

SOME PARASITES OF SPIDER EGGS

by

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Abstract Webs and cocoons of four species of spiders frequenting indoors and outdoors was examined. A detailed description of the adult spider, nature of the web and the location of the cocoon is made using diagrams as well. Three of the spider species studied were very specific in their habitat selection, being either completely indoor or completely outdoor living. Of a total of 997 cocoons collected during the study about 26% were parasitized. Five species of parasites emerged from these cocoons. Certain of the parasites, were found to parasitize the cocoons of more than one species of spiders. Incomplete parasitization of cocoons appears to be a common occurrence among spiders.

Introduction

Spiders constitute an important group of organisms due to their predatory habits. Most spiders are predaceous on insects and hence are important in the biological control of insect pests. Spiders in turn are subjected to predation. Their eggs in particular are subjected to parasitism. Many insects belonging to the order Hymenoptera parasitizes spider eggs encased in a cocoon.

The work reported here describes some preliminary observations on the biology and parasitism of four species of web spinning spiders commonly found in Sri Lanka.

Materials and Methods

Cocoons of spiders were collected from both indoors and outdoors from four districts of Sri Lanka, namely; Colombo, Ratnapura, Negombo and Kandy. Indoors, *ie*, inside of houses; the walls, ceilings and rafters of roofs were examined for spider webs containig cocoons. Outdoors; the vegetation in the front and back garden of houses were searched for spider webs and cocoons. Much care was taken when removing cocoons either off the web or the substratum to which they were attached. In each district, a total of five houses together with their compounds were examined for cocoons, monthly over a period of 12 months. Collections were done on three days of each month, from these five sites in each district. The cocoons thus collected were kept separately in vials plugged with cotton wool, until emergence of either spiders or parasites.

Results

A total of 997 cocoons were collected during the study, of which 25.8% were parasitized. The number of cocoons collected in each month from all the 4 districts over one year and the number that had been parasitized is given in Table 1. The cocoons that were collected belonged to four species of spiders commonly found in Sri Lanka. Of them two species *Uloborus geniculatus* and *U. germinata* were confined to indoors, *Gastroiantha germinata* was found only outdoors while the fourth species, *Cyrtophora cicatrosus* was found both indoors and outdoors. (Table 2.)

The distribution of the four species of spiders was observed to be different in the four districts studied. *Uloborus geniculatus* was present in all four districts and was found attached to walls. *Uloborus plumipes* was found attached to rafters of roofs. *Cyrtophora cicatrosus* frequents the roof (indoors) and it is found on short thick bushes, outdoors. *Gastrocantha germinata* is less common than the other three species and is found in association with large trees.

Each of these species of spiders spins a characteristic type of web and the cocoon is located in a specific place on the web. The female spider during oviposition first deposits the eggs and then spins a cocoon around the mass of eggs, using the secretions of the tubiliform glands. Often females guard the cocoons by remaining very close to them on the web, in which case it becomes very difficult to separate the cocoon from the parent female. The following is a description of the adults of the 4 species of spiders. A diagrammatic sketch of the adults and those of their respective webs showing the position of the cocoon are shown in Figs. 1 to 4.

U. geniculatus is about 8 mm long, dark brown in colour with a prominent opisthosoma. The web of this species (Fig. 1) is oval in shape and is about 20 cm in diameter. The cocoon is star shaped and pinkish brown in colour. Its diameter ranges from 0.5 - 1 cm. Eggs have an average diameter of 0.05 mm. *U. plumipes* is about 5 mm long, white in colour. Its web (Fig 2) is stretched across rafters of roofs and is about 3 cm across. The cocoon is oval in shape, about 5 mm in diameter and is white in colour. It is usually located at the centre of the web. Eggs contained in the cocoon have a diameter of about 0.04 mm. The female always remains very close to or almost attached to the cocoon. *C. cicatrosus* is about 5 mm. in length, greyish brown in colour with a pectinate structure on the 4th leg. Its web (Fig. 3) is of an irregular shape, about 15 cm across and is spun across to

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- Figure 1 - The web and adult of *Uloborus geniculatus* (1×3-)
Note the shape and location of the cocoon.
- Figure 2 - The adult and web of *Uloborus plumipes* (1×3).
Note the simple, compact web and the location of the cocoon.

fall on a number of planes. This species of spiders produces several cocoons that remain attached to one another in the form of a string of beads. Usually about 10 cocoons are held together in this manner. These are of different ages, the oldest often becomes empty following emergence, while the youngest, cocoon in the chain would have been just laid. The female often positions herself at this end of the chain. *G. germinata* male is colourful with black and reddish orange markings on opisthosoma. It is broader than long (4 mm. long and 10 mm. broad). The web (Fig. 4) is spun on a single plane between trunks of two large trees. It spans about 45 cm. across. This species deposits its cocoons on leaves of trees rather than on the web. Cocoons are yellow in colour and take the form of a powder puff. Often about 2-3 cocoons are found on the same leaf. The female often remains close to the cocoons. The cocoons of this species was difficult to locate and hence only a few were collected during the study.

