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THREE CASES OF PARASITISM IN THE MYGALOMORPH SPIDER *LASIODORA KLUGI* (C. L. KOCH) BY A FLY OF THE GENUS *EXETASIS* (DIPTERA, ACROCERIDAE) IN BRAZIL.

VERA REGINA D. von EICKSTEDT

(Seção de Artrópodos Peçonhentos, Instituto Butantan)

ABSTRACT: Three cases of parasitism in the Mygalomorph spider *Lasidora klugi* by an acrocerid fly were studied. ACROCERIDAE in their larval phase are known only as internal parasites, developing and evolving inside the host spider. Before emergence, the parasite consumes the greatest part of the host's content, thus killing it. Up to now there is only one described case of parasitism by ACROCERIDAE from Brazil (Vellard, 1934); the parasite however had not been identified by the author. For the first time in the literature a spider genus of the sub-family THERAPHOSINAE is cited as host of these flies.

The parasite insects have been reared by the author up to adulthood and were later sent to Prof. Evert Schlinger (University of California, Berkeley, U.S.A.) who identified them as a new species of the genus *Exetasis*, to be described elsewhere.

UNITERMS: Spider parasitism; *Lasiodora klugi* parasitism; Parasite flies; ACROCERIDAE flies; *Exetasis* flies.

INTRODUCTION

Instances of parasitism of spiders by acrocerids have been know for about one century. The oldest reference is by Menge (1866), who in his monograph of Prussian spiders stated to have reared a larva of *Ogcodes pallipes* Erichson from *Clubiona putris* Koch (CLUBIONIDAE). ACROCERIDAE in their larval phase are known only as internal parasites of spiders. The fecundated female lays masses of eggs over the ground, on twigs, on living or dead branches of shrubs and trees. After an incubation of several weeks, the tiny (some tenths of a millimeter long) but quite active larvae, known as planidia, emerge. They may remain standing erect beside their egg shell or may walk worm-like or jump from one place to the other in order to attach themselves to a suitable host which they may encounter. They enter the host by means of a piercing organ present on the head of the larva, which they use to tear the thin intersegmental membranes of the spider's legs.

Address:
C.P. 65, São Paulo, Brazil

Otherwise, they may use the natural orifices of the spider, such as the respiratory or genital slits, without lacerating the host's integument (Millot, 1938). According to Schlinger (1960) several larvae of *Ogcodes* were seen to enter the host through the intersegmental membranes of the legs but 50% of them seemed to prefer entering the spider through the dorsofrontal region of the abdomen. They develop, molt twice and change morphologically inside the host's body. When mature, the larvae emerge from the spider through the abdominal region, usually piercing it (Schlinger, 1952) or (according to Eason *et al.* (1967) for one larva of *Ogcodes pallidipennis* which was seen emerging from one of the lung slits of a female *Pardosa lapidicina*) emerges without damaging its abdomen.

The third larval stage, shortly before emergence, consumes the greatest part of the host contents, thus killing it. The larva, at this phase, is yellowish-white and its body is covered by a glossy, vicous substance. A short time before the emergence of the parasite, the spider, probably stimulated by the movements of the larva in its entrails, spins an irregular web of silken threads, similar to a pre-moulting web (Schlinger, 1962). This is the first sign that something anormal is going to happen.

According to most authors, not until this moment it is possible to know whether the spider is parasitired or not — it does not show any external evidence of parasitism, neither by changes of the body (the increased abdomen might well be mistaken as gravidity or overfeeding) nor by behavioral changes. This irregular web spun by the spider is the place where the larva will fix itself for pupation. It adheres to the silken threads by means of the oral hooks and a series of tiny groups of abdominal hook-like setae, with the head turned upwards. The larva then becomes motionless and graduaily darkens. After some days or weeks, the delicate pupal skin starts to break, and the imago emerges. Near the web there can be found the remains of the spider's body, reminding one more of an exuvia than that of the body of a spider.

