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Does the web of the social spider *Mallos gregalis* (Araneae: Dictynidae) attract flies?

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Introduction

Insect species frequently locate mates, food and oviposition sites by means of olfactory stimuli. A potential predatory tactic of spiders is to attract their insect prey by chemical mimicry of the mates, food or oviposition sites of the prey species. Eberhard (1977) recently provided evidence for use of this tactic by a neotropical bolas spider, and similar behaviour has been suggested for several other species (McKeown, 1963; Forster & Forster, 1973; Horton, 1979). One of the more interesting suggestions is that the social spider *Mallos gregalis* (Simon) attracts flies.

This small Mexican dictynid differs from related species of *Mallos* and *Dictyna* in having some rather unusual social characteristics (Jackson, 1978a). Individuals of all sex/age classes jointly occupy communal webs, with possibly as many as 20,000 individuals sharing a single web structure (Jackson & Smith, 1978). The spiders feed in unison on prey caught in the web (Burgess, 1979; Witt, Scarboro & Peakall, 1978), and there is virtually no cannibalism or intraspecific aggression (Jackson, 1979a). Most species of *Mallos* and *Dictyna* are solitary. A few species are communal but differ from *M. gregalis* by defending territories within web complexes. Unlike *M. gregalis* the solitary and the communal, territorial species tend to feed alone, and they are prone to respond aggressively and cannibalistically toward conspecific individuals. Diptera seem to constitute the predominant prey of the species of *Mallos* and *Dictyna* that have been investigated (Jackson, 1977).

If *M. gregalis* is able to attract its prey, this might contribute in an important way to understanding its special social characteristics. The most important observations on *M. gregalis* in its natural habitats were those of Diguet (1909a, b, 1915), carried out in the mountains of Michoacan. He reported that the people living in these regions employed the webs of *M. gregalis,* which they called "el mosquero", as fly traps around their homes. Diguet, as well as later writers (Berland, 1928; Gertsch, 1949; Burgess & Witt, 1976), emphasised the phenomenal capacity of these webs to capture flies, and this species was introduced to France as a potential biological control agent for flies (Berland, 1913; Semichon, 1910).

Diguet reported carrying out a simple experiment in which he placed a paper envelope over a web of *M. gregalis.* Flies landed on this paper in great abundance, but relatively few landed on paper placed elsewhere. His conclusion that the web of *M. gregalis* attracts flies is still quoted half a century later. However, it is difficult to evaluate this experiment since quantitative results and details concerning methods were not provided.

Some experiments similar to Diguet's were carried out in the laboratory. The results provided no evidence that the webs of *M. gregalis* attract flies. These experiments will be described here because of the potential importance of this issue in understanding social spiders.

Methods

General

The laboratory colony of *M. gregalis* originated from spiders collected by J. W. Burgess near Guadalajara, Mexico (Burgess, 1976). Details concerning maintenance are provided elsewhere (Jackson, 1979a). Adult houseflies (*Musca domestica*) were obtained from the stock culture in the Department of Entomology, North Carolina State University. Before the experiment, the flies were housed in a metal screen cage. Using a piece of cotton gauze (see Jackson, 1979b), the flies were taken from the cage by hand and introduced to the experimental apparatus individually. All experiments were carried out in the afternoon (15.00-18.00) in the same room used for maintenance of the spiders.

Statistical tests are described in Sokal & Rohlf (1969). All random determinations were made with a random numbers table (Rohlf & Sokal, 1969).

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Experiment No. 1

This experiment most nearly resembled the one reported by Diguet (1915). A colony of *M. gregalis* was provided access to a wooden frame on which it built a communal web. The frame was a hollow cube made by gluing together 12 sticks, each *ca* 10cm long. A transparent plastic terrarium (see Jackson, 1980, for details) was placed over this frame and three identical empty frames. The terrarium had a lid with a corked hole through which flies were introduced during the experiment. The terrarium was set on a piece of white cardboard that served as a floor. The frames were evenly spaced within the terrarium and taped to the floor. Whether the frame with the spider-colony was placed nearest to the north (N), S, E or W corner of the terrarium was determined randomly before each test. Between tests, the floor was rotated to bring the spider-colony into the randomly determined position. Each frame was covered with a piece of white cotton gauze. To begin a test, a fly was introduced through the hole on the lid. The first frame on which the fly landed was recorded along with the time that elapsed between introduction and landing. The fly was then removed before the next test began.