The cocoons of these four species of spiders were parasitized by five species of hymenopterans (Table 3). As indicated in the Table, more than one species of parasites were found to attack three of the spider species, while *U. plumipes* was parasitized by only a single species of parasites. Moreover, the distribution of the parasite species in the 4 districts was found to be different. In the Colombo and Negombo districts, from the cocoons of *C. cicatrosus* emerged *Eurytoma* sp. 2, while in Ratnapura both *Baeus* sp. and *Eurytoma* sp. 2 were found to parasitize the cocoons of this species of spiders. In Kandy only *Baeus* sp. emerged from *C. cicatrosus* cocoons.

On examination of the site of collection of cocoons belonging to *C. cicatrosus* it was evident that the parasite species differed depending on whether the cocoons were found indoors or outdoors. Cocoons collected from webs spun inside houses were not parasitized, while *Baeus* sp. emerged from cocoons found on the outside of the house (outer walls and rafters). From cocoons collected from outdoors, on vegetation, *Eurytoma* sp. 2 emerged. However, all the cocoons of *U. geniculata* and *U. plumipes* collected from the four districts were parasitized by a single species ie *Idris* sp. and *Eurytoma* sp. 2 respectively.

The number of eggs per cocoon in each species of spiders, the time taken to hatch and the total number of spiders that emerged from unparasitized cocoons is given in Table 3. From the cocoons of three species of spiders that had been parasitized both parasites and spiders emerged due to incomplete parasitization (Table 4).

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- Figure 3 - The web and the adult of *Cytophora cicatrosus* (1×3).
Note the cocoons that are joined together to form a string. Older cocoons are found at the top and younger ones at the bottom of the string.
- Figure 4 - The web, adult and the location of the cocoon of *Gastrocanthus germinatus* (1×3).

Discussion

Even though there are many more species of spiders frequenting indoors and outdoors, the present study had to be limited to four species of spiders due to numerous constraints.

The production of cocoons, or the frequency of oviposition of the four species of spiders was highest during the months from September to December. Moreover, the level of parasitism was also highest during the same months. The monthly variation in the production and parasitism of oothecae when compared with environmental factors such as rainfall (Fig 5) and temperature (Fig. 6), a definite trend was observed. (Information on temperature and rainfall was obtained from the records of the Metereological Dept., Colombo.) The increased production and parasitism of cocoons were observed to coincide with low temperatures and high humidity (rain fall). Hence, it appears that drought and high temperatures do not favour oviposition by spiders and therefore the survival of the parasites.

Of the four species of spiders examined; three species appear to be very specific in their habitat selection, confining themselves to either indoors or outdoors, unlike *C. cicatrosus* which was found both indoors and outdoors.

C. cicatrosus and *G. germinata* had been subjected to multiple parasitism as more than one species of parasites emerged from their cocoons (Table 3). Also, *Idris* sp. appears to be nonspecific in their habits, in that it was found to parasitize cocoons of *U. geniculatus* and *G. germinata*. According to the records at the British Museum, members of the genus *Pediobius* are hyperparasitic. Therefore, there is some possibility that *Pediobius* sp. collected during the study is a hyperparasita on a primary parasite that I failed to collect, or alternatively, it directly parasitizes *G. germinata*.

In all 4 species of spiders studied the mean duration of development ranged from 9-23 days at $29 \pm 2^{\circ}$ C. Hence, it appears that there are marked differences in the time taken by the eggs of each species to develop into adults. The average number of spiders that had emerged from the cocoons of *U. geniculatus* was much less than the average number of eggs contained in a cocoon (Table 4). The low egg hatchability or high egg mortality witnessed in this species of spiders is perhaps due to cannibalism. On dissection of a few cocoons of this specie's eggs, partially developed and fully developed stages of spiders were seen. Thus it is likely that the fully developed spiders; still inside the cocoon, feed upon the developing stages.

Figure 5 - Monthly variation of parasitism with rainfall.

Figure 6 - Monthly variation of parasitism with temperature.

Even though, incomplete parasitization of spider cocoons seem to be more the rule than the exception, *U. plumipes* cocoons from which *Eurytoma* sp. 1 emerged were completely parasitized, as no spiders emerged from such cocoons.

