomic analysis and the structure of the male palp indicate that it is related to the Porteriinae, a group of medium sized to large desid spiders that construct large semi-aerial sheet webs (see below). In contrast, *D. lubinae* is a small foliage dwelling spider that does not appear to spin webs (Davies, 1993). When collecting these spiders, we did not observe any silk structures associated with them and in captivity they did not spin silken structures other than draglines and seized the prey (*Drosophila* sp.) directly with their front legs.

Corasoides terania HUMPHREY, 2017 – Web 1, Stratum 1

Corasoides spp. are small to large spiders that construct extensive sheet webs in low vegetation (Humphrey, 2017; Humphrey, 2021). The characteristic web has been described as a 'platform web' (Humphrey, 2021). It consists of a funnel retreat in the substrate (e.g. amongst tree roots, in a crevice or amongst litter) leading into an elongated concave sheet suspended in the vegetation via long vertical guying lines (Fig. S27.A). The sheet consists of a more or less regular mesh of ecribellar silk (Fig. S27.B) (Humphrey, 2021). At the point where the lower guying lines attach to the sheet, it extends into tipped extensions (Fig. S27.E). In contrast to other Porteriinae that build comparable webs, *Corasoides* spp. move primarily on top of the web sheet (Fig. S27.G), and accordingly the funnel retreat opens to the upper surface of the sheet (hence the name 'platform web') (Fig. S27.F). The spiders were found active at night, in a lie-in-wait ambush posture on the sheet at the entrance of their funnel. One female constructed an egg sac in captivity. It was of a pendulous type, with several layers of flocculent silk and camouflaged with available debris (Fig. S27.C-D).

Fig. S27. Web of *Corasoides terania*. ***A.*** Typical 'platform web' tucked away in the undergrowth with retreat in between roots of a large tree extending into a long horizontal sheet attached to the vegetation and stabilized by long vertical guying lines above and below. ***B.*** Detail of the sheet with fine regular mesh structure of non-sticky lines. ***C.*** Pendulous egg sac constructed in captivity. ***D.*** Detail of the opened egg sac. ***E.*** Detail of sheet seen from side with the typical tipped stretches where the strained lower guying lines attach. ***F.*** Detail of tubular retreat between roots of a large tree. The funnel opens on the upper side of the sheet. ***G.*** Spider hunting on the sheet at night. In contrast to other Porteriinae, *Corasoides* spp. walk on top of the sheet instead of hanging from it.

Fig. S28. Web of *Nanocambridgea gracilipes*. ***A.*** Webs in bank with horizontal sheet spanned between overhanging dead ferns fronds. ***B.*** Detail of sheet consisting of dry silk lines. ***C.*** Detail of sheet with vertical guying lines. ***D.*** Webs in bank. ***E.*** Detail of funnel leading to retreat in soil (arrow). ***F.*** Detail of retreat with spider hanging in the centre (arrow).

Nanocambridgea gracilipes FORSTER & WILTON, 1973 – Web 1, Stratum 1

This gracile New Zealand representative of Porteriinae constructs horizontal sheet webs in banks and amongst tree roots with a funnel like retreat in the soil substrate (Fig. S28). The observed webs were of a flimsy structure. In contrast to the webs of *Cambridgea* and *Corasoides*, the web surfaces of

Nanocambridgea were distally broadening irregular brushed sheets (comparable to *Aorangia* spp., see above) suspended with only few guying lines. Lower guying lines seemed to be absent and some webs were even completely devoid of guying lines, with the sheets directly attached to substrate structures.

Cambridgea foliata (L. KOCH, 1872) – Web 1, Stratum 1

Cambridgea spp. are a dominant part of the New Zealand spider fauna with a variety of species differing in microhabitats, size and web structure (Forster and Wilton, 1973; McCambridge et al., 2019; Walker et al., 2020). Of these *C. foliata* is one of the largest species and considered to construct the largest webs (Walker et al., 2020). The webs consist of a large funnel like retreat in a substrate cavity opening underneath the elongated horizontal sheet (Figs. S29.A,C,D). The (semi-)aerial sheet is suspended in the vegetation with long guying lines to the sides above and below. The upper guying lines have also been termed 'knock-down threads' by previous authors (Forster and Wilton, 1973; Walker et al., 2020), as they may serve to stop flying prey. The lower guying lines strain the sheet in a way that the sheet is stressed into tipped extensions at the attachments (Figs. S29.A,C) (as in *Corasoides*). The sheet structure is a mesh (Fig. S29.E), which is usually less regular than in *Corasoides*. The spiders move on the underside of the sheet in a hanging fashion (Figs. S29.B,D).

