SITE SELECTION AND GROWTH OF THE LARVAE OF *EYLAIS DISCRETA* KOENIKE, 1897 (ACARI, HYDRACHNELLAE)

by

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ABSTRACT

The distribution of the larvae of *Eylais discreta* on the abdominal tergites of the host species *Sigara striata, S. falleni* and *Cymatia coleoptrata* is examined.

On *S. striata* and *S. falleni* the segments 3 and 4, on *C. coleoptrata* the segments 2 and 3 are successively preferred. There is but little influence of multiple infestations on this distribution.

The growth rate on the various tergites of *S. striata* is similar, while on *C. coleoptrata* a possible difference could not be proved statistically. The larvae of *E. discreta* generally hibernate on the host; during this phase there is little growth; not until March-April they start growing faster. The larvae on *C. coleoptrata* are retarded in growth compared to those on *S. striata.*

The larvae on *S. falleni* do not show any increase in size; this water bug species is immune to infestation by various Hydrachnellae.

INTRODUCTION

The larvae of *Eylais discreta* Koenike, 1897, are parasitic on various genera of corixids (Hemiptera) (Lanciani, 1969; Nielsen & Davids, 1975). It is known that the attachment of the larvae of *Eylais* species takes place on the dorsal side of the abdomen, not on the intersegmental membranes but on the tergites themselves.

Lanciani (1969) noted a preference of the larvae of *E. discreta* for the third abdominal tergite in the corixid genera *Hesperocorixa, Callicorixa* and *Sigara.* Nielsen & Davids (1975) observed that the second and third abdominal tergites are preferred by these larvae in *Cymatia coleoptrata* (Fabricius, 1777) and *Sigara striata* (Linnaeus, 1758), respectively. The aim of the present investigation is to study the distribution of the mite larvae on the various abdominal tergites and the possible influence of the selected site on the growth rate of the larvae of *E. discreta.* Such differences in growth rate are known for *Arrenurus papillator* (O. F. Müller, 1776). The larvae of this species have a larger size on the subcosta than on the anal veins of the wings of dragonflies (Münchberg, 1963). The same holds true for the larvae of *Limnochares aquatica* (Linnaeus, 1758) attached on the prothorax of Gerridae, compared with those on the meso- and metathorax (Pahnke, 1974).

When studying these phenomena, one has to study the growth first.

METHODS AND RESULTS

Host insects were collected by dip net on several dates in winter and spring in the surroundings of the "Naardermeer" (a lake 20 km S.E. of Amsterdam) and in ditches in the neighbourhood of Purmerland (15 km N. of Amsterdam). In the laboratory the water bugs were preserved in 70% alcohol and each specimen was checked on mite larvae. The position and length of the mite larvae were determined.

Three corixid species proved to be infested with *E. discreta* larvae, viz. *Sigara striata, S. falleni* (Fieber, 1848) and *Cymatia coleoptrata.*

Distribution on the abdominal tergites

The position of the *E. discreta* larvae on the various abdominal segments of the three host species is summarized in table I.

When the mite loads on the various abdominal segments in the course of the season are compared, it appears that on the whole there are no changes in distribution during hibernation and during the growth period of the larvae.

In *Sigara striata* 14% of the mite loads were multiple. When we found larvae on tergite 1 and

Table I. Number of *Eylais discreta* larvae found on the different abdominal segments of three host species. The total number of corixids examined is indicated as well.

Segment no.	1	2	3	4	5	6	7	8	number of hosts	number of parasitized hosts
Sigara striata	3	45	172	108	14	—	—	1	4625	240
Sigara falleni	—	15	52	24	—	—	—	—	710	44
Cymatia coleoptrata	13	140	81	14	1	—	—	—	5228	219

5, mostly the host was heavily parasitized. In *Cymatia coleoptrata* 9% of the mite loads were multiple and when we found larvae on segment 1 and 4, again mostly the host insect was multiple infested. In *S. falleni* 5% of the mite loads were multiple.