In order to further understand the habits of the spiders and their, parasites, more studies involving rearing, field observations and field collection of spiders have to be carried out. The present study provides a preliminary investigation into some of the interesting and discrete members of our indoor and outdoor animal community.

Acknowledgement

I wish to thank Dr. A. D. Austin and Dr. Z. Bouvcek of the British Natural History Museum for identifying the spiders and their parasites. The identified specimens are lodged in the Biological Science Museum, of the University of Sri Jayawardenapura, Nugegoda. I am grateful to Dr. J. P. Edirisinghe for suggesting this study and for writing the manuscript. This project was carried out as a part of the B. Sc. (General) Degree Course in 1982/83.

Table 1
The total number of spider cocoons collected in each month and the number parasitized.

	June.	July,	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apri.	May.
Total No. of Cocoons	31	24	47	107	210	257	131	87	09	24	12	18
% Parasitized	16.1	12.5	14.9	26.2	31.9	35.8	32.6	13.8	0	0	0	5.5

TABLE 2

The four species of spiders collected during the study and their location.

- 1) *Cyrtophora cicatrosus* - Both Indoors and Outdoors
- 2) *Uloborus geniculatus* - Indoors only
- 3) *Uloborus plumipes* - Indoors only
- 4) *Gastrocanthus germinata* - Outdoors only

TABLE 3

The hymenopterans that parasitized the cocoons of the four species of spiders and their host relationships.

<i>Species of Spiders</i>		<i>Species of Parasites</i>
1) <i>C. cicatrosus</i>	←	<i>Baeus sp.</i>
	←	<i>Eurytoma sp. 2</i>
2) <i>G. germinata</i>	←	(?) ← <i>Pediobius sp.</i>
	←	
3) <i>U. geniculatus</i>	←	<i>Idris sp.</i>
4) <i>U. plumipes</i>	←	<i>Eurytoma sp.</i>

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Table 4

The mean number of eggs per cocoon and duration of embryonic development in the 4 species of spiders.

Species of Spiders	No. of eggs per cocoon $\bar{X} \pm S. E.$	No. of Spiders that emerged per Cocoon	Duration of embryonic development (days)
<i>U. gerriculatus</i>	102 \pm S. E. 13.6 (n=15)	63.9 (n=36)	12.3 (n=6)
<i>C. cicatrosus</i>	25.2 \pm S. E. 10.12 (n=17)	23.4 (n=20)	9.0 (n=16)
<i>U. plumipes</i>	48.2 \pm S. E. 10.2 (n=17)	41.15 (n=20)	13.0 (n=5)
<i>G. germinata</i>	174.6 \pm S. E. 2.1 (n=5)	157.2 (n=5)	23.0 (n=5)

Table 5

The mean number and type of parasites emerging from incompletely parasitized cocoons of spiders

Species of Spiders	No. of Cocoons	Av. No. of Spiders Emerging	Type and Av. No of Parasites emerging
<i>U. geniculatus</i>	13	4.2	59.5 - <i>Idris sp</i>
<i>U. plumipes</i>	12	0	4.5- <i>Eurytoma sp</i>
<i>C. cicatrosus</i>	50	1.48	4.08- <i>Eurytoma sp</i> 2
	11	10.3	17.5 - <i>Baeus sp</i>
	5	12.4	20.8 - <i>Idris sp</i>
<i>G. germinata</i>	3	5.2	26.4 - <i>Pediobius sp</i>
	4	2.4	12.5 - <i>Idris sp</i>

