

phenoxetol in distilled water as a good sorting medium (Balachandran, 1973) and for sorting, special types of brushes, needles, forceps and fillers have to be used. Specimen tubes having screw caps with plastic coated liners are preferable for storing the sorted specimens. The common practice of immersing tubes of specimens in a jar of preservative has to be discouraged. The volume of plankton to that of storage fluid has to be in the ratio of 1:5 and the containers should be selected accordingly. The concentration and types of additives and the diluents used in the preparation of storage fluids shall depend on the nature of plankton stored. As polythene is permeable to air, glass containers are preferred. Use of rubber washers and liners must be avoided as they melt and swell in due course. Container lids should be rust proof and air tight and must be filled to the brim to avoid air bubbles and drying up of plankton sticking to the sides. Periodic topping up after checking pH can add to improved preservation. Change of preservatives occasionally can be of additional benefit. Specimen jars properly labelled and catalogued are best stored in air-conditioned rooms and preferably in darkness, to avoid damage caused by light and temperature.

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#### A PRELIMINARY NOTE ON THE OCCURRENCE OF CEPHALINE GREGARINES (PROTOZOA : SPOROZOA) IN INSECTS OF KALYANI, WEST BENGAL

THE cephaline gregarines have been the object of intensive study in many parts of the world since Watson<sup>1</sup> and Kamm<sup>2</sup> published their monographs on these parasites. A new classification was proposed by Grassé<sup>3</sup> who also recorded the then known

species of the group. In India, Ray<sup>4</sup> and Ray and Chakravarty<sup>5</sup> first started work on this group of protozoa and more accounts have been published from time to time by other authors. Recently we have undertaken a comprehensive survey work on the occurrence of cephaline gregarines (Protozoa : Sporozoa) in insects in and around Kalyani, West Bengal, India, and also to study the morphology, life-history and bionomics of this group of parasites. The present communication records our survey work on three orders of insects comprising 11 families and 26 species (including one nymphal stage, which could not be identified beyond family level). A brief note on some of our earlier work on the same line has already been published<sup>6</sup>.

For studying the presence of the gregarines, the host insects are collected from fields and gardens in and around Kalyani and brought to the laboratory alive, their gut contents smeared, fixed in Schaudinn's fixative and Bouin's fluid, and subsequently stained in Heidenhain's iron alum-haematoxylin. The entire mid-gut of the parasitized insects is fixed in Bouin's fluid, cut into 5 microns thick sections and stained as above for observing the intra-cellular stages of the parasites. Cysts collected from mid- and hind-gut of insects are kept in moist chambers for development of spores in living condition.

The present work was initiated on February 12, 1973, and our observations upto December 20, 1973 have been recorded in this paper. The orders, families and species to which the host insects belong, the number of specimens examined as well as infected and the percentage of infection have been indicated in Table I. It is noted that while all the six species of the order Orthoptera are infected, none belonging to the order Hemiptera is parasitized, whereas out of the 17 species of coleopteran insects more than 50% carry protozoan parasites of the group. As regards seasonal intensity, infection is very scanty during summer, increases greatly during monsoon and decreases gradually with the fall of temperature during winter.

So far, we have recorded a new genus *Phleobum* with the type-species *P. gigantinum*<sup>7</sup> and a new species *Quadruspinospora chakravartyei*<sup>8</sup>, both cephaline gregarines, from *Phleoba antennata* Brunn. and *Spathosternum* sp. respectively. Preliminary studies show that parasites obtained from other insects belong to the genera *Hyalospora* Chakravarty, 1935, *Gregarina* Dufor, 1828, *Stenophora* Labbé, 1899, *Stylocephalus* Ellis, 1912 and *Quadruspinospora* Sarkar and Chakravarty, 1969, and are likely to be new species. Detailed study of their life-histories, intra-cellular development and sporulation is now being worked out.

TABLE I

Showing the orders, families and species of insects examined for cephaline gregarines and also the incidence of parasites in them

