HYPERPARASITISM IN RHOPALOSIPHUM MAIDIS[1]

EVONEO BERTI FILHO[2]

ABSTRACT - The purpose of this study was to evaluate the percentage of hyperparasitism in the complex of parasites of *Rhopalosiphum maidis* (Fitch 1856) (Homoptera, Aphididae). The data obtained showed that *Asaphes* sp. and *Pachyneuron* sp. (Hymenoptera, Pteromalidae) were the most common among the hyperparasites found.

Index terms: Homoptera, Aphididae, *Asaphes, Pachyneuron,* hyperparasites.

HIPERPARASITISMO EM RHOPALOSIPHUM MAIDIS

RESUMO - A presente pesquisa trata da avaliação da percentagem de hiperparasitismo no complexo de parasitos de *Rhopalosiphum maidis* (Fith 1856) (Homoptera, Aphididae). Os dados obtidos indicaram que *Asaphes* sp. e *Pachyneuron* sp. (Hymenoptera, Pteromalidae) foram os mais freqüentes entre os hiperparasitos encontrados.

Termos para indexação: Homoptera, Aphididae, *Asaphes, Pachyneuron,* hiperparasitos.

INTRODUCTION

The corn leaf aphid, *Rhopalosiphum maidis* (Fitch 1856) (Homoptera, Aphididae) is a cosmopolitan pest occurring between the latitudes of 40°N and 40°S. The insect was first observed by Fitch, in 1856, on the corn stem that bears the ears, and has been recorded attacking a large variety of cultivated plants such as: oat (*Avena sativa* L.), corn (*Zea mays* L.), rye (*Secale cereale* L.), barley (*Hordeum vulgare* L.), wheat (*Triticum aestivum* L.), sorghum (*Sorghum* spp.), and sugarcane (*Saccharum* spp.), in which it has been shown to be the agent in the dissemination of the sugarcane mosaic (Wildermuth & Walter 1932, Silva et al. 1968, Bertels 1973, Gallo et al. 1978). Therefore, the control of this pest is very important due not only to the direct action of the aphid on the plants, but also to its indirect effects as vector of viruses. The biological control appears as an outstanding measure of control, because quite a few number of parasitic Hymenoptera on *R. maidis* has been recorded in several partes of the world as reported in the following references cited by Thompson (1950), Galo (1951), Bertels (1956), Lima (1962), Peck (1963), Sweetman (1963), Silva et al. (1968), and Hagen et al. (1976): *Aphelinus maidis* Timberlake Aphelinidae) Hawaii - Timberlake (1927); *Aphelinus nigritus* (Howard) (Aphelinidae) USA - Archer et al. (1974); *Aphelinus semiflavus* (Howard) (Aphelinidae) USA - Hartley (1922) Spain - Mercet (1929); *Aphelinus varipes* (Forester) (Aphelinidae) USA - Archer et al. (1974); *Aphidencyrtus* sp. (Encyrtidae) India - Ramakrishna Ayyar & Margabandu (1934); *Aphidencyrtus aphidivorus* (mayr) (Encyrtidae) Russia -Meier (1929); *Aphidius exiguus* Hal. (Aphidiidae) Morocco - Mimeur (1934); *Aphidius platensis* (Brèthes) (Aphidiidae) Brazil - Lima (1962), Silva et al. (1968); *Aphidius testaceipes* (Cresson) (Aphidiidae) Brazil - Gallo (1951), Bertels (1956) Lima (1962), Silva et al. (1968); *Asaphes vulgaris* Walker (Pteromalidae) Russia - Meier (1929); *Lygocerus aphidium* Kiell. (Ceraphronidae) Russia - Meier (1929); *Lysiphlebus testaceipes* (Cresson) (Aphidiidae) Hawaii -Swezey, (1926) Cuba - Loftin & Christenson (1932), USA - Wildermuth & Walter (1932), Wilson (1948 Archer et al. (1974); *Microterys aeruginosus* Dalm. (Encyrtidae) Russia - Meier (1929); *Pachyneuron aphidis* (Howard) (Pteromalidae) Russia - Meier (1929); *Pachyneuron siphonophorae* (Ashmead) (Pteromalidae) USA - Peck (1963).

