Web, Reproduction and Commensals of the Semisocial Spider *Cyrtophora moluccensis* (Araneae: Araneidae) on Guam, Mariana Islands[1]

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Abstract

The web of each individual was a three dimensional labyrinth of threads supporting a central dome (a horizontal orbweb with hub stretched upward); the spider hung inverted beneath the hub; a chain of one to four eggsacs was suspended above the hub. Web, spider orientation and position of eggsacs resembled that of *Cyrtophora citricola* but the orbweb lacked tangle threads connecting from below and formed a dome without the edges flared upward. Five eggsacs contained from 1100 to 1850 eggs or young. Spiderlings migrated together to the edge of the labyrinth where they rested in "nursery webs". From 1 to 12 *Cyrtophora* occupied individual domes in 11 webs selected to be about 1 m^3. Adult females built adjacent webs forming composite masses of tangle webbing (often several meters across) occupied by smaller *C. moluccensis,* two *Argyrodes* spp., *Tetragnatha* sp., *Leucauge* sp., *Gea* or *Argiope* sp. and an unidentified araneid. Excluding new spiderlings, the total number of specimens per web was 7 to 26. The number of species per web was two to five. An *Argyrodes* and an clubionid was seen feeding upon *Cyrtophora.*

Introduction

The web, eggsacs, spiderlings and associated species of *Cyrtophora moluccensis* (Doleschall) were observed in Guam from January, 1969 to May, 1970. We noted the species on Saipan, but were unable to locate *C. moluccensis* in the Eastern Carolines (Ponape, Nukuoro, Ngatick, and Kapingamarangi) or the Marshalls (Maloelap, Ailuk and Majuro). Kullmann (1959, 1961 and 1964) provides extensive descriptions of the web, eggsacs and natural history of *C. citricola* and therefore allows comparisons with *C. moluccensis.*

Adult female *C. moluccensis* were about 2.5 cm total body length; adult males were about 3 mm; and newly emerged spiderlings were about 2 mm. Female abdominal patterns were extremely variable with large areas of black or reddish brown to bright greenish orange mottling on white or whitish background.

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Abdominal patterns of juveniles were always white, green and silver. Kullmann (1959) suggests that coloration of developing *C. citricola* comes to match the background and that similarly colored objects are selected to remain hanging in the web. Although *C. moluccensis* has color variants, most were represented in a composite web against the same general background.

Web Construction and Associated Species

The individual web was a three dimensional structure consisting of a labyrinth web surrounding and supporting a horizontal orbweb-like dome. The orbweb was supported above by numerous connections to the main threads of the labyrinth, but lacked connections below. These connections contributed to the tangle layer immediately above the dome. The spiral thread was offset at each radius to give a zigzaged or notched appearance. Individual meshes formed a hexagon, similar to that illustrated for *C. citricola* by Kullmann (1958). The dome diameter was approximately four to six times the height. The labyrinth of a single adult female measured about 1 m×1 m with a dome diameter of about 80 cm. Figure 1A shows the adult female in the resting position. Figure 1B shows a diagrammatic sketch of the adult female web, with an egg sac. Spiderlings constructed identical webs with dome diameters of about 7 mm.

In contrast to *C. moluccensis*, Kullmann (1959) described the web of *C. citricola* from Sardinia as a labyrinth web consisting of an upper and a lower division separated by a flat, horizontal orbweb with the outer edges and central hub pulled upward. There were tangle web connections to the orb from both above and below; the downward connections were relatively few, leaving a "running space" below the orb. Otherwise the webs were similar. Kullmann (1964) illustrated laboratory constructed webs of *C. cicatrosa* from New Guinea. The orbwebs were domed with the outer edges raised and supported by a tangle web. Several successive orbs were produced and the spider left the old orbs intact to form a series of floors beneath the new dome. Interestingly, *Mecynogea basilica* (=*Allepeira lemniscata*), an araneid of the southeastern U.S., constructs a web of the same general form (illustrated in Levi and Levi, 1968, and McCook, 1889). McCook notes that *M. basilica* produced a domed web with light sheet of cobweb supported below the dome. He states that this web component might be the collapsed remnant of an old orb or might represent a special structure. Kullmann (1964) reported that *C. citricola* always destroyed the old orb before constructing a new one. *C. moluccensis* was never observed to have more than one orb.