Experiment No. 2

Using a different but comparable colony of *M. gregalis* on a cubical wooden frame, this experiment was carried out exactly as Experiment No. 1 except that the web was not covered with gauze. Flies that landed on the web during the experiment were usually unable to escape (see Jackson, 1979b). They were removed with forceps before beginning the next test.

Experiment No. 3

Ten mature females and ten large immatures of *M. gregalis* were placed inside a clear plastic cage (10 x 10 x 6.5 cm; for details of cage design, see Jackson, 1978b). The spiders were fed after one week, and the experiment was carried out after another week. During the experiment, the cage with the spider-colony and an identical empty cage were connected to a Y-shaped walkway for the flies. This was constructed from three *ca* 20cm long transparent plastic tubes (diameter *ca* 4cm). The three branches of the apparatus (i.e. the three tubes) will be referred to as A, B and C. A was at an oblique angle to B and C; B and C were *ca* 90° to each other. A was plugged with a stopper. B was inserted *ca* 1cm through a large hole on the side of the cage with the spider colony; C was similarly inserted through a hole in the empty cage. Since the diameter of the tubes was less than that of the holes on the sides of the cages, the tubes were held in place with plasticene (modelling clay). Before each test, whether B was to be on the left or right side was determined randomly. To begin a test, the stopper was removed briefly from A and the fly was introduced. The first branch and the first cage that the fly entered were recorded. Latencies were recorded also (i.e. time elapsing between the start of the test and entry into an arm or cage). The fly was removed from the apparatus before beginning the next test. Those flies that entered the cage with the spider-colony were usually captured in the web and

	Experiment No. 1			Experiment No. 2			Experiment No. 3					
							Enter Arm			Enter Cage		
Choice	Number	Latency (sec)		Number	Latency (sec)		Number	Latency (sec)		Number	Latency (sec)	
		Mean	Range		Mean	Range		Mean	Range		Mean	Range
M. gregalis	10	60	15-198	14	54	22-130	26	21	2-91	26	41	7-128
Control	40	55	2-331	36	89	19-485	24	20	1-88	24	44	5-163

Table 1: Experimental results. If fly landed first on frame with spider colony (Exp. No. 1 or 2) or first entered cage with spider colony or arm of apparatus connected to cage with colony (Exp. No. 3), its choice was recorded as "*M. gregalis*". If it landed first on empty frame, entered empty cage, or entered arm connected to empty cage, its choice was recorded as "control".

had to be removed with forceps before the next test began.

Results

Experimental results are provided in Table 1.

If the silk of *M. gregalis* does not attract flies, then the expected number of flies to land first on frames with silk in Experiments Nos. 1 and 2 would be 12.5 and the expected number to first enter the arm or cage with silk would be 25 in Experiment No. 3. Using G-tests of goodness of fit with Yates' correction (G-tests can be used interchangeably with the more familiar χ^2-tests) to compare the observed with the expected frequencies, there was no evidence of attraction (Exp. 1, G = 1.019; Exp. 2, G = 0.104; Exp. 3, G = 0.181). Since latencies did not follow a normal distribution, they were compared using Mann-Whitney U-tests, non-parametric tests that can be used in lieu of t-tests. After transformations, the U-statistics can be compared with the critical values of Student's t-distribution. These tests provided no evidence that the latencies with which flies landed on the silk-covered frames differed from the latencies with which they landed on control frames in Experiment No. 1 (t = 0.509) or No. 2 (t = 1.340). In Experiment No. 3 there was no evidence that latencies to enter arms (t = 0.728) or cages (t = 0.942) associated with silk differed from latencies for control arms and cages. (For all tests, $P > 0.1$).

Discussion

None of the experiments provided evidence that the webs of *M. gregalis* attract houseflies (Table 1). Different results might conceivably be found using different experimental designs, different species of flies, etc. The flies involved in Diguet's experiments were most likely *M. domestica,* but this was never stated definitely. However, given the results of my experiments and the difficulty of evaluating Diguet's experiment, there seems little basis on which to accept the hypothesis that the webs of *M. gregalis* attract flies.

Possibly, flies are attracted not to the web itself but to the carcasses of other flies entangled in the web. Fly carcasses from earlier feeding were present in the webs used in my experiments, but possibly carcasses were much more numerous in nature and in Diguet's experiments.

Another possibility is that the success of the web of *M. gregalis* in capturing flies is related more to its extreme stickiness. Flies are very active animals that tend to land briefly on many objects in their surroundings, but those that land on webs of *M. gregalis* rarely escape (Jackson, 1979b). If the spiders place their webs in habitats with especially large fly populations, there might be little need for attraction of flies by the web. Clearly, there is a need for field studies to clarify this issue.