There are, up to present, only two cases dealing with the biology of acrocerids from the neotropical region: that of Schlinger (1968) who reared *Arrynchus maculatus* Schlinger from the chilean Theraphosid *Phrixotrichus roseus* (Guerin) and that of Vellard (1934) on a *Grammostola actaeon* (Pocock) from Paraná, Brazil, parasitized by a larva that, according to Vellard "présente tous les caractères des *Ochaea;* ce n'est ni l' *O. calida* Wied, ni l' *O. lugubris* Gerst; je n'ai pu me procurer actuellement la description des deux autres espèces de ce genre décrites au Brésil".

The Seção de Artrópodos Peçonhentos of the Instituto Butantan in São Paulo receives every year hundreds of specimens of living Mygalomorph spiders (tarantulas or "caranguejeiras" in Brazil) from the most diverse regions of the country. These specimens are sent by people willing to learn something about their peculiarities, by persons aware of their importance to public health, who became our assiduous collaborators, or are obtained during the excursions of the Instituto Butantan staff. Among some of these spiders I had the opportunity to observe three cases of parasitism of *Lasiodora klugi* (MYGALOMORPHAE: THERAPHOSIDAE) by acrocerid flies of the genus *Exetasis* (= *Ocnaea* of authors but *not* Walker, 1852).

Most of the published records of endoparasitism by acrocerids published up

to present involve true spiders (LABIDOGNATHA), especially of the families LYCOSIDAE and SALTICIDAE. Few cases were recorded in Mygalomorph spiders of the family CTENIZIDAE (Brauer, 1869; Jenks, 1938) and THERAPHOSIDAE (Baerg, 1958; Eason *et al.,* 1967 and Schlinger, 1968). Among the THERAPHOSINAE, no instance of parasitism has been published prior to this note. Besides this, the cases of parasitism by ACROCERIDAE in Mygalomorph spiders described up to now, involved only fossorial genera. Therefore, this account on parasitism of a nomadic THERAPHOSINAE, may be of interest to entomologists and biologists in general.

MATERIAL AND METHODS

At arrival in the lab the spiders are identified and then put inside wooden cages. Each cage has a number and a corresponding slip of paper, where there are recorded: classification, sex, origin and arrival date of the spider, name and address of the collector. The spiders are checked regularly and observations on shedding, making of cocoons, birth of spiderlings, changes in behavior, feeding, etc. are recorded.

The cages measure 30x25x20 cm., the back wall is of wire screen and the front is a glass sliding door. This way, cleaning, treatment and observation of the spider are easily done. The several cages (about 400) are arranged by numerical order in special shelves, one next to the other in a rearing room. During hot weather the animals are kept at room temperature, during cold weather the room is heated to 23°C. Every two or three weeks the spiders are fed with a live baby mice. The water they are supposed to drink is kept in little clay containers and renewed constantly; the water never must be missing in the cage.

The hosts have been identified by the author and the acrocerid parasites by Prof. Evert Schlinger (University of California, Berkeley, U.S.A.) who concluded that these ACROCERIDAE represent a new species of *Exetasis* which he intends to describe. The drawings were done with a camera lucida by Mrs. Delma Travassos. The exact time of emergence from the host and eclosion of the adults were recorded, but not the precise dates of pupation.

BIOLOGICAL DATA

First case: On December 26, 1967, we have received a specimen of *Lasiodora klugi,* sent by the company "Sul Madeiras, Ltda". The spider had been captured when trying to escape from a log of rosewood (jacarandk) from Bahia, Brazil. On January 26, 1968, the spider moulted in the laboratory and on June 26 of the same year was found dead inside its cage. The body was almost empty and showed in the dorsum of the abdomen, near the base, two orifices. Inside the cage two yellowish-white larvae were found, and were preserved in 70% alcohol for study. They will be described by Schlinger. Their collection number is N.º 310, IB. The host, unfortunately, was not preserved.