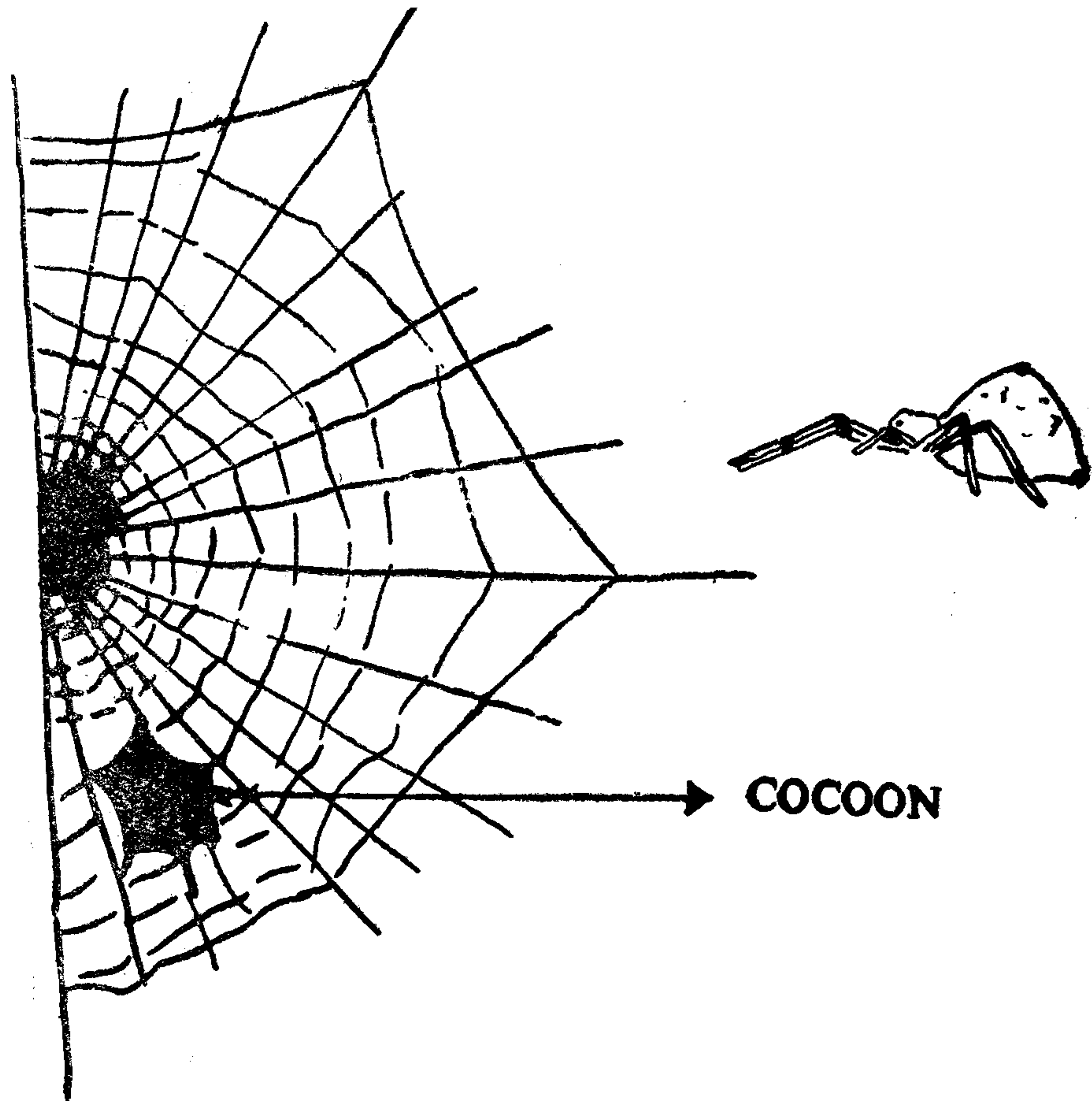


Figure 1 - The web and adult of *Uloborus gemiculatus* (1 X 3).
Note the shape and location of the cocoon.