Growth rate on the hosts

Eylais larvae grow as well in width as in length, and in the parasitic phase they are about circular. In comparing width and length measurements, it became clear to us that length could be used as a measure of growth.

The samples were collected in the surroundings of the "Naardermeer" during winter and spring of the years 1972-1973, till the beginning of May when *E. discreta* nymphs leave the host. The data are given in fig. 1. This figure represents the mean lengths of *E. discreta* larvae taken from all abdominal tergites on the various sampling dates. In autumn there is but little growth (just hatched

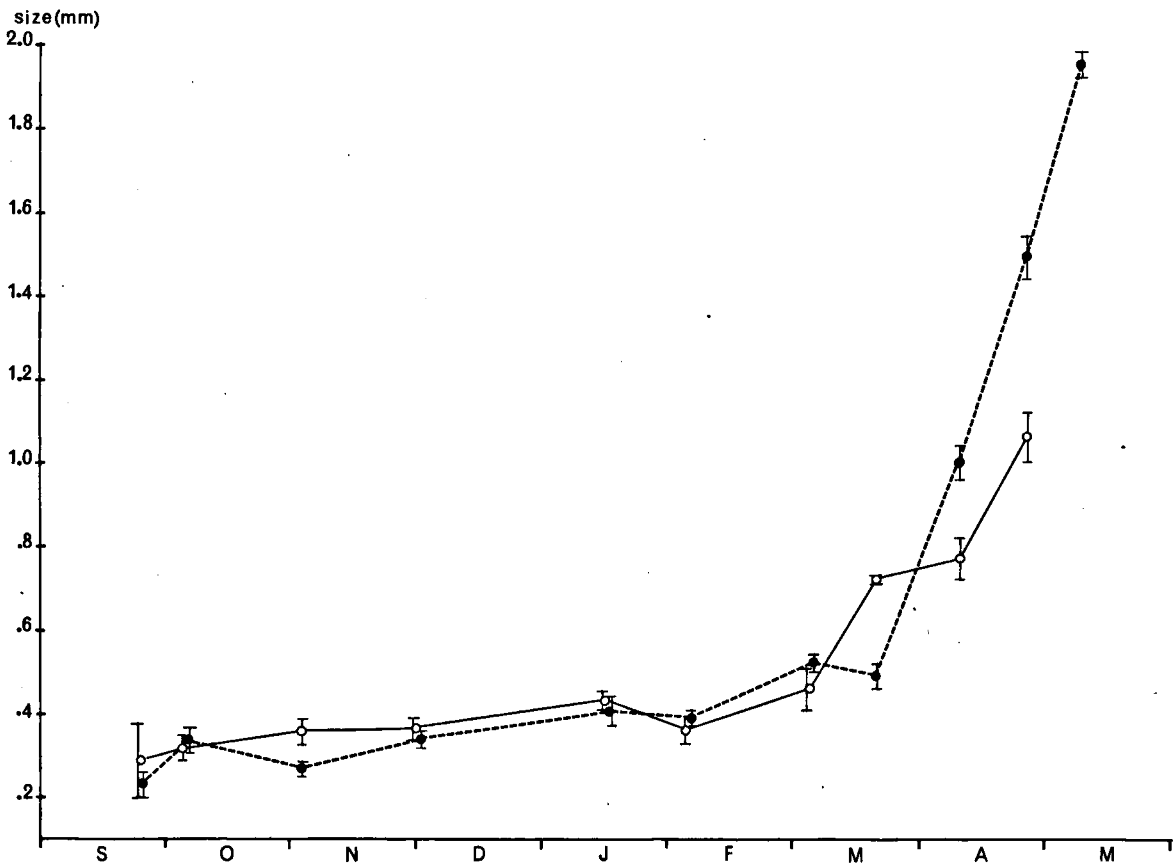

Fig. 1. Mean length of *E. discreta* larvae parasitizing on *S. striata* (●---●) and on *C. coleoptrata* (o—o) during winter and spring. Bars represent the standard error.
Number of mite specimens examined on the various sampling dates (26.IX.1972, 6.X.1972, 3.XI.1972, 1.XII.1972, 16.I.1973, 6.II.1973, 5.III.1973, 20.III.1973, 10.IV.1973, 26.IV.1973 and 9.V.1973): on *S. striata* 3, 18, 46, 25, 5, 14, 20, 18, 33, 21 and 4, respectively; on *C. coleoptrata* 3, 14, 7, 10, 12, 6, 2, 3, 16 and 18, respectively.