2nd. case: On February 16, 1968, the Company Masul S. A., Osasco, sent us six specimens of *Lasiodora klugi*, found in a load of logs from Colatina, State of Espírito Santo, Brazil. Three specimens were already dead at the time arrival, and were included in the arachnological collection of the Seção de Artrópodos Peçonhentos of the Instituto Butantan (N.º 3845 IB). Of the three remaining specimens, one was a male which died on February 24, 1970, and was not parasi-

tized; the second, a female, is still alive; the third, an immature specimen, was parasitized by two larvae, which emerged on July 5, 1968, causing the death of the spider (preserved under N.º 28, IB). The larvae were reared. At the time of emergence, the larvae had a whitish color, with a slight greenish tinge. On July 25, 1968, the pupae had already formed, with a yellowish-brown coloration, and hung from the irregular web spun by the spider (Photograph 1). On September 2, 1968, one of the imagos had freed itself almost completely from the puparium, the wings and legs plainly visible. On September 9, 1968, it walked about the cage, very slowly, dying a few days afterwards (the exact date was not recorded). The host was a juvenile female spider, with the genital slit still closed.

3rd. case: An immature specimen of *Lasiodora klugi*, without procedence, arrived at the Instituto Butantan on December 11, 1967. On February 20, 1969 shedding took place and on July 10, 1969, it was found dead in the cage. Near its body, were two shining larvae each with eight dark ventral spots (setal platelets). One larva was found dead the following day, but the other was reared to an adult. On July, 1969, the pupa was already formed and its skin contained a gap near the region of the head (prothoracic gap). On July 15, 1969, the pupa had a much darker color, practically grey; the gap reached the median region of the body. On August 12, 1969, the adult emerged, and the puparium had at this time a blackish color. Two days later the adult was found dead, being preserved together with the remmants of the host (N.º 3955, IB). The host was an immature female, with the genital slit closed and the spermathecae still in process of formation.

CONCLUSIONS

1. Contrary to the observations of several authors dealing with north temperate spiders, emergence of these brazilian parasites occurred during the winter. One possible explanation is that the spiders were kept under laboratory conditions, in heated rooms during the winter. It is possible that, if the spiders were kept under natural conditions of temperature, the parasites would have emerged later.

2. In all three cases two larvae per host emerged. In one of the cases (2nd.) it seems that the second larva used the same hole as the first did, for no other exit hole was found. Other cases of double or multiple parasitism by acrocerids are those of Jenks (1938), Baerg (1958), Eason *et al.* (1967), and Montgomery (1903).

3. It was always possible to see the exact site of fixation of the larvae near the edge of the exit hole (Fig. 1 and 2). In that region a small chitinized shell (spiracular plate) was observed containing the spiracular remnants of the second-instar larva. In case 2, the region of fixation of the larva which used the same exit hole as the first, could be seen very clearly: simmetrically to this exit hole there was a slightly modified integument region with the two second-instar larval caudal spiracles at the center. Millot (1938) cites an analogous fact for *Ogcodes* in the abdomen of a *Clubiona* but this is the first time that an illustration is given of these structures. Thus, contrary to most author's statements that the detection of parasitism can be done only just prior to the emergence of the larva, an accurate examination of the spider integument would have revealed much earlier this fact, at least in our three specimens.

4. The time of development of the larvae could not be determined, since the spiders received were already parasitized. However, we could observe that from arrival to emergence of the larvae, periods between 139 and 577 days elapsed The larvae needed from 33 to 66 days from host emergence to adulthood.

RESUMO — Foram estudados três casos de parasitismo entre a aranha caranguejeira *Lasiodora klugi* e uma espécie nova de môsca do gênero *Exetasis* (ACROCERIDAE). Os acrocerídeos na sua fase larval são sempre parasitas internos de aranhas, desenvolvendo-se e transformando-se profundamente no interior delas. Antes de emergirem do hospedeiro, consomem a maior parte do seu conteúdo interno, matando-o.