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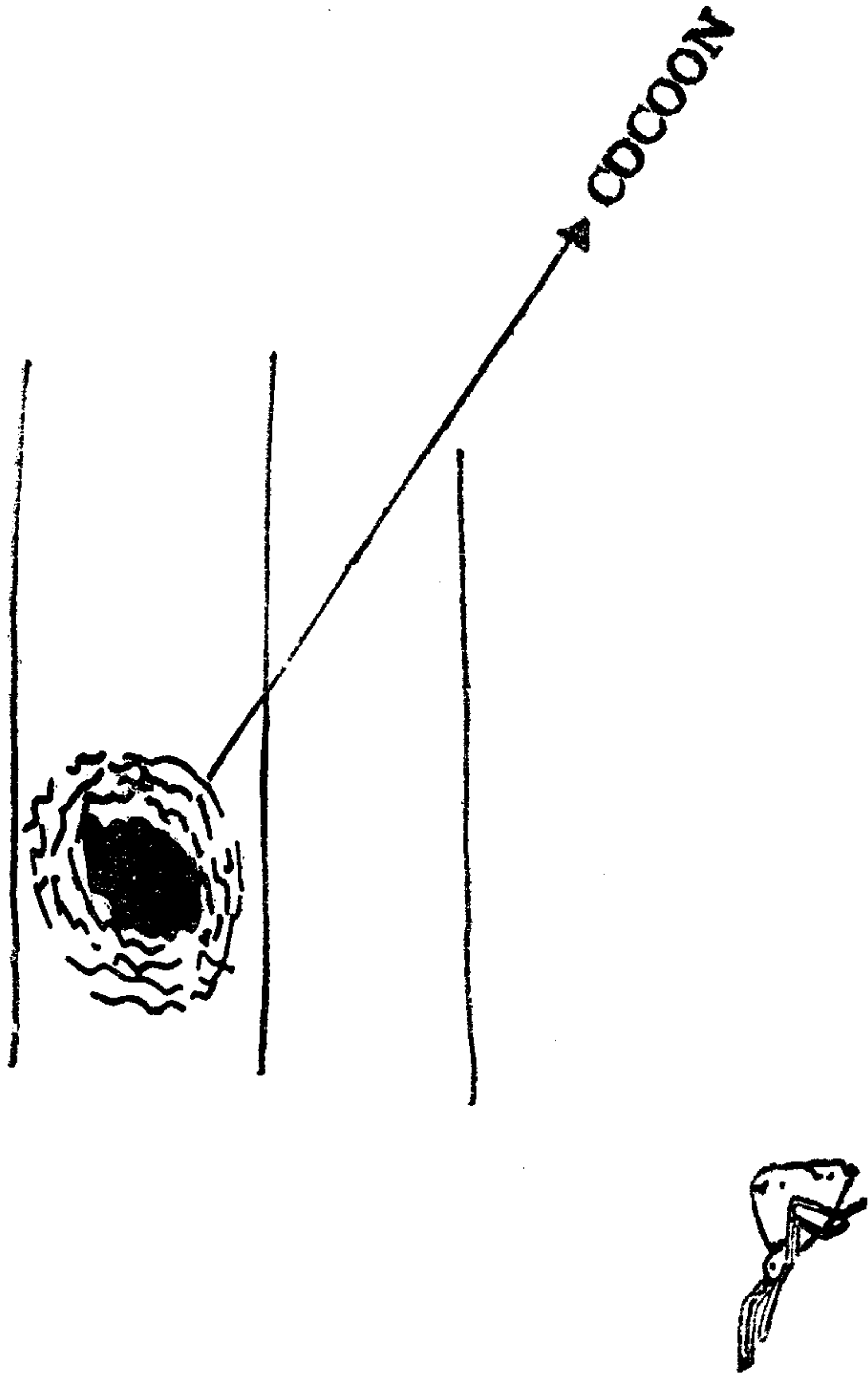


Figure 2 - The Adult and web of *Uloborus plumipes* (1×3). Note The simple, compact web and the location of the cocoon.