larvae measure 200 µm in length) and the larvae scarcely increase in size during winter and early spring. As fig. 1 shows, the length of hibernating larvae is about 350 µm. We also have some data of the winter 1970-1971 and here the length is about 500 µm. Possibly, water temperatures in autumn are responsible for these differences. In March the growth rate increases rapidly and at the end of April the larvae may have reached lengths up to 2000 µm.

There is, however, a distinct difference in the growth of *E. discreta* on *Sigara striata* and on *Cymatia coleoptrata.* In winter and early spring the growth of *E. discreta* on the two host species is about similar, but in April there is a clear difference. *E. discreta* larvae from the smaller of the two hosts are retarded in growth rate (*C. coleoptrata* and *S. striata* have a volume of about 4 and 14 mm^3, respectively).

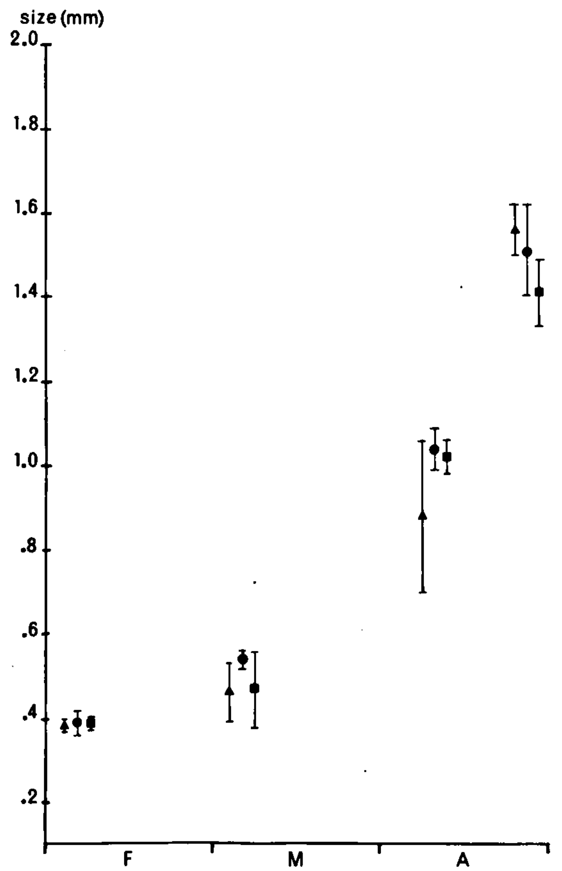

Fig. 2. Mean length of *E. discreta* larvae on the abdominal tergites 2 (▲), 3 (●) and 4 (■) of *S. striata* in spring. Bars represent the standard error.
Number of mite specimens examined on the four sampling dates (6.II.1973, 5.III.1973, 10.IV.1973 and 26.IV.1973): on 2nd tergite 2, 3, 3 and 6, respectively; on 3rd tergite 9, 14, 18 and 8, respectively; on 4th tergite 3, 3, 9 and 7, respectively.

S. falleni was regularly collected together with *S. striata* and *C. coleoptrata. E. discreta* larvae choose the same segments in *S. falleni* as in *S. striata.* However, the larvae do not grow on *S. falleni.* This water bug is "immune" to this parasite. In spring fewer mites on *S. falleni* were found than in autumn. Probably the mite larvae die, shrivel and fall from their hosts. On this host species only mite larvae of a length of 200 µm are found.

Growth rate on the different abdominal tergites

Now it becomes clear that possible differences in growth rate on the various tergites have to be examined in a period of real growth, i.e. in April. We have a sufficient number of data on the larvae from abdominal tergites 2, 3 and 4 of *Sigara striata.* Thus their mean lengths on different dates in spring can well be compared. The results are given in fig. 2 (data of 1973). There is no evidence for differences in growth on these tergites.