The labyrinths of adult and subadult *C. moluccensis* females were usually built adjacent to one another, merging into composite webs suspended from brush or in forest canopy openings. These were frequently massive, being several meters across and extending from near ground level up 5 m into forest layer. The lowest dome was usually 1 to1.5 m above ground. Within these composite webs, juveniles and adult males constructed their domed webs supported in the main labyrinth threads.

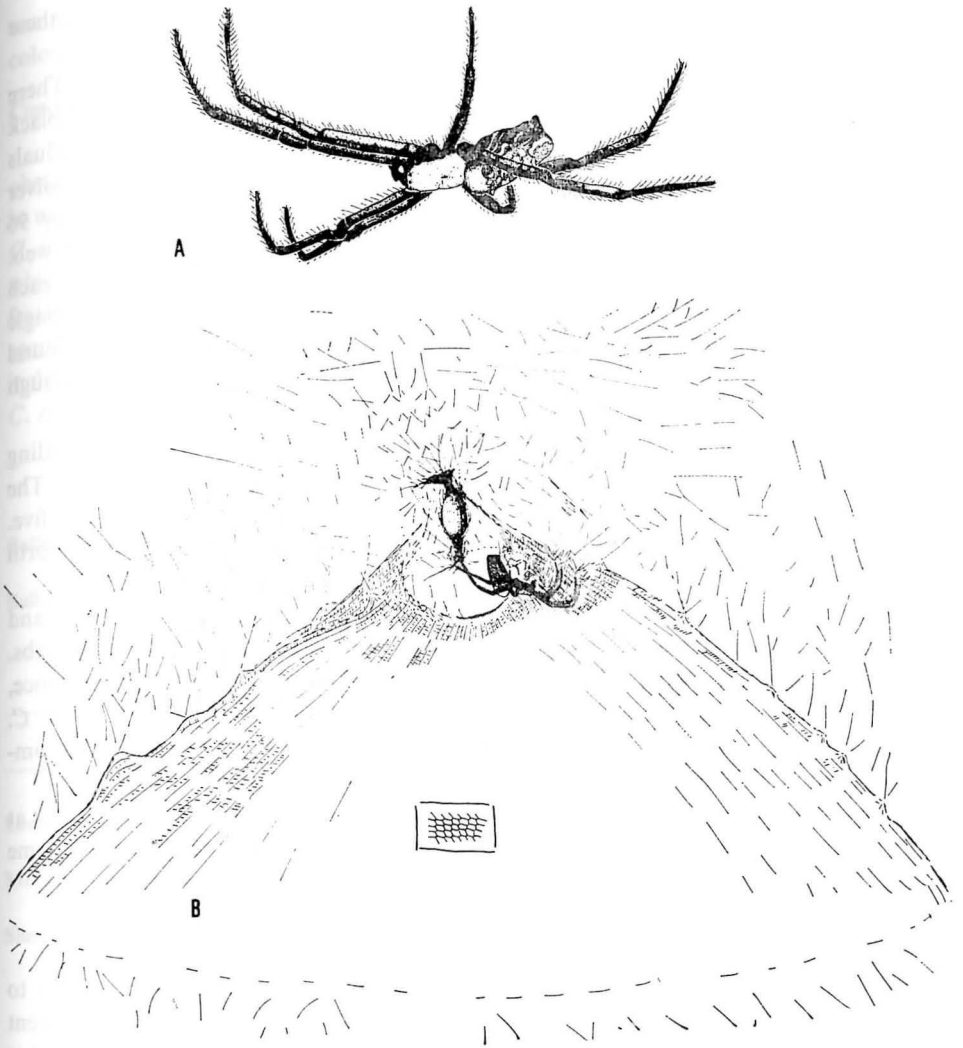

Fig. 1. A. Adult female *Cyrtophora moluccensis* in resting position. B. Diagrammatic sketch of adult female in resting position in domed web with egg sac. Inset is enlargement of orb web construction.

