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EGG FEEDING BY *TEGENARIA* SPIDERLINGS (ARANEAE, AGELENIDAE)[1]

Guillermo Ibarra N.

Centro de Investigaciones Ecológicas del Sureste[2]
Area Agroecológica, 2a. Poniente 36
Ap. Postal 36, 30700 Tapachula, Chiapas, México

and

Laboratoire d'Ethologie et Sociobiologie, Université Paris XIII
Av. Jean-Baptiste-Clément, 93430 Villetaneuse, France

ABSTRACT

Egg feeding activity has been observed within the egg sac in spiderlings of two species of *Tegenaria* Latreille (Agelenidae), in which this phenomenon had not been previously reported. The two species differ in their proportion of egg consumption; their ecological characteristics and life cycle are probable factors that account for the proportional difference in egg feeding.

INTRODUCTION

In spiders, eclosion leads to a stage in which spiders are still incompletely developed. They have little motility and cannot weave or capture prey. In order to complete their development they must remain within the egg sac during a certain length of time which varies according to the species and the conditions of development. This stage, named incomplete (Holm 1940), larval (Vachon 1957), deutovum (Gertsch 1949) or quiescent (Valerio 1974), consists of one or more phases, separated by the shedding of the vitelline membranes. At the end of this stage the first true molt takes place and the larva transforms into a nymph, which is defined as being complete, active and with functioning venom and silk glands (Vachon 1957, Foelix 1979). This nymph remains inside the egg sac for some time before emerging to begin its solitary life. Some authors (Burch 1979, Turnbull 1973) assume that when the nymphs emerge from the egg sac they still have vitelline reserves from which they feed until dispersion occurs. Nevertheless it is known that in several species, the spiderlings (larvae or nymphs) feed on inviable eggs before emergence, as in the families Loxoscelidae (Galiano

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[2] Present address.

1967), Clubionidae (Lecaillon 1904, Mansour et al. 1980, Peck and Whitcomb 1970), Gnaphosidae (Holm 1940), Thomisidae (Schick 1972) and Theridiidae (Juberthie 1964, Kaston 1970, Valerio 1974).

I have detected egg feeding by first nymphs in two species of *Tegenaria* Latreille (Agelenidae), with a remarkable difference in the proportion in which the phenomenon occurs in each species. I believe the difference might probably be determined as much by ecological dissimilarities in the habitat of each of these species as by their life cycles.

MATERIALS AND METHODS

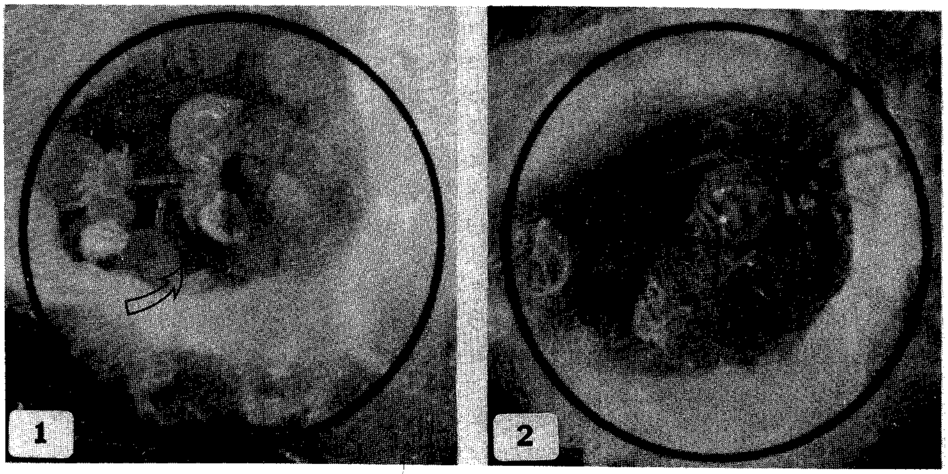
The first observations were made on *Tegenaria* sp. during a study on the predatory behavior of this species (Ibarra 1983, in press). Adults were collected in a tropical forest (Chiapas, Mexico) and were kept and mated in the laboratory. The females wove their egg sacs, from which the spiderlings later emerged, within the cages. A record was kept of the number of spiderlings that emerged from each egg sac and later they were separated individually to start the predatory behavior study.

