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THE BEHAVIOUR OF *APHYTIS CHRYSOMPHALI*, A HYMENOPTERUS PARASITE OF THE COCONUT SCALE, *ASPIDIOTUS DESTRUCTOR*, IN SRI LANKA

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ABSTRACT

Sinnathamby, S. V. (1980). The behaviour of *Aphytis chrysomphali* a hymenopterus parasite of the coconut scale, *Aspidiotus destructor*, in Sri Lanka. *Ceylon Cocon. Q.* 31, 93–97.

Aphytis chrysomphali Mercet, an aphelinid parasite of the coconut scale, *Aspidiotus destructor* Sign. was studied in the field with reference to its behavioural response to the host. When the data on parasitism collected from a single site at seven different times were analysed, only on three occasions did the parasite show a significant direct density-dependent response to changes in host density.

INTRODUCTION

Aphytis chrysomphali Mercet (Hym: Aphelinidae) has been observed to parasitise *Aspidiotus destructor* Sign. (Hem : Diaspididae) in Sri Lanka (Sinnathamby, 1977). *A. chrysomphali* is also an important parasite of the California red-scale (De Bach, 1974). The percentage parasitism by this parasite was found to be 5% to 95% of female scales in Fiji (Taylor, 1935). In Sri Lanka the parasitism of the coconut scale by *A. chrysomphali* has been observed to vary from 2% to 78% (Sinnathamby, unpublished data). The field data on parasitism collected were analysed using the method described by Hassell (1966). The behavioural response observed is measurable within one generation of the parasite. The type of behavioural response exhibited by a parasite to its host can be shown by plotting the k value (the killing power of a particular mortality factor on a logarithmic scale) against the logarithm of the host density (Varley and Gradwell, 1960). In this study, the relationship of parasitism of *A. destructor* by *A. chrysomphali* is shown by regression of k values on the logarithm of the population density of *A. destructor*.

MATERIALS AND METHODS

i. Detection of parasitisation

A. chrysomphali generally attacks the third instar of the female scale including those that oviposit and rarely attacks the male scale in their larval and prepupal stages. There is no apparent difference between a parasitised and an unparasitised scale to the naked eye but the parasitised scale can be easily identified under the microscope by the following characteristics:

(a) Parasite eggs and newly hatched parasite larvae feeding on the body contents of the scale are visible when the latter is slightly raised with a needle.

(b) The larval meconia of the parasite whose number varies from 4 to 6 are visible through the transparent scale covering as black or brown coloured small shiny bluntly pointed bodies. These get dislodged under the scale covering after the emergence of the parasite.

(c) The adult parasite or its developing instars, the cast skins of the larvae and pupae or fragments of host integument are other indications.

(d) Parasite exit holes on the surface of the scales could be used as a criterion to detect parasitism. However, it is not always possible to use this criterion since at times the parasites emerge beneath the edge of the scale covering without making an exit hole on the latter.

ii. Sampling site and sampling method

The studies on the parasitism of *A. destructor* by *A. chrysomphali* were carried out at Bandirippuwa Estate, Lunuwila in the North Western Province of Sri Lanka. The sampling site (Fig. 1) was a 0.8 ha block containing hybrid palms (Tall x Dwarf). There were about 15 infested palms in the plantation with an average of two infested fronds per palm. About four leaflets per frond were found to be affected by the scale. The study was based on samples from ten palms at the rate of one leaflet per palm collected approximately at 20 day interval commencing from March 1976.

iii. Experiment

The scales within 1 cm^2 leaf surface area were examined at five different points on the infested leaflet. The total number of scales and the number parasitised within the respective area were noted and the mean density per unit area was estimated from the values. The killing power or k value which is the difference between the logarithm of the density of *A. destructor* before and after the action of the parasite, *A. chrysomphali*, was plotted against the logarithm of the host density.

RESULTS

Table 1. *Relationship between host density and parasitism*

Date of sampling	*Values* $b=$	$r=$	*Level of significance*	*Fig. No.*
5th March	0.180	0.68	< 0.001	2 a
25th March	0.073	0.17	> 0.1	2 b
14th April	0.169	0.47	< 0.05	2 c
4th May	0.009	0.05	> 0.1	2 d
24th May	0.087	0.70	< 0.001	2 e
13th June	-0.146	-0.19	> 0.1	2 f
2nd July	0.167	0.33	> 0.1	2 g
* March – July	0.081	0.24	< 0.05	2 h

