through a Zetopan-Binolux II, dark-field fluorescence microscope fitted with a exciter filter E-2, grade/thickness U'G 1 1.5 and absorption filter Sp 2, grade/thickness GG13 1 + 3 plus Wratten foil 2A.

The histochemistry of translator apparatus, thus, shows that corpusculum is composed of lignins, lipids, cutin, and negligible amount of proteins whereas the retinaculum and the lateral blades are lipoidal. A direct correlation between the distribution of metabolites in the stigmatic tissue and the appearance of the translator apparatus is envisage. Thus, developmental and histochemical studies reveal that the translator apparatus is stigmatic in origin.

VG gratefully acknowledges the award of a fellowship by CSIR, New Delhi.

31 December 1984

1. Jensen, W. A., *Botanical histochemistry*, Freeman, San Fransisco, 1962.
2. Ruthmann, A., *Methods in cell research*, G. Bell and Sons, London, 1970.
3. Ford, J. H., In: *Sporopollenin*, (eds), Brooks, J., Grant, P. R., Muir, M., van Gizel, P. and Shaw, G. Academic Press, London, 1971.
4. Rendle, A. B., *The classification of flowering plants*, Cambridge University Press, London, 1971.
5. Vijayaraghavan, M. R. and Shukla, A. K., *Proc. All India Symp., Sardar Patel Univ. Vallabh Vidyanagar*, 1976, p. 36.
6. Vijayaraghavan, M. R. and Shukla, A. K. *Proc. IV. Intl. Palynol. Conf., Birbal Sahni Insttt. of Palaeobotany*, Lucknow, 1976, 192.
7. Vijayaraghavan, M. R. and Cheema Kumkum, *Acta Histochem.*, 1977, **59**, 15.

PARASITE-HOST INTERACTION IN RELATION TO THE NEMATODE *ANGUILLULINA APTINI* (SHARGA)—A PARASITE ON *MICROCEPHALOTHRIPS ABDOMINALIS* (CRAWFORD) AND *FRANKLINIELLA SCHULTZEI* (TRYBOM).

R. VARATHARAJAN,*
Entomology Research Institute, Loyola College, Madras 600 034, India.
* *Permanent address: UPASI Tea Research Institute, Cinchona 642 106, India.*

INFORMATION on nematodes infesting thrips is limited to species such as *Thrips physapus* Linn[1], *Heliothrips fasciatus* pergande[2], *Stenothrips graminum* Uzel[3,4], *Aptinothrips rufus* (Gmelin)[5–7] and *Frankliniella occidentalis* (Pergande)[8] in Europe and detailed studies on the percentages of nematode parasitism and the ecology of the host parasite interaction being restricted only to the species *Aptinothrips rufus*[5–7] infested by a nematode *Anguillulina aptini* (Sharga). Information presented here highlights the discovery of the species for the first time in India parasitizing two new thrips hosts and their occurrence in relation to host density as well as abiotic factors.

The incidence of the nematode *A. aptini* was observed in *Microcephalothrips abdominalis* (Crawford) and *Frankliniella schultzei* (Trybom), while studying their ovarian structure. Periodical samplings of thrips were made in a selected experimental plot by collecting 25 flowers (*Wedelia chinensis* and *Helianthus annuus*) every week. The flowers were brought to the laboratory in polythene bags and thrips species from the respective flowers were isolated and examined. By dissecting the thrips the number of different stages of nematodes was counted. Dissected thrips having nematodes were carefully separated on a fresh slide using a micropipette. Nematodes were stained with Nile blue and were photographed with the aid of Leitz photomicroscope.

Periodical observations revealed the occurrence of the parasite during almost all months of the study period (May 1981–May 1982). The percentage of parasitism in *M. abdominalis* was 21 when the population of thrips reached a peak with 450 per 25 flower heads, while it was 2.2 during low populations of thrips. In *F. schultzei*, the maximum percentage of parasitism was 29.6 with the maximum abundance of the host *i.e.* 430 thrips per 25 flower heads, whereas a minimum of 4.5% parasitic incidence was observed when the host was less abundant. Since the population of the thrips species was also determined by abiotic factors, the relation between the host and the parasite in terms of their abundance was correlated with abiotic factors (figure 1). This correlation also revealed that high rainfall exerted a negative influence on the degree of parasitism, while the occurrence of the nematode was triggered at a temperature range of 31–35°C with 65% humidity.