Later, adult *T. saeva* Blackwall were collected in buildings in the suburbs of Paris (France). These spiders were mated in the laboratory and four egg sacs were removed from the cages a short time after they were woven. Each of these was cut approximately one centimeter in length along its external silk layer, in order to open it enough to display the eggs in its interior. Each egg sac was placed in a plastic box with the observation window facing upwards. Two pieces of sponge at either side supported a slide which covered the observation window in order to protect the eggs from air currents and possible intruders, without obstructing their observation. The egg sacs were observed once a day, until eclosion took place. From that moment on, three observations were made daily, each consisting of five minutes. One of the egg sacs was exposed to programmed photographic equipment and photographs were taken every two hours.

RESULTS

In 350 spiderlings of *Tegenaria* sp. that emerged from six egg sacs, no evident difference in size was observed, except for 15 individuals which had a considerably larger opisthosoma than the rest, all these 15 emerged from the same egg sac (this being the last produced by one of the reproductive females). These spiderlings had an accelerated rate of development and underwent the second molt between four and seven days after they emerged, whereas the rest took from 21 to 45 days to do so.

In the four egg sacs of *T. saeva* 162 spiderlings hatched from the eggs, but four died before the emergence from the egg sac. I have observed egg feeding by 14 individuals, and a progressive enlarging of the opisthosoma in many others (Figures 1 and 2). At emergence all of the 158 survivors had an expanded opisthosoma, and there was no evident difference in size between them. The observations on the behavior of these spiderlings inside the egg sac are



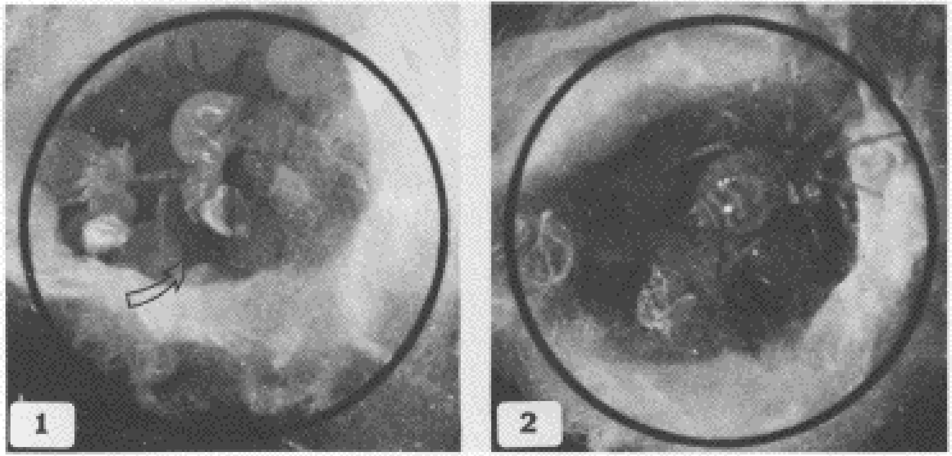
Figs. 1-2.—First nymphs of *Tegenaria saeva* inside the egg sac: 1, two days after molting, a nymph is feeding on an egg (arrow); 2, four days after molting, note the more bulky opisthosomae because of egg feeding. The circle is 5 mm in diameter.

summarized as follows: A) There is a close synchronization between individuals for the eclosion, and later for the first molt. B) The motility of the larvae is highly reduced in comparison to that of the nymphs. C) The nymphs can feed repeatedly on eggs from the day after they undergo the first molt. D) An egg is not consumed all at once, but progressively. In the majority of these cases, the egg is consumed completely; only the chorion, which looks like a deflated ball, is left. The increase in the volume of the opisthosoma is then clearly noticeable (Figures 1 and 2). E) No aggressive act of behavior was observed, either among the nymphs or the larvae. F) In the majority of these cases (153) the nymphs molted the second time without any additional food.