Cambridgea sp. L. KOCH, 1872 – Web 1, Stratum 0

This small undescribed *Cambridgea* species was collected from between the bases of grass tussocks. We did not observe the web. Another species known from tussocks, *C. quadromaculata*, has been described to build a reduced irregular tangle web (Blest and Taylor, 1995), which is probably an adaptation to the microhabitat, lacking suitable structures to suspend a sheet web. This could similarly be the case for our species.

Fig. S29. Web of *Cambridgea foliata*. ***A.*** Typical web with retreat in tree hollow extending into a long aerial sheet suspended with vertical guying lines attached to vegetation. ***B.*** Spider moving underneath the sheet, as is typical. ***C.*** Web in suburban garden with retreat between car tyres (the sheet was about 0.5 m across). ***D.*** Detail of funnel extending from retreat in tree hollow opening below the sheet. ***E.*** Detail of sheet with fine mesh structure of non-sticky lines.

Baiami volucripes (SIMON, 1908) – Web 1, Stratum 0

Baiami are cribellar representatives of the Porteriinae known from South-Western Australia. According to Gray (1981), *Baiami* spp. construct extensive cribellar sheet webs (up to 1 m length) extending from a funnel retreat in the substrate, e.g. in soil, a rotten log or under a stone. The sheet is suspended in the vegetation with guying lines and the spider moves underneath the sheet (Gray, 1981). Egg sacs are spherical, camouflaged with debris and deposited in the retreat (Gray, 1981). We did not observe *Baiami* spp. ourselves, but received the material for the phylogenomic study from the Western Australian

Museum. According to the attached collection notes the specimen of *B. volucripes* was hand collected from 0.5 m deep in old building rubble.

Tartarus GRAY, 1973 sp. – Web 1, Stratum 1

Tartarus spp. are large long legged troglobiotic spiders known from the limestone caves of the Nullarbor plane in Southern Australia. According to previous authors these spiders construct modified sheet webs in the shape of a broad funnel spun against a rock surface (Forster and Wilton, 1973; Gray, 1981). The spider sits on the rock surface in the middle of this 'funnel' (Gray, 1981), similar to *Stiphidion* spp. (see above). The funnel includes cribellar lines (Gray, 1981). These webs are quite similar to the web of the unrelated American lampshade spiders (*Hypochilus* spp.) (Griswold et al., 2005; Shear, 1969) and could be utilized in the same way, both as retreat and a prey capture device (Gray, 1981). We did not observe *Tartarus* spp. ourselves, but received the material for the phylogenomic study from the Western Australian Museum. According to the attached collection notes the specimen of *Tartarus* sp. was collected from the dark zone inside a cave.

Ischalea spinipes L. KOCH, 1872 – Web 0, Stratum 1

I. spinipes is a cursorial hunting spider found in the vegetation in variable habitats in New Zealand (Forster and Wilton, 1973). It has a highly elongated body shape and various colour patterns (ranging from yellow to green), camouflaging them when sitting on leaves, dry grass blades or twigs (Forster and Wilton, 1973). We found these spiders by beating the lower branches of shrubs and trees in a coastal bushland.