The numbers of infested specimens of *Cymatia coleoptrata* in April are too small to permit conclusions.

DISCUSSION

The distribution of the *E. discreta* larvae on the abdominal tergites of *Sigara striata* found by us, agrees with the remarks of Lanciani (1969). We are sure that the tergites 1 and 5 in *S. striata* and 1 and 4 in *C. coleoptrata* are occupied by larvae more frequently in multiple than in single infestations, though not exclusively as Lanciani says. The infection percentage of the bugs in our material was considerably lower than in Lanciani's and the same holds true for the rate of multiple infestations.

In autumn and winter, when there is only a slight growth, the distribution on the tergites is similar to that in April, hence there is no loss from special tergites. To all appearance the larvae complete their development on a once chosen tergite. It remains questionable whether the corixids are capable of brushing off the larvae.

Not only the larvae of *E. discreta* have a preference for the first abdominal tergites, but also other *Eylais* species show a comparable preference. Larvae of *E. setosa* Koenike, 1897, are found on the abdominal tergites 1, 2 and 3 of the water beetles *Hygrotus inaequalis* (Fabricius, 1777) and *H. versicolor* (Schaller, 1783). The same is true for *E. extendens* (O. F. Müller, 1776) larvae on the water beetle *Haliplus ruficollis* (De Geer, 1774).

By way of exception, we found larvae of *E. discreta* on the underside of a hemi-elytrum, on the head and under the pronotum. Sometimes there is a slight increase in size on these places, but we do not suppose that the larvae will complete their cycle on these attachment sites. Rather often during winter and spring we found larvae between head and pronotum, mostly not attached but free moving. These findings correspond with those of Böttger (1962). According to this author *E. discreta* larvae stay 2—4 days after infection between head and pronotum, before they crawl to the abdominal tergites in order to attach there. Possibly this will last longer in winter, but it is hard to imagine that it will last for months. This is again an indication (see also Nielsen & Davids, 1975) that eggs may hatch during winter and spring. From these data it appears too that the larvae move about on their hosts, and thus really can make their choice for the site of attachment.

E. discreta larvae have only little growth in winter and early spring, however, in April the growth rate is considerable. A similar growth pattern can be seen in other Hydrachnellae parasitizing corixids, e.g. *Hydrachna conjecta* Koenike, 1895, and *H. cruenta* O. F. Müller, 1776 (Davids & Schoots, 1975). It is striking that in autumn growth must be strongly retarded. Based on temperature only, growth should be as rapid in autumn as in spring. Therefore this retardation should be considered as a diapause. Generally, day length and temperature are the principal inducing factors. It is also possible that development of gonads of the host insects plays a part in this phenomenon. There is some evidence that *E. discreta* larvae in multiple infestations are on an average somewhat smaller than larvae in single infestations, but this could not be demonstrated quantitatively. On the other hand, the distinct difference in growth of *E. discreta* larvae on *Sigara striata* and on *Cymatia coleoptrata* is quantitatively proved. The reason why the parasites on *C. coleoptrata* remain smaller can be a matter of food supply.

No differences in growth could be demonstrated on the various abdominal tergites. Although quantitative evidence is lacking, we have the impression that *E. discreta* larvae on the second abdominal tergite of *C. coleoptrata* have a more rapid growth than the larvae on the other abdominal tergites in this host.

It is striking that *Sigara falleni* is "immune" to *E. discreta*. The same has been found by Davids (1973) for *Hydrachna conjecta*.

We found the same phenomenon in *H. cruenta*, but it is even more striking that the nymphs of *S. falleni* are not "immune". Larvae of *H. cruenta* attach to the legs of corixids and they parasitize nymphs as well as imagines, in contrast to the other species mentioned. On the nymphs they increase in size but on the imagines they shrivel. Apparently, this "immunity" is built up in the beginning of the adult phase.

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