DISCUSSION

The enlarged opisthosomae of 15 individuals of *Tegenaria* sp. made me suspect a case of egg feeding. Forster (1977) observed that in salticid spiderlings, any reinforcement in feeding results in the reduction in length of the first nymphal instar. So the accelerated rate of development of the same 15 individuals of *Tegenaria* sp. is a further evidence to assume that they fed on eggs. Therefore in this species the proportion of egg feeding detected is 4.2% of the total number of eclosed spiderlings. The egg feeding directly observed in several individuals of *T. saeva,* the similarity in size in all the survivors at emergence, and the fact that a great number of survivors molted the second time without having any additional food, permit me to state that all of them fed on eggs. So in this species, the proportion of egg feeding is 97.6% for all the eclosed spiderlings; this value differs greatly from that found in *Tegenaria* sp.

I can tell that the cases reported here are of spiderlings that fed on inviable eggs and not on other spiderlings because: A) the nymphs tolerated one another while they were feeding on the eggs, I saw no instance of aggression between them, and the small number of spiderlings that died before the emergence is proof that this should be rare; B) the *Tegenaria* spiderlings become capable of feeding at the first nymphal stage, the larvae being too immobile to do it; C) The reduced



Figs. 1-2.—First nymphs of *Tegenaria saeva* inside the egg sac: 1, two days after molting, a nymph is feeding on an egg (arrow); 2, four days after molting, note the more bulky opisthosomae because of egg feeding. The circle is 5 mm in diameter.

motility of the larvae make them probably subjects of cannibalism by the nymphs, but the synchronized development prevents this, and allows only the inviable eggs (when these are present in the egg sac) as food for the nymphs.

Thus the difference in the percentages of egg feeding between the two species is due in all probability to the proportion of inviable eggs which the female deposits in the egg sac. So in *Tegenaria* sp. practically all of the eggs were viable, except those in one sac, whereas in each sac of *T. saeva* there was a proportion of inviable eggs sufficiently large enough for the nymphs to feed on before they emerged from the sac. In various species of spiders, it has been observed that the proportion of viable eggs drops in the last egg sacs of each female (Christenson, Wenzl and Legum 1979, Horner and Starks 1972, Jackson 1978). This might be the explanation for the single case of egg feeding detected in *Tegenaria* sp. It might further indicate that the presence of eggs (whether they be viable or not) is capable of evoking the egg feeding behavior in these nymphs.

Valerio (1974) demonstrated that egg feeding helps to prolong the survival of the first nymphs. Thus, egg sacs with a higher proportion of inviable eggs have a higher probability of egg feeding; though their rate of eclosion is diminished; the possibilities of survival for the emerged spiderlings are increased.

There seem to be two ways for optimizing the reproduction as a function of the number of viable and inviable eggs in each sac. In one case, the vitellum produced by the female is used to produce the largest number possible of spiderlings (as in *Tegenaria* sp.). On the other hand the vitellum is used to produce stronger individuals, but in smaller numbers (as in *T. saeva*). What determines the predominating way in each species? I believe the answer lies on the particular life cycle and the characteristics of the habitat of each species.

In *Tegenaria* sp. the females make their egg sacs from November to March, whereas *T. saeva* does so from September to December. In the habitat of the first species potential prey are abundant during the whole year, but for the second species potential prey become scarce in the autumn, precisely when the spiderlings emerge. The females of *T. saeva* must then spend part of their reproductive potential in inviable eggs so that a small number of nymphs develop enough to survive the winter season, when the potential prey have practically disappeared and the weather is unsuitable for active life. Because the *Tegenaria* sp. nymphs do not have to face the scarcity of prey (neither at the moment of emergence nor later), it is more profitable for the females of this species to produce the highest number of nymphs possible. Thus each species optimizes the use of its own resources (vitellum produced) in function of its possibilities to exploit the resources of its habitat (potential prey).

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