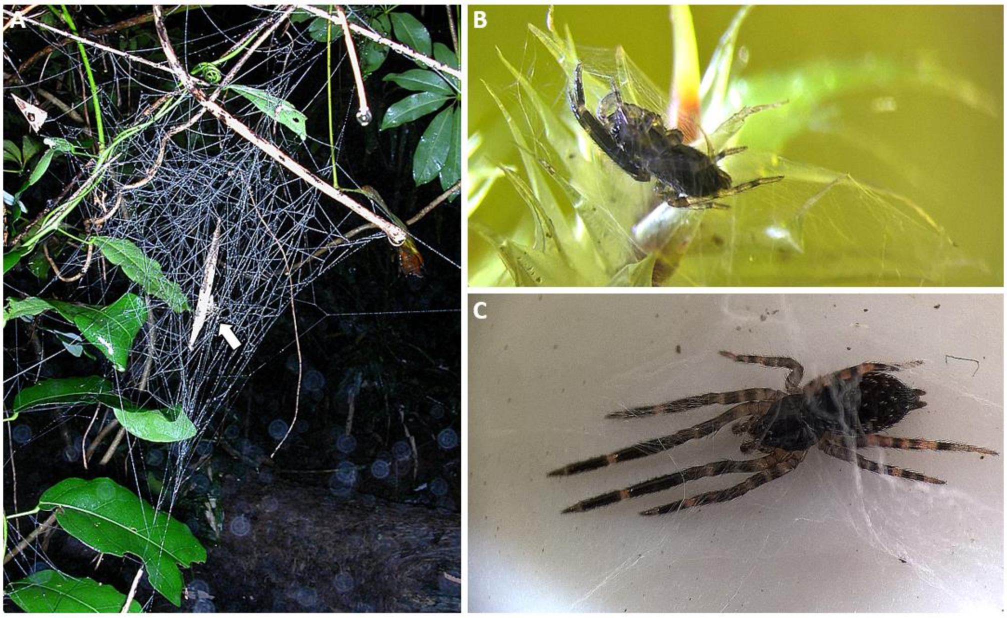

Fig. S30. Webs of *Manjala* and *Dardurus.* ***A.*** Brooding web of *Manjala* sp., the arrowhead points to the spider sitting on the leaf retreat in the web centre. Photo by Martín Ramírez, reproduced with kind permission. ***B & C.*** Details of tube web spun by *Dardurus* sp. in captivity.

Manjala plana DAVIES, 1990 – Web 0, Stratum 1

Manjala spp. are Australian spiders with a habitus somewhat similar to *Ischalea* spp. They are found in the vegetation and in litter (Davies, 1990). Females of *M. plana* have been found to construct a 'brooding web' with the egg sac deposited inside a dry rolled leaf that is suspended in a tangle of threads, some of which appear to be cribellar (Davies, 1990; M. Ramírez, pers. comm., Fig. S30.A). The spiders guard the egg sac either inside the suspended leaf retreat (Davies, 1990) or sitting on the leaf retreat (M. Ramírez, pers. comm., Fig. S30.A). Outside of the breeding period these spiders seem not to construct webs. We found them sitting on foliage at night, with no silk structures associated. In captivity, they did not construct silken structures other than draglines and captures prey (*Drosophila* sp.) by seizing it with the front legs. As Davies (1990), we also found some individuals of this species on the ground (by litter sieving), suggesting that this spider is mobile between strata. Our coding follows the observation that it frequently occupies above ground strata and is seemingly not primarily a ground dwelling spider.

Dardurus DAVIES, 1976 sp. – Web 1, Stratum 0

This undescribed species was collected from low vegetation, litter and debris in a montane rain forest in the highlands of Tasmania. Characters of the body and the epigyne structure indicate that it is associated with species described in the genus *Dardurus*. These spiders have been reported to construct U-shaped tubular burrow webs with two openings in rotten wood and soil substrates (Davies, 1976; Whyte and Anderson, 2017). The tubes are camouflaged with debris and there is no sheet or tangle associated with any of the burrow entrances (Davies, 1976). It is, hence, unclear if and how this tube web assists prey capture. All collected three individuals of the undescribed species constructed loose tubular webs in captivity (either in the provided moss or attached to the plastic lid of the jar) and typically rested at the entrance of the web (Figs. S30.B,C). The webs were not camouflaged and rather flimsy, but it is unclear if this is representative of their natural behaviour. It is apparent that these spiders adopt a lie-in-wait hunting strategy, ambushing prey from their retreat. Even though the web itself might not assist in the immobilization of the prey, it could serve in signalling, when the prey touches the silk of the tube. We therefore decided to code this species as web builder.

Quemusia cf. *raveni* DAVIES, 1998 – Web 1, Stratum 0

Quemusia spp. are cribellar representatives of the Australian Metaltellinae, a group of Desidae also found in America (Davies, 1998). We found these spiders by sieving litter and under rotten logs. We did not observe the webs nor prey capture behaviour of this species, but assume that it is similar to *Austmusia wilsoni*, which is a web builder (see below).

Austmusia wilsoni GRAY, 1983 – Web 1, Stratum 0

This species has previously been found under rotten logs on the ground and in pitfall traps (Gray, 1983). We found this species in sparse ecribellar tangle webs constructed under rotten logs and in banks. The spiders were usually found hanging upside down in the web. In captivity they also constructed tangle webs in which they rested and moved in a hanging fashion.