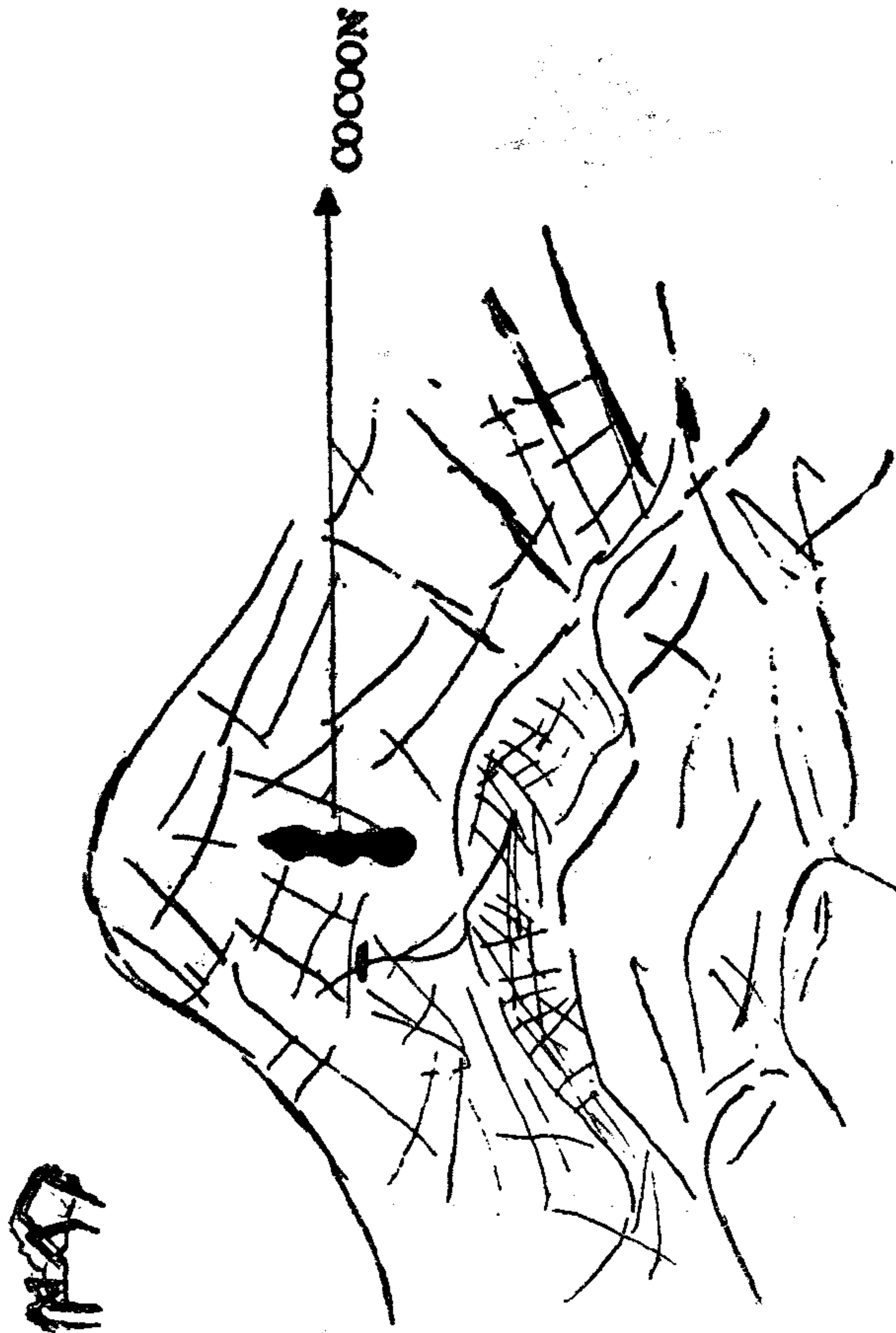


Figure 3 - The web and the adult of *Cytophora cicatrosus* (IX.3).
Note the cocoons that are joined together to form a string.
Older cocoons are found at the top and younger ones at the
bottom of the string.

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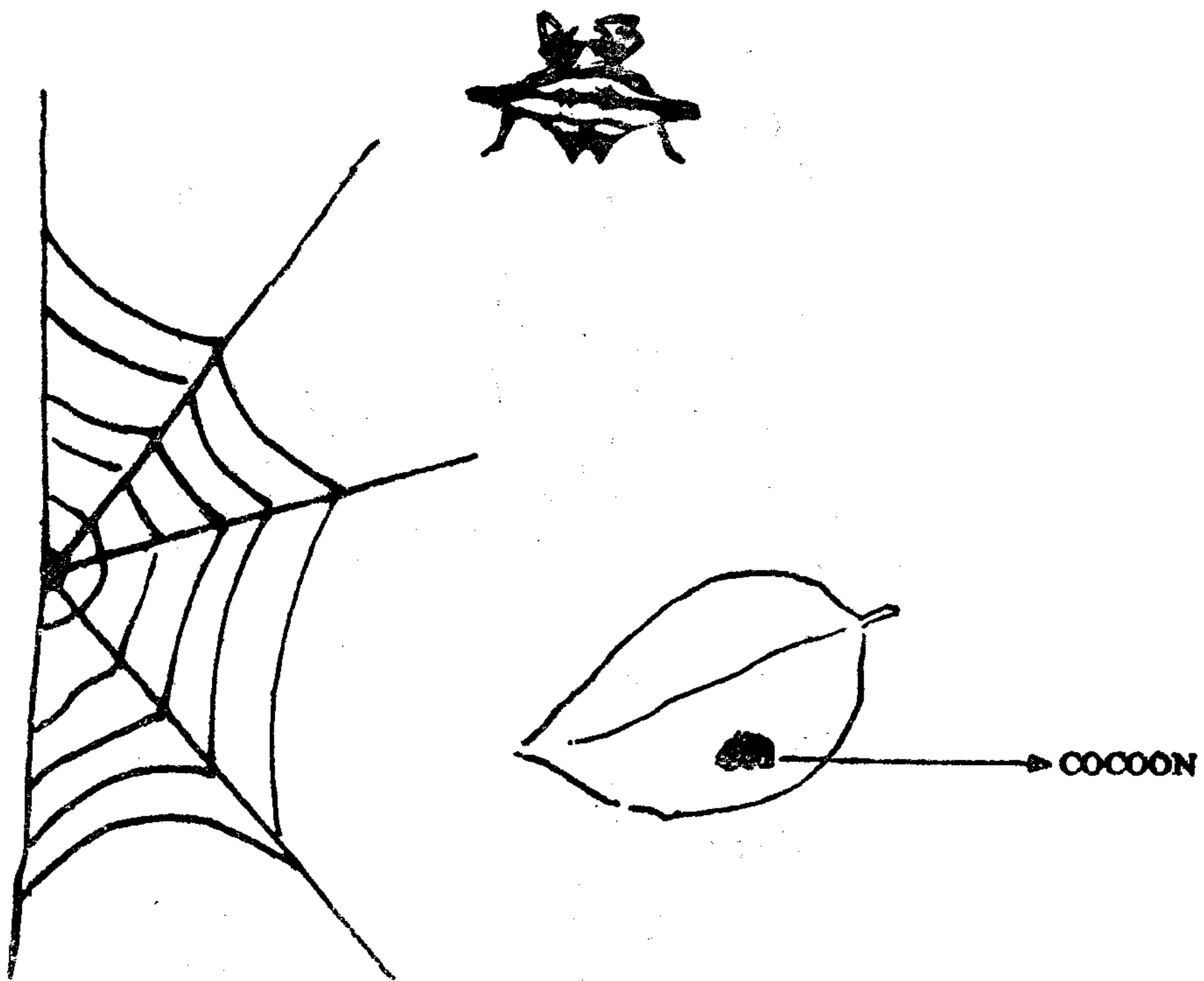