Code No.	Order	Family	Species	Number of specimens examined	Number infected	Percentage of infection
A <sub>5</sub>	Orthoptera	Acrididae	<i>Acrida exaltata</i> (Walk.)	32	23	71.8 %
A <sub>10</sub>	"	"	<i>Trilophidia annulata</i> (Thunb.)	16	4	25.0 %
A <sub>9</sub>	"	Pyrgomorphidae	<i>Atractomorpha crenulata</i> (Fabr.)	39	24	61.5 %
A <sub>4</sub>	"	Acrididae	<i>Phleoba antennata</i> Brunn.	38	22	57.9 %
A <sub>16</sub>	"	"	<i>Spathosternum</i> sp.	36	31	86.1 %
A <sub>11</sub>	"	Gryllotalpidae	<i>Gryllotalpa</i> sp.	7	1	7.1 %
B <sub>3</sub>	Hemiptera	Reduviidae	<i>Rhinocoris fuscipes</i> (Fabr.)	1	×	—
B	"	Lygaeidae	<i>Lygaeus hshopes</i> (Fabr.)	3	×	—
B <sub>2</sub>	"	Pyrrhocoridae	Nymph (identified upto family)	4	×	—
G <sub>1</sub>	Coleoptera	Scarabaeidae	<i>Adoretus</i> sp.	7	×	—
G <sub>2</sub>	"	"	<i>Anomala</i> sp.	2	×	—
G <sub>16</sub>	"	"	<i>Schizonycha</i> sp.	5	×	—
H	"	"	<i>Onthophagus</i> sp.	22	×	—
F	"	Tenebrionidae	<i>Gonocephalum</i> sp.	130	78	60.0 %
G <sub>3</sub>	"	Chrysomelidae	<i>Raphidopalpa</i> (= <i>Aulacophora</i> ) <i>foveicollis</i> (Lucas)	98	77	78.5 %
G <sub>4</sub>	"	"	<i>Haltica</i> sp.	34	3	8.8 %
G <sub>5</sub>	"	"	<i>Aulacophora intermedia</i> Jacoby	98	51	52.0 %
G <sub>7</sub>	"	"	<i>Lema</i> sp. <sub>1</sub>	87	29	33.3 %
G <sub>8</sub>	"	"	<i>Lema</i> sp. <sub>2</sub>	19	8	41.1 %
G <sub>10</sub>	"	"	<i>Oides bipunctata</i> (Fab.)	7	×	—
G <sub>13</sub>	"	"	<i>Aethomorpha</i> sp.	12	×	—
F <sub>4</sub>	"	"	<i>Corynodes</i> sp.	1	×	—
F <sub>2</sub>	"	Curculionidae	<i>Mylocerus</i> sp.	37	32	86.4 %
F <sub>1</sub>	"	"	<i>Xanthoprochilus</i> sp.	19	16	84.2 %
	"	"	<i>Lepropus</i> sp.	24	5	20.8 %
F <sub>3</sub> F <sub>3</sub>	"	Cicindelidae	<i>Cicindela sexpunctata</i> Fabr.	2	×	—

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#### INTER-RELATIONSHIP BETWEEN THE APHID *APHIS GOSSYPH* AND THE LEAFHOPPER. *AMRASCA DEVASTANS* POPULATIONS ON BHENDI

THE natural environment is an unstable system and as the number of insects present is ever fluctuating, the inter-relationship amongst the constituent species is complex. Differences in the abundance of one species may be expected to influence the populations of other species, when several more or less closely related pests like scales, aphids, white flies, mealy bugs, thrips and mites live and feed in the same tissues of plants as observed by DeBach<sup>1</sup>. Competition between mites, *Metatransychus ulmi* and *Tetranychus telarius* on apple and between leafhoppers, *Empoasca* spp. and white flies, *Bemisia tabaci* G. and between leafhoppers *Erythroneura* spp. and tingide, *Corythucha ciliata* Say on Scycamore<sup>2</sup> has been reported. Jayaraj<sup>3</sup> observed that the population of *Amrasca* (*Empoasca*) *devastans* (Dist.) was low on bhendi (*Abelmoschus esculentus* L.) plants infested with *Aphis gossypii* Glover, however data were not collected. Hence the present study was made to find out the existence of such relationship between aphids and leafhoppers.

The pest population data were gathered on 'Pusa Sawani' bhendi on four leaves in each of 6 randomly selected plants in each of three replications. The counts were taken at weekly intervals commencing two weeks after sowing till a week

before pulling out of plants. As the pest population was very low at early stage and started declining as the crop matured, the counts taken from 5th to 10th weeks alone were taken for working out the correlation coefficient between aphids and leafhopper nymphs and adults.

The leafhopper nymphs were found to be less on leaves with increased numbers of aphid as evidenced from the significant correlation coefficient value ( $r = -0.619$ ) at  $P = 0.01$  level (Fig. 1). The 'r' value obtained for aphid and leafhopper adult populations was not significant (Table I).

TABLE I  
Inter-relationship between aphid and leafhopper  
populations (No. of insects/24 leaves)

Age of plants in weeks	Reproduction	Aphid Nymphs and adults	Leafhopper		
			Nymphs	Adults	Total
5	1	475	10	15	25
	2	1225	10	14	24
	3	360	9	9	18
6	1	630	15	17	32
	2	130	19	12	31
	3	435	12	8	20
7	1	380	25	11	36
	2	125	26	18	44
	3	135	24	12	36
8	1	295	33	25	58
	2	343	41	15	56
9	1	498	37	17	54
	2	129	38	25	63
	3	97	50	18	68
10	1	67	42	14	56
	2	30	57	12	69
	3	18	44	10	54

Correlation coefficient to the population aphid ( $n = 17$ )      \*\* -0.619      N.S.      \* -0.572  
-0.081

N.S. — Not Significant  
\* — Significant at  $P = 0.05$   
\*\* — Significant at  $P = 0.1$