Analysis of the number of nematodes present in the body cavity of thrips indicated a maximum of 108 larvae, 47 eggs, 5 males, and 7 females and a minimum of a few eggs and larvae with one female nematode per individual host. Males were fewer and sometimes even absent. The infestation of the nematode was seen only in female thrips including their pupal stage and it was

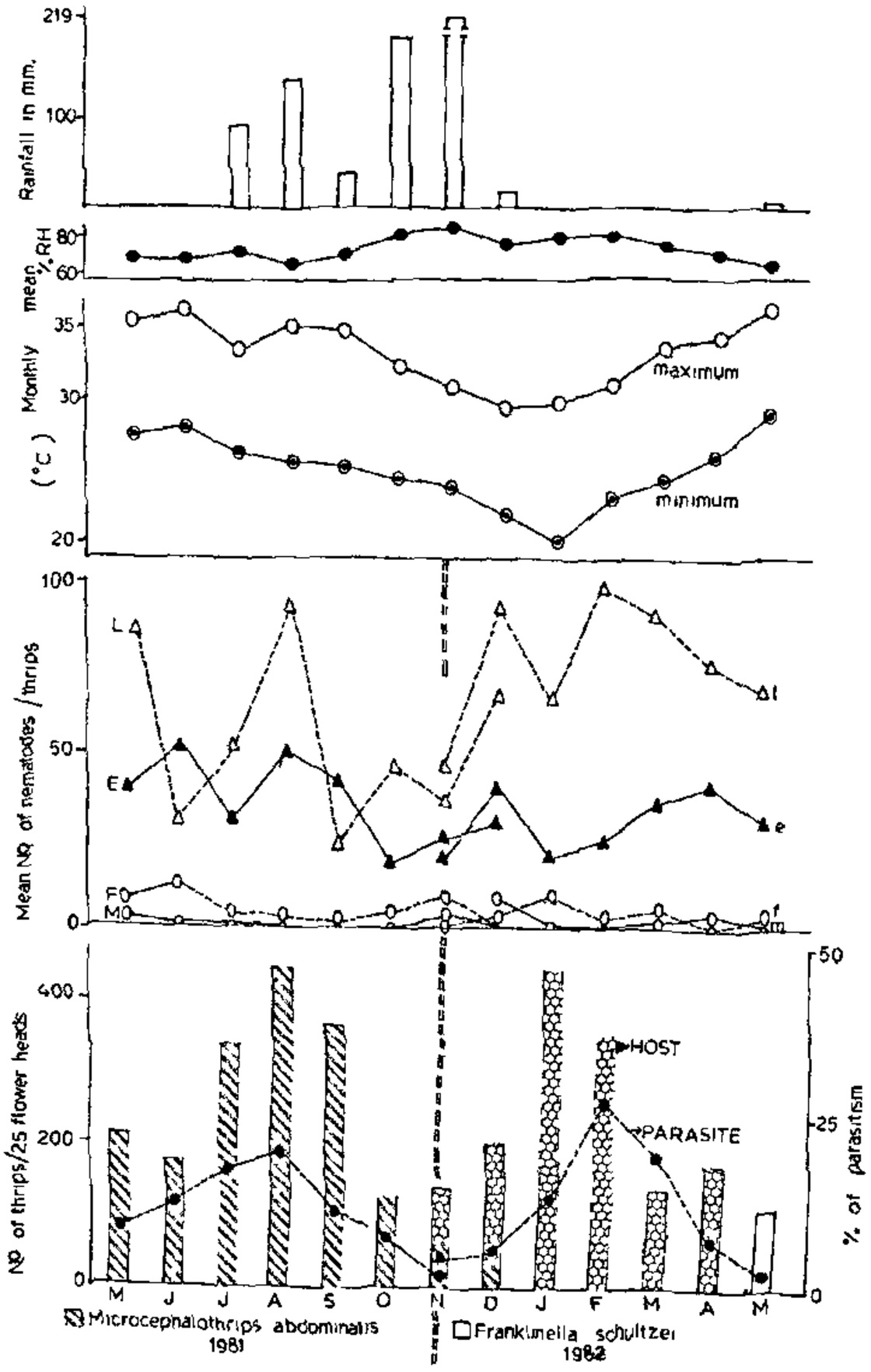

Figure 1. Population trends and host-parasite interactions of thrips and the nematode. E—egg, L—larva, M—male, F—female. These represent stages of the nematode *A. aptini* infesting on *M. abdominalis*. e—egg, l—larva, m—male, f—female. These represent stages of the nematode *A. aptini* infesting on *F. schultzei*

never found in either males or larval stages of thrips. All the infested thrips showed different stages of nematodes in varying numbers, the pupal stages of thrips showing the maximum number of eggs and adults of nematode. Thrips, 8–10 days old, had fewer number of nematode eggs and adults, but harboured a maximum number of their larvae.