Eleven composite webs were examined for all spiders and eggsacs in July, 1969. Five were from tangantangan brush (*Leucaena leucocephala* DeWit) in an area exposed to wind and sun near the University of Guam. Six webs were collected in moderately protected limestone forest near the Naval Hospital. The webs were selected to be about 1 m^3.

A total of 8 adult female, 3 adult male, 25 subadult-juvenile and about 80 newly emerged spiderlings *C. moluccensis* were removed from these eleven webs. From 1 to 12 *C. moluccensis* had constructed domes in each "composite" web.

Although larger composite webs frequently contained many mature females, these webs had only a single adult with none to three eggsacs in each.

Six other spider species were found occupying the *Cyrtophora* webs. There were two species of *Argyrodes* (Theridiidae). One species, with a silver and black cone shaped abdomen, body length about 3 mm, was represented by 36 individuals in nine webs with from 1 to 11 specimens per web. The other, with a silver streaked brown abdomen and body length about 5 mm, was represented by 96 individuals (including 24 spiderlings) in 11 webs with 1 to 25 spiders per web. *Tetragnatha* sp. (Tetragnathidae) was represented by three individuals, one in each of three webs. There were 17 *Leucauge* sp. removed from four webs. A single *Gea* sp. or *Argiope* sp. juvenile and a single unidentified Araneidae was also found in the webs. At night, two clubionids were seen in the webs actively moving through the labyrinth.

Excluding new spiderlings, the total number of spiders per web including *Cyrtophora*, ranged from 7 to 26, with six webs having from 10 to 14. The number of species per web, including *Cyrtophora*, ranged from two to five. Seven small lantern shaped eggsacs resembling those described for North American *Argyrodes* (Exline and Levi, 1962) were also found in the webs.

There were no distinct webs associated with the *Argyrodes* spp. specimens and they seened to rely upon small insects entangled in the *C. moluccensis* webs. *Argyrodes* moved about the webs actively while avoiding the host. In one instance, a male of the larger *Argyrodes* species was feeding upon an adult female *C. moluccensis*. North American species of *Argyrodes* have been described as commensals and observed feeding upon their hosts (Exline and Levi, 1962).

Two specimens of clubionid spiders were active in the labyrinth webs at night. One was feeding upon a small juvenile *C. moluccensis* and an empty dome of appropriate size was near.

Reproduction

Eggsacs were present in the webs throughout the year. Commonly one to three, but as many as four, were suspended in a chain with the most recent below the others. In one web the lowest sac contained about 1400 developing spiderlings. The second contained about 1850 spiderlings ready to emerge. Adjacent to the web was a "nursery web" containing several hundred spiderlings, apparently from the third and uppermost sac. Three sacs from other webs contained about 1100, 1300, and 1500 eggs. Assuming an estimated 1100 eggs per sac and at least three sacs per female, then the female produced a minimum of 3300 eggs per year. Kullmann (1961) reported that *C. citricola*, a smaller species, produced 5 eggsacs with about 200 eggs per sac or about 1000 eggs per female.

C. moluccensis constructed a whitish eggsac with separate oval halves, 13 mm × 17 mm, that were held together by the friction of their overlapping sides and by a loose covering of light-greenish, wooly, nonadhesive silk. Together the convex halves formed a cavity 9 mm deep. The eggsac of *C. citricola* had

a convex lid and flat base (Kullmann, 1961). *C. citricola* eggsacs were covered with colored silk of brown felt with gray-green tufts.

Conclusions

Quantitative population ecology depends heavily on a basis of natural history observations. Whole groups of organisms, *e.g.*, spiders, are frequently ignored in ecological studies due to a lack of natural history data and ready identification. *C. moluccensis* is a large, conspicuous, abundant and easily identified island species which has readily accessible reproductive stages. It is obviously tied to habitat features and have interesting behavioral interactions with its own and other species. Shear (1970) points out the extent of social phenomena in spiders, including communal web building and feeding of young. The social interactions of *C. moluccensis* remain to be explored.

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