Existia até agora sòmente um caso relatado sôbre a biologia de ACROCERIDAE do Brasil (Vellard, 1934) onde, porém, o autor não chega a identificar o parasita. Pela primeira vez na literatura, um gênero de aranha da sub-família THERAPHOSINAE é citado como hospedeiro dessas môscas.

Os insetos parasitas foram criados pelo autor até a fase adulta e, posteriormente, enviados ao Prof. Evert Schlinger (University of California, Berkeley, U.S.A.) que os identificou como espécie nova do gênero *Exetasis*, que êle irá descrever.

UNITERMOS: Parasitismo em aranhas; Parasitismo em *Lasiodora klugi*; Dípteros parasitas de aranhas.

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TABLE 1: BIOLOGICAL DATA

HOST			PARASITE			
N.º	sex	caged on	emergence	larval* period	adult	from emergence to imago
310 IB	♀	26.XII.1967	26.VI.1968	180	....	....
28 IB	♀	16.II.1968	5.VII.1968	139	2.IX.1968	60 days
3955 IB	♀	11.XII.1967	10.VII.1969	577	12.VIII.1969	33 days

* larval period (inside the host) recorded only in the lab. (in days).

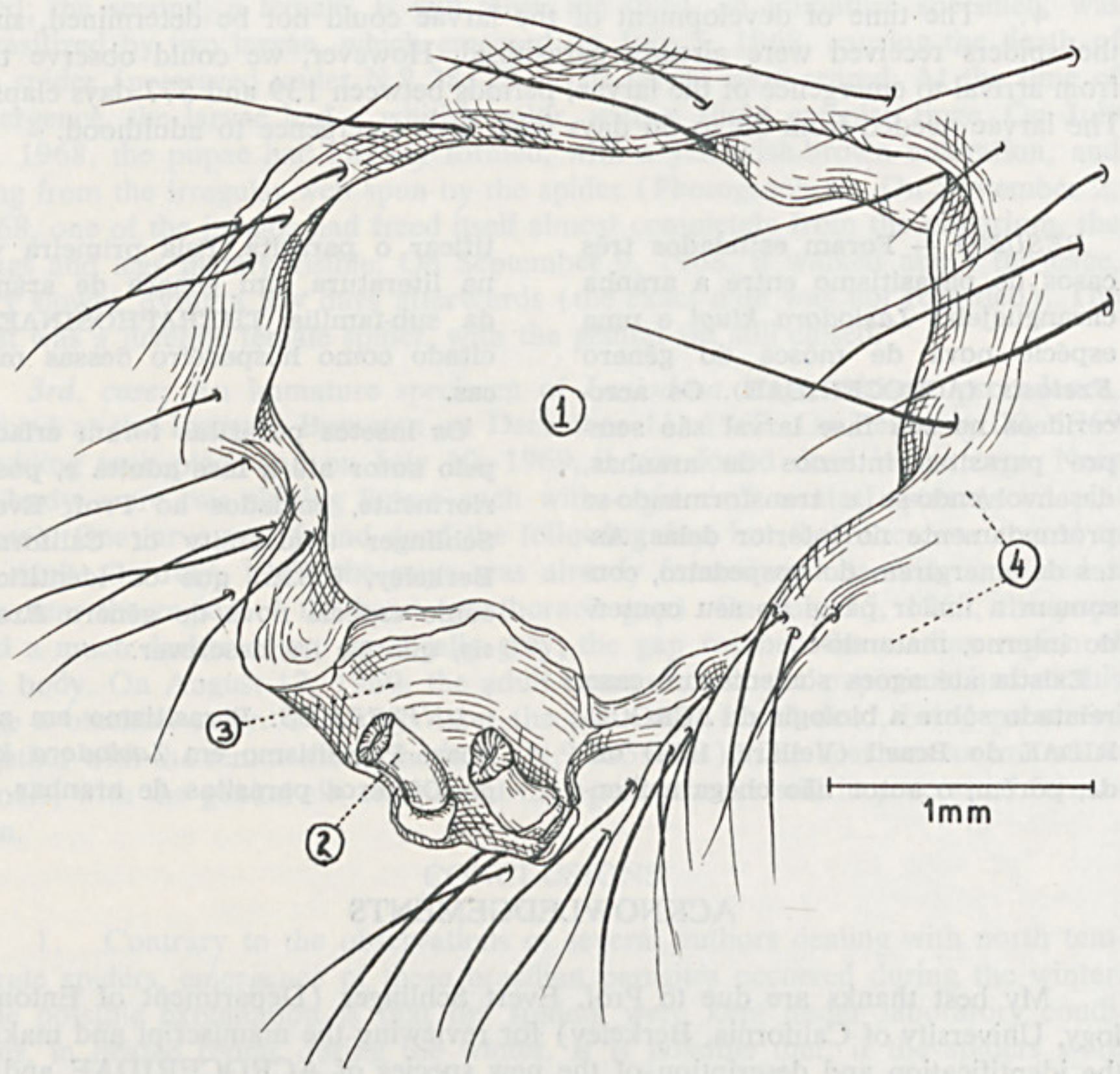

Fig. 1: Emergence hole of an *Exetasis* sp. larva showing: 1) emergence hole 2) spiracular remnants seen from inside 3) spiracular plate seen from inside 4) spider's integument with its setae

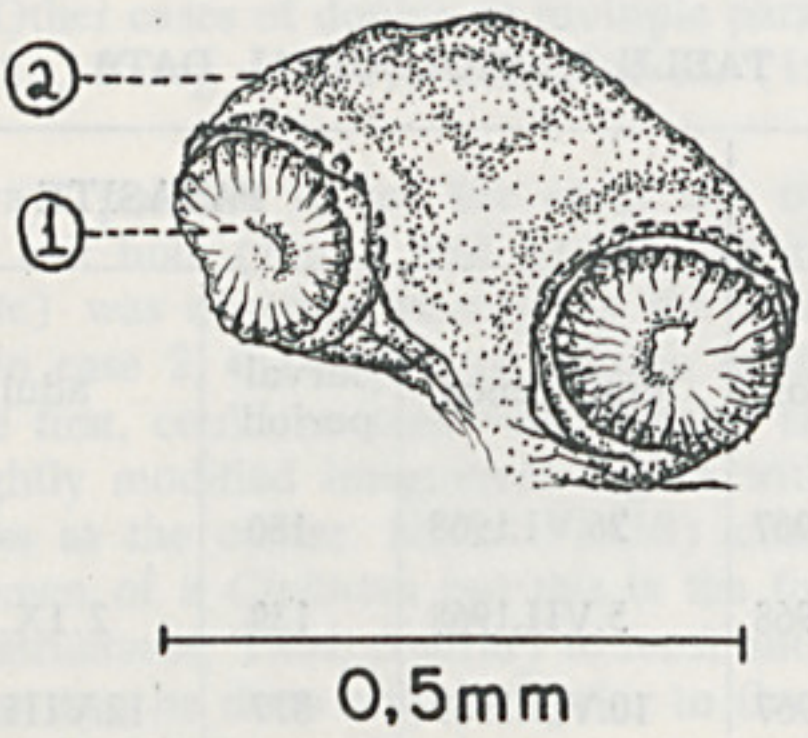

Fig. 2: Region of fixation of an *Exetasis* sp. larva in the abdominal spider integument showing: 1) caudal spiracles of the larva 2) spiracular plate seen from outside.