Morphologically both infected and uninfected thrips were similar and observations on dissected thrips of different ages indicated the clear damage to the ovary due to parasitization. In most of the infected thrips, the ovaries showed a few developing eggs and, particularly in heavily infected thrips, the ovarioles presented an underdeveloped condition. (figure 2).

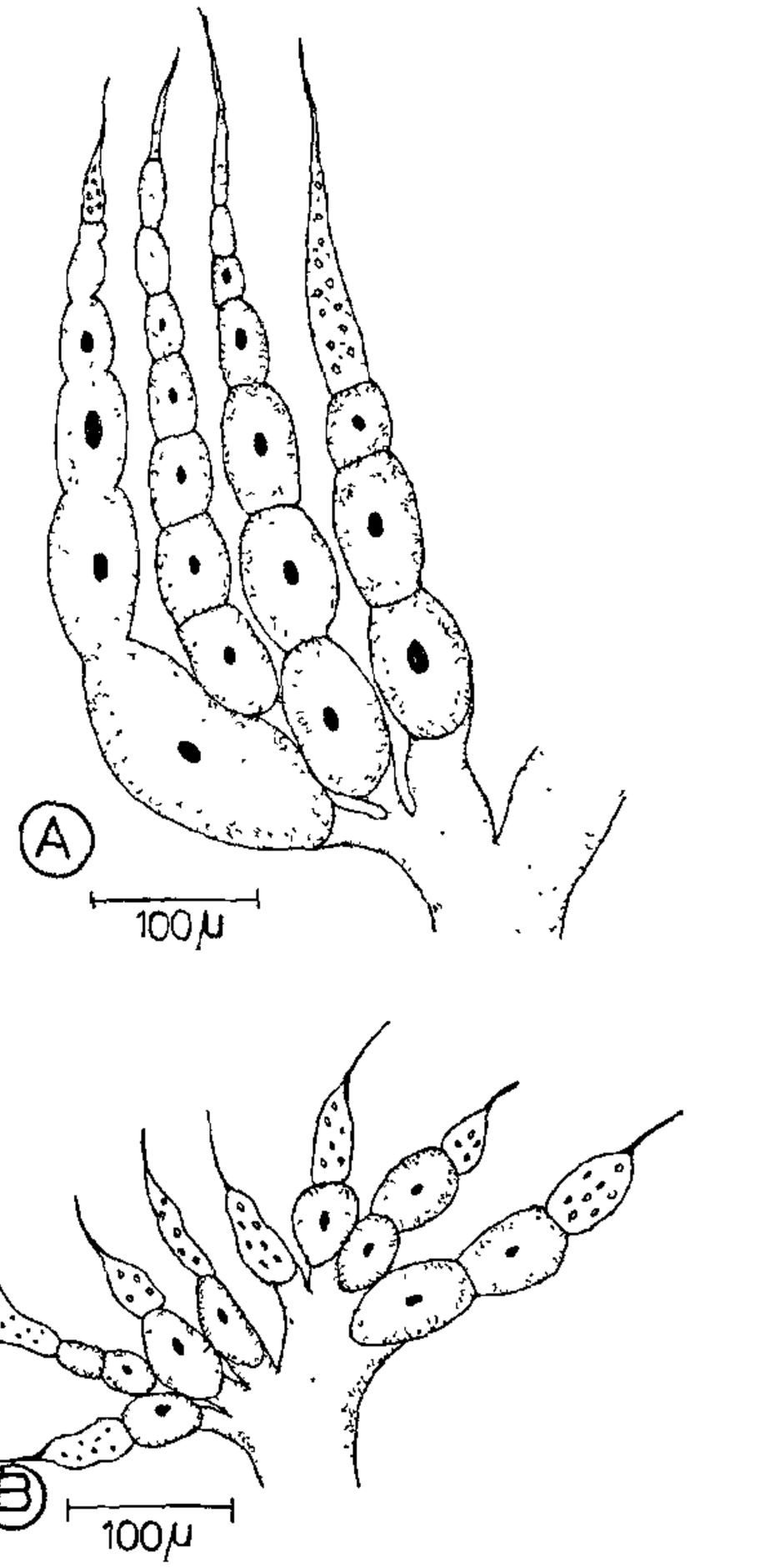

Figure 2. Ovarian structure *F. schultzei*. **A.** Normal ovary **B.** Parasitized ovary

As regards the mode of infection, the entry of the nematode into the host appeared to be through the intersegmental membranes[5]. Though the presence of this nematode was reported in the mid-gut and rectum of thrips[7], in the present investigation nematodes were observed only in the body cavity.