MATERIAL AND METHODS

From a corn field located in Gill Tract (University of California, Albany), seven leaves densely covered with aphid mummies were collected from five plants in a row, on November 1975. Some dead aphids, alates and wingless, were also collected for identification. In laboratory, 100 mummies without emergence holes were taken at random from the leaves and each mummy was placed in a small vial. As the parasites emerged, they were mounted with the empty mummies. All the mummies on the leaves were counted after the following categories:

a. Mummies with holes
b. Mummies without holes

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[2] Engº Agrº, Doutor, Prof. Assist., Escola Superior de Agricultura Luiz de Queiroz-USP, Caixa Postal, 9, CEP 13400 - Piracicaba, SP.

c. Mummies with smooth holes (*)
d. Mummies with jagged holes (**)
e. Mummies with one parasite
f. Mummies with two or more parasites
g. Mummies with ectoparasites
h. Mummies with endoparasites
(*) Emergence holes with regular margins where the lid always occurs.
(**) Emergence holes with irregular margins.

The aphid was identified by Dr. Robert Van Den Bosch and the parasites were identified through the use of keys.

RESULTS AND DISCUSSION

A total of 1,610 mummies were counted on the leaves. Only those mummies in good conditions were counted, because a large number of them were covered by a thick layer of adhesive honeydew and some were smashed and hardly allowed to see if there were any emergence hole. A number of mummies were dissected to observe the number of parasites present and the type of parasitism (ecto or endo); however, only four mummies were found to have two parasites. The others showed dead adults or pupae of Hymenoptera, meconia and fungus. Some of those mummies with dead parasites were tightly surrounded by the margins of the dry corn leaves or covered by the adhesive honeydew. It seemed that these two factors prevented the aeration for the pupae and the exit for the adults. The presence of some Psocoptera on the leaves should suggest that these insects, though not observed in this experiment, could be responsible for some dead parasites if they really attacked the aphid mummies, because a small hole made by them could disrupt the micro environment inside the mummy where the parasite was developing.

From the counting on the leaves, the results were the following: .

mummies with holes -946
mummies without holes - 664
mummies wity smooth holes - 157
mummies with jagged holes - 789

From the set of 100 mummies placed in the vials, the results are shown in Table 1.

The chalcids of the Family Pteromalidae (*Asaphes* and *Pachyneuron*) were the most numerous among the hyperparasites found. According to Stary (1966), the pteromalid female attacks parasitized aphids and lays an egg on the surface of the parasite last instar larva or pupa. The pteromalid larva feeds gradually on the parasite, kills it and pupates inside the aphid already mummified by the primary parasite.

Another secondary parasite found was *Lygocerus* (Ceraphronidae), whose females look for mummified aphids which contain praepupa or pupa of the primary parasite on whose surface they lay an egg. The ectoparasite larva feeds mostly on the thorax and abdomen of the pupa; sometimes, more than one egg is laid, but, due to competition, only one larva reaches maturity. The female of *Charips*, a cynipid of the Subfamily Charipinae, attacks the living aphid that contains the primary parasite larva on which it lays an egg. The larva feeds gradually and, by a certain mechanism, the development of the host larva is prolonged and the cynipid pupates inside the cocoon of the primary parasite, inside the mummified aphid. During the experiment, from two pupae of Syrphidae flies found on the corn leaves emerged the parasites:

Asaphys sp. (Pteromalidae) - 5 individuals
Bothriothorax sp. (Encyrtidae) - 8 individuals

TABLE 1. Number of parasites emerged from aphid mummies, genus, family, type of exit hole and of parasitism, number of mummies with fungus and dry material.

Parasite		Family	Exit hole	Parasitism
Charips sp	3	Cynipidae	jagged	endoparasite
Lygocerus sp.	5	Ceraphronidae	jagged	ectoparasite
Pachyneuron sp.	32	Pteromalidae	jagged	ectoparasite
Asaphes sp.	24	Pteromalidaé	jagged	ectoparasite
Aphelinus sp.	3	Aphelinidae	smooth	endoparasite
Dead parasites	18	-	-	-
Mummies with fungus	9	-	-	-
Mummies with dry material	6	-	-	-

As one can see, the food chain of aphids and their natural enemies is rather numerous, for not only the parasites but also the predators have their parasites and the percentage of hyperparasitism surely plays an important role in the natural limitation of the corn leaf aphid, *Rhopalosiphum maidis* (Fitch).

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