Figure 4 - The web, adult and the location of the cocoon of *Gastrocanthus germinata* (IX 3).

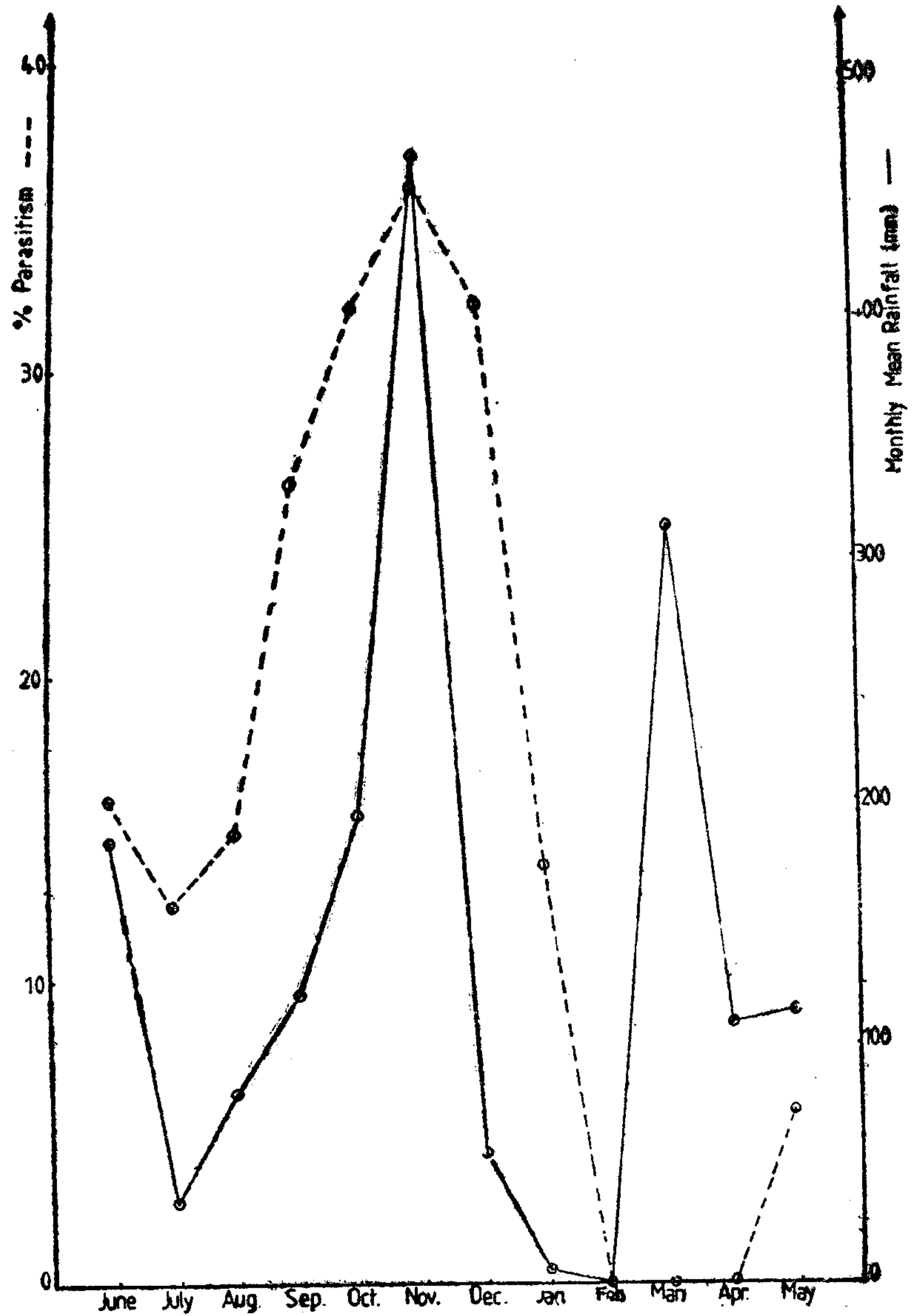


Figure 5 - Monthly variation of parasitism with rainfall,