The incidence of nematode parasite (*A. aptini*) on *M. abdominalis* and *F. schultzei* brought to light the occurrence of the nematode parasitism in thrips in all months of the study period, but the percentage of parasitism depended on ecological parameters such as the density of the hosts as well as abiotic factors (temperature, rainfall, and relative humidity). A direct correlation was observed between the parasites and the hosts in terms of number *i.e.* as the host population increased the percentage of parasitism also tended to be higher. This is also quite evident in *Aptinothrips*

rufus parasitised by the same species of nematode (*A. aptini*)[5, 6].

The most striking feature in this host-parasite relation was the occurrence of different stages of the nematode in the host of varying ages. The thrips pupae were most infected with parasitic adults and eggs, while in senescent adults (approximately 9th day), nematode larvae outnumbered the other stages. This variation at different stages of parasitic occurrence indicates that the parasite proliferates inside the host for the maintenance of its population, since the infection initially started with adults. It is curious to note that even after careful examination of hundreds of thrips, not even a single male was parasitized by the nematode. In the case of *A. rufus* also only the female thrips became infected by this parasite[7]. The specificity of these parasites infesting the females may be due to the restriction of its infestation to only the ovaries of the thrips host, the degree of ovarian damage depending largely on the density of the parasite in the host system.

The author is grateful to Prof. T. N. Ananthakrishnan, Director, Entomology Research Institute, Loyola College, Madras for valuable suggestions and for a critical persual of the manuscript.

1 January 1985

1. Uzel, H., *Koniggratz.*, 1895, p. 472.
2. Russell, H. M., *Bull. Bur. Ent. U.S. Dept. Agric.*, 1912, **118**, 49.
3. Kolobova, A. N., *Trudy poltav. Sel-khoz. opyt. stn.*, 1926, **49**, 1.
4. Lewis, T., *Proc. R. Ento. Soc. London (A)*, 1961, **36**, 89.
5. Lysaght, A. M., *Parasitology*, 1936, **28**, 290.
6. Lysaght, A. M., *J. Anim. Ecol.*, 1937, **6**, 169.
7. Sharga, U. S., *Parasitology*, 1932, **24**, 268.
8. Wilson, E. O. and Cooley, L., *Ann. Ent. Soc. Am.*, 1972, **65**, 414.

TOXICITY OF MERCURY ON THE OVARIES OF THE CARIDEAN PRAWN, *CARIDINA RAJADHARI* (BOUVIER)

R. SAROJINI and B. VICTOR*
Department of Zoology, Marathwada University, Aurangabad 431 004, India.
** Department of Zoology, St. Xavier's College, Palayamkottai 627 002, India.*

HIGHEST concentrations of mercury appear to occur in the Crustaceans either when they pass large quantities of water over their respiratory surfaces or bioaccumulated through food-chain[1, 2]. There is considerable evidence to indicate that mercury can cause structural damage to gill epithelia and kidney tubules and neurological disorders[3, 4]. It was reported that continuous accumulation of mercury may reduce the ability of every cell in the body of fish to maintain proper intracellular ionic composition[5]. The present study reports the toxicity of mercury on the ovaries of the freshwater prawn, *Caridina rajadhari* (Bouvier) (Crustacea, Decapoda, Atyidae).

C. rajadhari was collected from Kham river, near Aurangabad, Maharashtra and they were acclimated to the laboratory conditions for a week. Acute bioassay studies were conducted according to standard methods[6]. All acute exposures with mercuric chloride were for 96 hr, static at $26 \pm 1°C$ in dechlorinated water. The survival data for 20 animals per each concentration were used to calculate the median lethal concentration (LC_{50})[7]. Change in colour was observed and the animals usually turn over prior to death, providing good indication of pending mortality. The LC_{50} values of mercury were found to be 0.009120 ppm for 24 hr, 0.006918 ppm for 48 hr, 0.005784 ppm for 72 hr and 0.004786 ppm for 96 hr.

Thereafter healthy, non-ovigerous, intermoult (stage-C) animals of identical size (mean total length = 2.5 cm) and ovarian stage (matured with green coloured ovary) were selected and divided equally into two groups: control and experimental. The experimental prawns were exposed to the sub-acute concentration of 0.00069 ppm of mercuric chloride for 30 days. Animals were fed on alternative days with wheat bran and green algae. The medium was changed on alternate days. After every 10th day, the ovaries from the living animals of both groups were dissected and fixed immediately in Bouin's fluid for 24 hr. The tissues were cut at 7 μm and stained with Harris' haematoxylin and eosin for histological observations.

On exposure to mercury, a burst of hyperactivity