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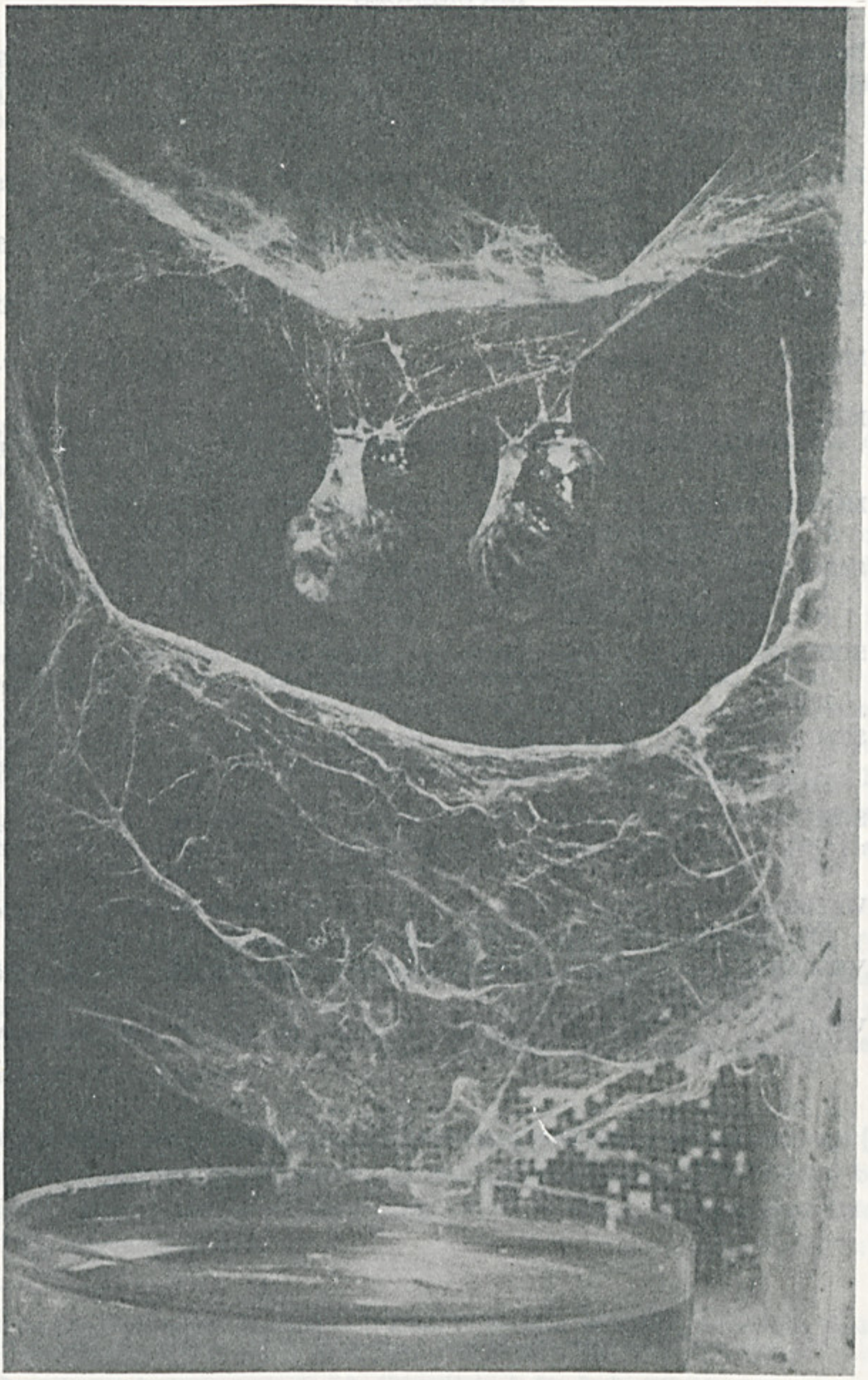

Photograph 1: Pupae of *Exetasis* sp. hanging from the web spun by *Lasiodora klugi*.

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