Toxopsoides cf. *erici* SMITH, 2013 – Web 0, Stratum 1

The genus *Toxopsoides* harbours small spiders with laterigrade legs that are commonly found in the rain forest habitats. We found that this group seems to be quite speciose and includes species with shorter and less laterigrade legs found in leaf litter and others with comparably longer legs and a flattened habitus frequently observed on tree trunks and other vertical surfaces after nightfall. The genus is in high need of revision, as currently only four species are described.

Colcarteria GRAY, 1992 sp. – Web 1, Stratum 0

Colcarteria spp. are small cribellar spiders that have been reported to build small sheet webs on the ground, in rotten logs and in caves (Gray, 1992). The single specimen used in this study was a donation. The web structure and hunting behaviour was not observed.

Amphinecta mara FORSTER & WILTON, 1973 – Web 0, Stratum 0

Amphinecta spp. are medium sized cursorial hunters on the ground in woodland habitats of New Zealand, often found by turning rotten logs (Forster and Wilton, 1973). Forster and Wilton (1973) reported that these spiders construct a flimsy web, which is rather a retreat than a snare. Further, as both sexes are often found in pitfall traps, they argued that these spiders are likely nocturnal cursorial spiders. This was confirmed by our observations. The retreat was often constructed under rotten logs and was in the shape of a thin silk cell with one or two openings (Fig. S31.A). According to Forster and Wilton (1973) the egg sac is spherical and deposited in the retreat.

Fig. S31. Retreats of Amphinectinae. ***A.*** Retreat of *Amphinecta* sp. under rotten wood. ***B.*** Retreat of *Mamoea rufa* in soil under rotten log. ***C.*** Brooding retreat with egg sac (white mass in centre). ***D & E.*** Retreats of *Mamoea rakiura*.

Mamoea rufa (BERLAND, 1931) – Web 0, Stratum 0

Mamoea spp. are common New Zealand amphinectines with similar ecology to *Amphinecta* spp. (Forster and Wilton, 1973). This was confirmed by our observations. During the daytime the spiders were found in a dense tubular or cell-like retreat with two openings (Figs. S31.B,D,E), built into cavities, crevices or depressions in the substrate (i.e., logs and wood pieces on the ground or in the soil underneath). Some females were found guarding an egg sac in a brooding retreat. Such brooding retreats appeared larger in size, with the sub-spherical egg sac attached to the upper silk wall (Fig. S31.C).

Fig. S32. Webs of Amphinectinae. ***A.*** Web of *Maniho tigris* in rock crevice in coastal cliff. ***B.*** Web constructed by *Maniho tigris* in captivity, arrows indicate cribellar threads. ***C & D.*** Details of cribellar threads (arrows) in web shown in *B*. ***E.*** Web of *Maniho tigris* on the ground between stones and base of grass tussock; the arrow points to the retreat. ***F.*** Detail of retreat in web shown in *E* with the resting spider. ***G.*** Web of *Akatorea gracilis* in rotten log; the arrow points to the spider.

Maniho meridionalis FORSTER & WILTON, 1973 – Web 1, Stratum 0

Spiders belonging to this genus are web-building amphinectids common in Southern New Zealand. Marples (1959) described the web of *Maniho* spp. as an irregular sheet connected to a short tubular retreat in the moss on tree trunks. We found *M. tigris* in such irregular webs in debris at the base of tussocks in a montane forest (Fig. S32.E-F). The sheet was densely woven and the spider was hanging in a tubular retreat in the litter at the edge of the sheet. Another individual of this species was found in a rock cave in a coastal cliff. In this instance, the sheet was extending from a tubular retreat in a crevice and comprised of more or less radially arranged lines between which split or entire cribellar lines were suspended in a zig-zagging manner (Fig. S32.A). Such structures were also produced in captivity, where details of the cribellar threads could be observed (Fig. S32.B-D). *M. meridionalis* built a similar web in captivity.

Maniho MARPLES, 1959 sp. – Web 0, Stratum 0

This undescribed species of *Maniho* was collected from under rotten logs on the ground. We did not record any web structure associated with this species, and hence coded it as free hunting.

Akatorea gracilis (MARPLES, 1959) – Web 1, Stratum 0

Spiders belonging to this genus have been primarily found in decaying wood on the ground (Forster and Wilton, 1973; Marples, 1959). This was confirmed by our own observations. We found this species in association with tubular surface webs spun against the substrate in spaces within the rotten logs (Fig. S32.G).

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