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References

BERLAND, L. 1913: Utilisation pour la capture des mouches, des nids de l'araignée mexicaine: *Coenothele gregalis* E. Simon. *Bull.Mus.natn.Hist.nat.Paris* **1913**: 432-433.

BERLAND, L. 1928: La répartition géographique des araignées sociales. *C.r.somm.Séanc.Soc.Biogéogr.* **1928**(37): 33-36.

BURGESS, J. W. 1976: Social spiders. *Scient.Am.* **234**: 100-106.

BURGESS, J. W. 1979: Web-signal processing for tolerance and group predation in the social spider *Mallos gregalis* Simon. *Anim.Behav.* **27**: 157-164.

BURGESS, J. W. & WITT, P. N. 1976: Spider webs: design and engineering. *Interdisc.Sci.Rev.* **1**: 322-335.

DIGUET, L. 1909a: Sur l'araignée mosquero. *C.r.hebd.Séanc. Acad.Sci., Paris* **148**: 735-736.

DIGUET, L. 1909b: Le mosquero. *Bull.Soc.natn.Acclim.Fr.* **56**: 368-375.

DIGUET, L. 1915: Nouvelles observations sur le mosquero ou nid d'araignées sociales employé comme piège à mouches dans certaines localités du Mexique. *Bull.Soc. natn.Acclim.Fr.* **62**: 240-249.

EBERHARD, W. G. 1977: Aggressive chemical mimicry by a bolas spider. *Science, N.Y.* **198**: 1173-1175.

FORSTER, R. R. & FORSTER, L. M. 1973: *New Zealand spiders.* Auckland, Collins.

GERTSCH, W. J. 1949: *American spiders.* New York, D. Van Nostrand.

HORTON, C. C. 1979: Apparent attraction of moths by the webs of araneid spiders. *J.Arachnol.* **7**: 88.

JACKSON, R. R. 1977: Comparative studies of *Dictyna* and *Mallos* (Araneae, Dictynidae): III. Prey and predatory behavior. *Psyche, Camb.* **83**: 267-280.

JACKSON, R. R. 1978a: Comparative studies of *Dictyna* and *Mallos* (Araneae, Dictynidae): I. Social organisation and web characteristics. *Revue Arachnol.* **1**: 133-164.
JACKSON, R. R. 1978b: The mating strategy of *Phidippus johnsoni* (Araneae, Salticidae): I. Pursuit time and persistence. *Behav.Ecol.Sociobiol.* **4**: 123-132.
JACKSON, R. R. 1979a: Comparative studies of *Dictyna* and *Mallos* (Araneae, Dictynidae): II. The relationship between courtship, mating, aggression and cannibalism in species with differing types of social organisation. *Revue Arachnol.* **2**: 103-132.
JACKSON, R. R. 1979b: Predatory behavior of the social spider *Mallos gregalis*: is it cooperative? *Insectes soc.* (in press).
JACKSON, R. R. 1980: The mating strategy of *Phidippus johnsoni* (Araneae, Salticidae). III. A cost-benefit analysis. *J.Arachnol.* (in press).
JACKSON, R. R. & SMITH, S. E. 1978: Aggregations of *Mallos* and *Dictyna* (Araneae, Dictynidae): population characteristics. *Psyche, Camb.* **85**: 65-80.
McKEOWN, K. C. 1963: *Australian spiders.* Angus & Robertson, Sirius Books, 1963 edition edited by N. Roberts, Sydney.
ROHLF, F. J. & SOKAL, R. R. 1969: *Statistical tables.* San Francisco, Freeman.
SOKAL, R. R. & ROHLF, F. J. 1969: *Biometry.* San Francisco, Freeman.
SEMICHON, L. 1910: Observations sur une araignée mexicaine transportée en France. *Bull.Soc.ent.Fr.* **1910**: 338-340.
WITT, P. N., SCARBORO, M. B. & PEAKALL, D. B. 1978: Comparative feeding data in three spider species of different sociality: *Araneus diadematus* Cl., *Mallos trivittatus* (Banks) and *Mallos gregalis* (Simon). *Symp.zool.Soc.Lond.* **42**: 89-97.

Nomenclatural Note

Notice is given of the possible use of plenary powers by the International Commission on Zoological Nomenclature, published in *Bull.zool. Nom.* **36**(4), 18 February 1980, and comments are welcome.

2294 *Bellota* Peckham & Peckham, 1892 (Araneae): proposed designation of type species.

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Editor