* Data of the seven samples combined

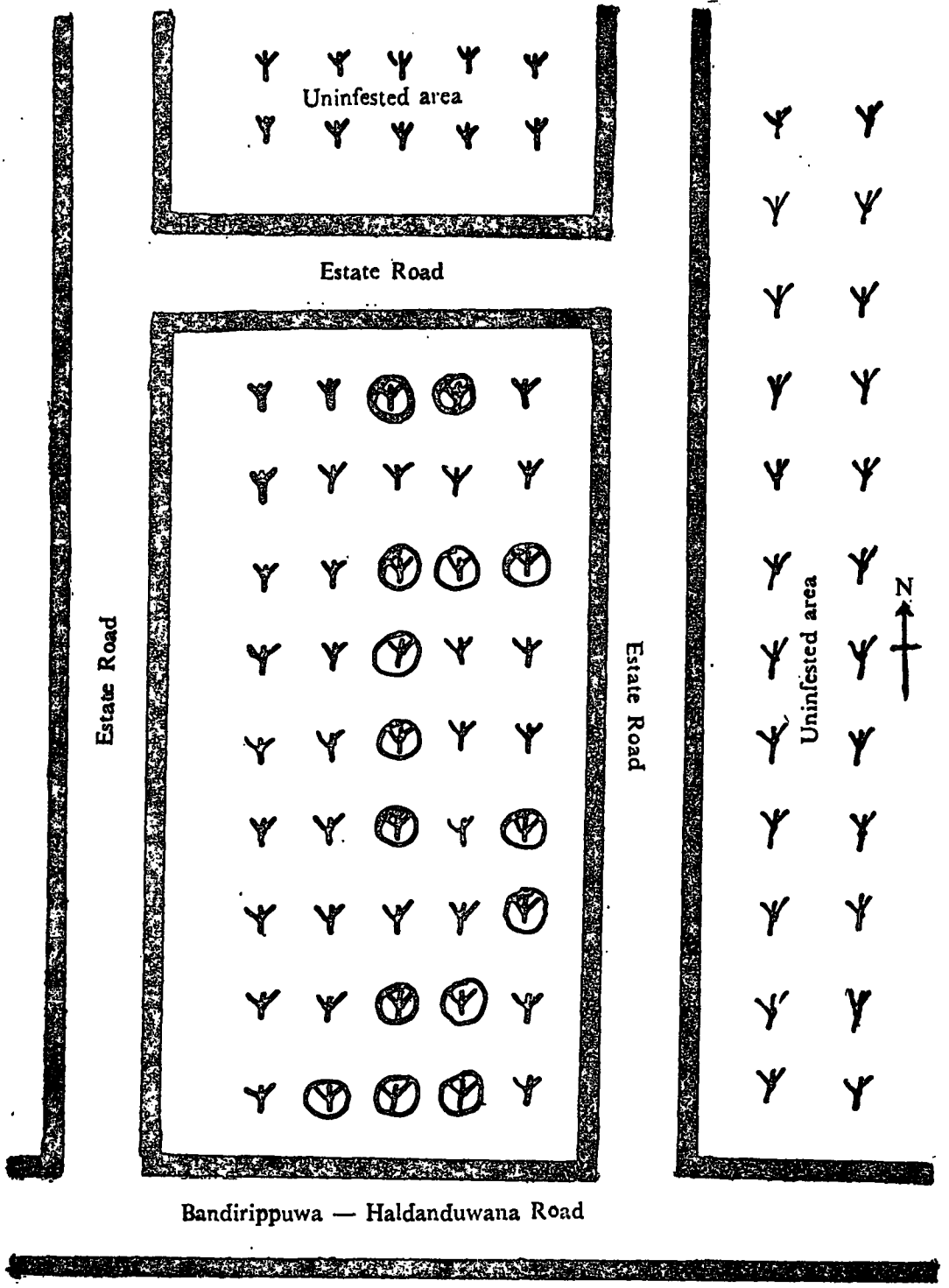

Fig. 1. Sampling site at Bandirippuwa Estate, Lunuwila.

