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OBSERVATIONS ON THE SOCIAL SPIDER, *ANELOSIMUS DOMINGO* (ARANEAE, THERIDIIDAE), IN SOUTHWESTERN PERU

Although *Anelosimus domingo* Levi (Araneae, Theridiidae) was described in 1963 (Levi 1963), little is known about its natural history. It is now evident that *Anelosimus saramacca* Levi and Smith (1982) is a synonym of *A. domingo* Levi (1963). (NEW SYNONYMY: Levi, per. comm.). Levi and Smith (1982) mention that the species is cooperatively social and include some habitat features in their description. Here we intend to definitively document the cooperative foraging in this species and report some preliminary observations of its web structure and behavior patterns in relation to other *Anelosimus* species.

In 1987 and 1988 we discovered a total of five communal webs of *A. domingo* in the forest undergrowth vegetation of the Tambopata Reserved Zone (12°50'S, 069°17'W), Madre de Dios, Peru. This 5,500 hectare reserve consists of pristine Amazonian forest on the border between the Tropical and Subtropical Zones as classified by Holdridge et al. (1971). All of the *A. domingo* webs that we found were located in the upper flood plain forest type at Tambopata. This forest type is created by flooding that occurs periodically in certain areas of the Amazon basin creating a secondary flood plain with soils richer than upland forest (Erwin 1984). This habitat, which has a very diverse plant community, is dominated by palms (*Iriartea*) of medium height (25-35 m tall). Each web was positioned in the undergrowth such that it was exposed to direct sunlight from zero to a maximum of three hours each day. *A. eximius* appears to have a much broader habitat range as we found its webs in five of the seven forest types described at Tambopata as well as along lagoons and paths where they could be exposed to sunlight 6 or 7 hours in a day. Another social species in the same genus found at Tambopata, *A. rupununi*, was only found in clearing areas or along bodies of water where they were exposed to direct sunlight nearly all day (pers. observ.). We found the first two webs of *A. domingo* in June 1987 and observed them periodically between that time and August 1988. By July 1988, one of those webs had deteriorated and disappeared and we had found three additional webs. Webs were isolated and uncommon even within the appropriate forest type (smallest nearest neighbor distance was 2.5 km).

The appearance of *A. domingo* webs is very similar to that of *A. eximius* (see Brach 1975; Vollrath 1982; Christenson 1984 for descriptions of *A. eximius* webs). All of the webs we found consisted of a single basket-shaped sheet of webbing with dead leaves and adjacent vegetation incorporated as retreats. Above this sheet was a non-sticky tangle of barrier webbing that can extend into neighboring vegetation several meters (Table 1). We estimate that there were several hundred individuals housed in each web, however, at any moment in time, only about 20-40 spiders were distributed in obvious areas (Table 1). The rest of the spiders were in retreats under leaves where many of them were situated in such a way that they could efficiently respond to prey or other disturbances in the web. Also in these retreats some adult females would be guarding egg sacs and caring for very young juveniles. Because it was difficult to see into the retreats in the *A. domingo* webs, we were unable to determine if females fed spiderlings by

Table 1.—Measurements in cm of *A. domingo* webs. Sheet measurements represent the length, width and depth of that basket-shaped structure. The height of the web is given as the lowest point of the sheet. The barrier extends up from the sheet into vegetation.

Web	Sheet	Height	Barrier	# Spiders visible (mean ± SD)
1	80 × 81 × 22	40	200	32.5 ± 11.3
2	65 × 70 × 40	70	140	27.5 ± 5.5
3	41 × 38 × 15	32	79	21.4 ± 12.3
4	110 × 140 × 35	12	290	39.3 ± 18.3
5	22 × 18 × 10	84	45	11.3 ± 6.1

regurgitation in a manner similar to *A. eximius* (Christenson 1986 and pers. observ.).

Just as for *A. eximius* (Nentwig 1985), the cooperative behavior and large webs constructed by *A. domingo* enables them to capture prey many times their own body size and mass (Table 2). The prey capture sequence is virtually identical to that we have observed in a sympatric population of *A. eximius*. When an insect enters the web several spiders emerge and begin to subdue the insect by circling and wrapping it with silk. Periodically individuals will move in and bite until the insect is killed. Although not significant with our small sample size, it appears that a larger number of spiders react in a shorter period of time to larger prey (Table 2). It took more individuals of *A. domingo* significantly longer to subdue large prey items (35-40 mm in length) in comparison to smaller prey (5-15 mm in length) (Mann Whitney *U*-test, $p < 0.05$) (Table 2). If the insect is relatively small it is moved from an exposed area of the web to one of the more protected retreats where spiders in all age classes can feed. Larger insects are left in the lower portion of the barrier web and the spiders emerge from retreats to feed on them there.

Interspecific tolerance and even interspecific cooperation have been reported for other social spider species (Fowler and Levi 1979; Krafft 1970, 1975). We found, however, that *A. domingo* and *A. eximius* are not tolerant of one another. Adult females of *A. eximius* did not survive when introduced into the field webs of *A. domingo*, although we were very successful at introducing spiders into different colonies of the same species. Six laboratory experiments were conducted in which one female of each species (matched by size) was introduced into a six-dram vial measuring 2.5 × 4.5 cm (3-6 spiders of a single species lived well for extended periods of time in vials of this size). In two experiments we introduced the spider at the same time. In the first vial, the *A. domingo* had attacked the *A. eximius* within the first five minutes and they had five aggressive interactions

Table 2.—Number of spiders and duration of the reaction period and handling time of prey items introduced into *A. domingo* webs (mean ± SD). a = Values for largest prey size are significantly different from values for smaller categories by Mann-Whitney *U*-test ($P < 0.05$).

Prey size	*N*	Reaction time (sec)	Number of spiders reacting	Handling time (sec)[a]	Number of spiders handling[a]
5-10 mm	4	0.6 ± 0.5	3.1 ± 1.2	201 ± 91	2.3 ± 3.3
10-15 mm	5	0.3 ± 0.5	3.3 ± 1.3	375 ± 158	4.0 ± 8.2
35-40 mm	4	0.2 ± 0.7	7.1 ± 5.2	982 ± 315	10.1 ± 3.2

within an hour. That female *A. domingo* killed the *A. eximius* in the third day. In the other vial no activity was observed and, by the third day, the two spiders had divided the space approximately equally with one spider at each end. In four other vials we introduced one female first and allowed her 24 hours to establish a small web inside the vial before we introduced the female of the other species. Two vials received *A. domingo* first and two vials received *A. eximius* first. The results of these experiments were symmetrical. Of the two vials in which *A. domingo* established webbing prior to *A. eximius*, one ended up with a single *A. domingo* and the other ended up with a single *A. eximius* after three days. The outcome was identical for the vials in which *A. eximius* was introduced first. The results of these experiments indicate that *A. domingo* and *A. eximius* will not coexist peacefully or cooperate with one another. It is apparent, however, that these species are capable of using one another's web. Also there appears to be no home bias among these spiders. That is, the spider spinning the initial web had no advantage in the contests we set up.

The observations we have made firmly places *A. domingo* among the cooperatively social spiders of the genus. Because sociality is well-developed among *Anelosimus* spiders, comparative studies of all aspects of their biology become important to our understanding of the evolution of social behavior both within this genus and in other spiders as well. Certainly more detailed investigations of *A. domingo* will help us understand some of the ecological factors that influence the evolution of social behavior.

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Ann L. Rypstra and **R. Scott Tirey**, Miami University, 1601 Peck Blvd., Hamilton, OH 45011 USA.

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