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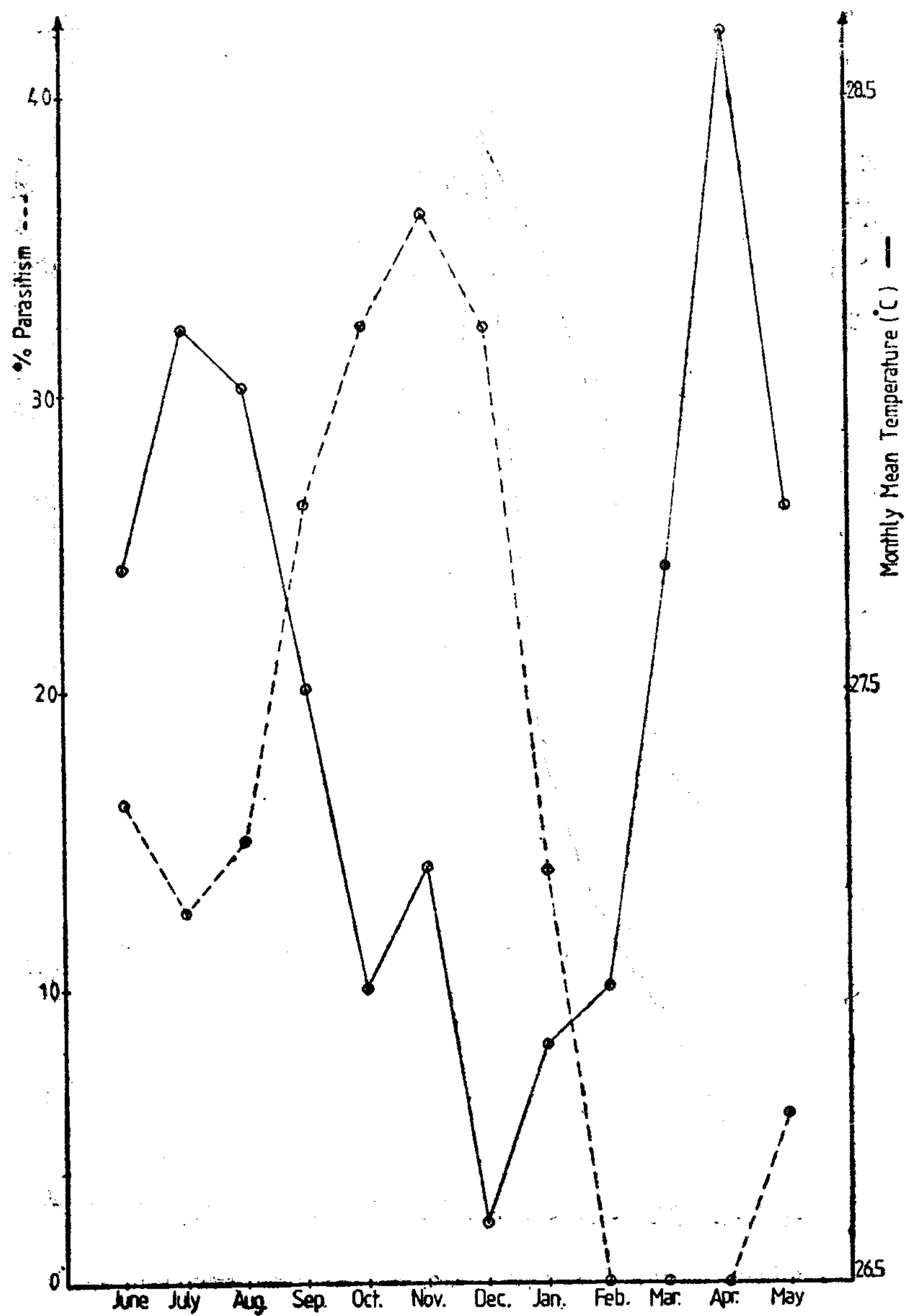


Figure 6 - Monthly variation of parasitism with temperature.