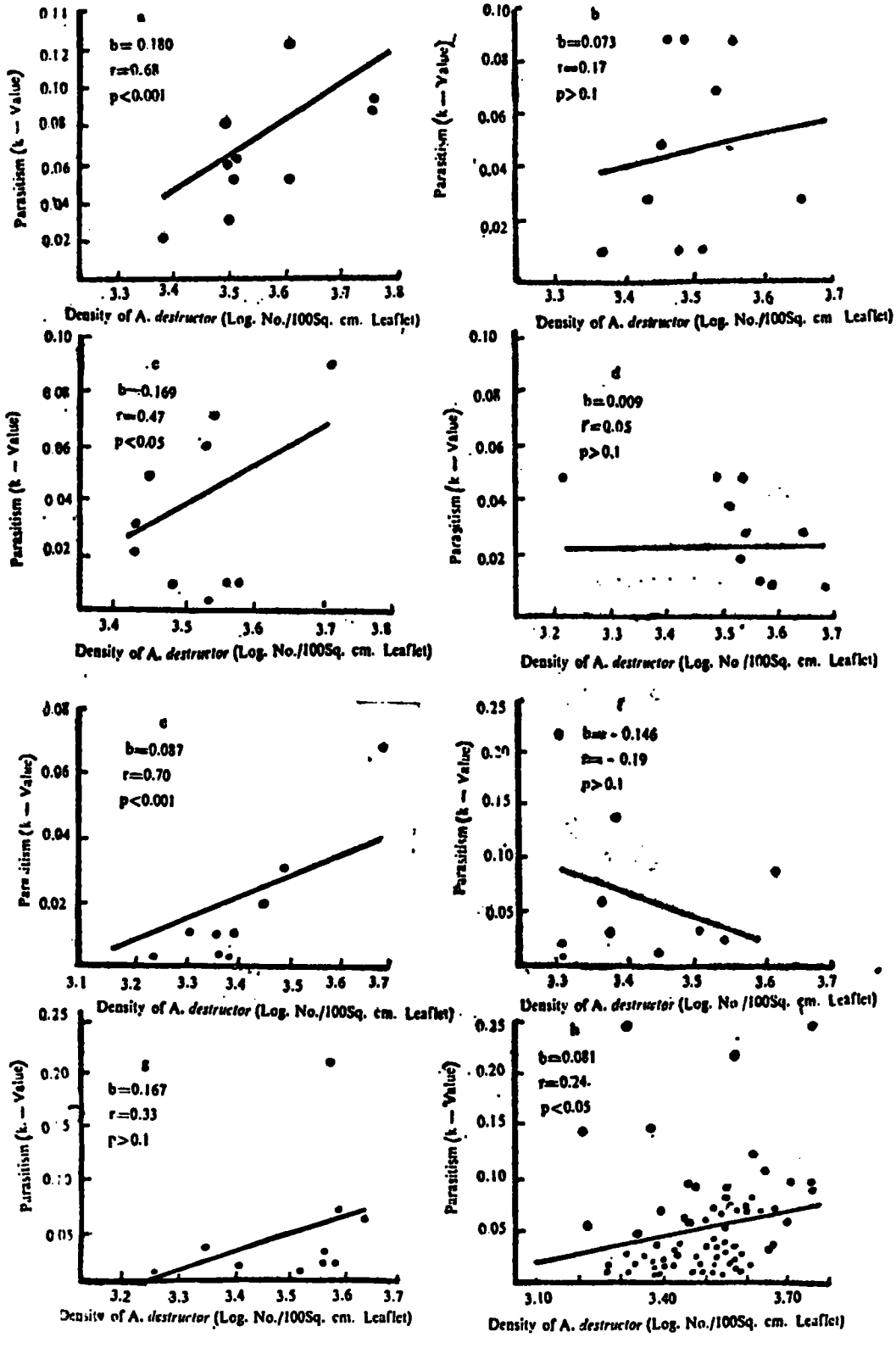

Fig. 2. The relationship between the K - value for parasitism of Aspidiotus by Aphytis and Log. density of Aspidiotus at Bandirippuwa Estate, Lunuwila.

DISCUSSION

It is possible to get an idea of the regulatory mechanism of any mortality factor by plotting the k values on the logarithm of the population density on which it acts (Fig. 2). A positive slope denotes a direct density – dependent response where there is a proportionate increase in mortality as the host population density increases and a negative slope denotes an inverse density – dependent response where there is a reduction of mortality with increase in the host population.

In the present study, except on three sampling times (Figs. 2a, 2c and 2e), statistical analysis failed to reveal any significant direct density-dependent mortality by *A. chrysomphali.* However, on account of the difficulty experienced in the separation of the generations of both the host and the parasite, the absence of any detectable density relationships at other sampling times is not an indication of a total absence of such a relationship. *A. chrysomphali* also has the habit of parasitising a large number of scales in some pockets of the infestation and a very few scales in certain other parts of the infestation. This difference in behaviour may be attributed to the different conditions in each microhabitat of the infestation. Although a long-term detailed study of the host and the parasite may unravel some of the problems, such a study cannot be carried out due to the sporadic and transient nature of *A. destructor* infestations on coconut in Sri Lanka. However, this parasite could be used as potential controlling agent of *A. destructor* in Sri Lanka.

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