

ECOLOGICAL STUDIES ON CERTAIN APHID PARASITOIDS ESPECIALLY THOSE OF *Aphis craccivora* Koch.

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ABSTRACT

Laboratory and field experiments were carried out at Mansoura district to survey the primary parasitoids associated with five aphid species namely, *Aphis craccivora* Koch, *Brevicoryne brassica*(L.), *Sitobion avenae* (Fabricjus), *Rhopalosiphum maidis* (Fitch) and *R.padi* (L.). These species infested the host plants ,broad bean, cowpea, cabbage, wheat and corn during the two seasons of 1998 and 1999. The results indicated that five aphid parasitoids were recorded. Among them, *Diaeretiella rapae* (M'Intosh) was the most common parasitoid which emerged from the four aphid species, *Aphis craccivora*, *Brevicoryne brassica*, *Sitobion avenae* and *R.padi*. There are no previous records for *Diaeretiella rapae* as a parasitoid of *A.craccivora* in Egypt. Therefore, the present study represents the first record of this species as an important parasitoid of *A.craccivora*. The population density of this aphid species and its parasitoids as well as the percentages of parasitism on broad bean and cowpea were studied.The peaks of mummified aphids on broad bean were recorded during January and March, while it were recorded on cowpea in September and August, in 1998 and 1999, respectively. The results also indicated the effective role of these parasitoids in controlling the infestations of *A.craccivora* on both broad bean and cowpea in the field.

Keywords :Ecological studies , *Aphis craccivora*, parasitoids

INTRODUCTION

Aphids (Aphididae, Homoptera) are serious insect pests which occur all over the world and infest different crops. They damage plants roughly through loss of sap by sucking, reaction of plant tissues by aphid saliva in different ways such as (change of colour, curling of leaves and stems ... etc) also, excreting viscous honeydew on which the sooty- moulds usually develops and finally through transmission of virus diseases to plants (Ibrahim , 1987).

The routine application of pesticides to control aphids has two adverse features. Firstly, they are mostly non selective and kill aphid natural enemies, which causes further disturbance of the ecosystem. Secondly, as in other species, resistant strains of aphids are expected to develop soon (Doutt and smith, 1971).However, Biological control is one of the most important bases of integrated control programs since the concerned biotic agents include parasitoids, predators and pathogens (Sarhan 1976).

According toVan Den Boch *et al.*(1962) and (1970); Ragab (1996) and Ragab and Ghanim (1997) some aphid parasitoids (Aphidiidae, Hymenoptera) are well known as active bio-control agents for many aphid species in the world .

Therefore, The present study aims to throw some light on the parasitoid species associated with aphids infesting broad bean, cowpea, cabbage, wheat and corn at Mansoura district. The population density of *Aphis craccivora* Koch. and its parasitoids as well as the percentages of parasitism are also investigated

MATERIALS AND METHODS

To survey the aphid parasitoids, random samples of the following aphid species: *Brevicoryne brassicae* (L) , *Sitobion avenae*, *Aphis craccivora*, *Rhopalosiphum maidis* and *R. padi* were collected from different host plants cultivated at the Experimental Research. Station of the Faculty of Agriculture, Mansoura University, during the two years 1998 and 1999. These host plants were cabbage, broad bean, cowpea, wheat and maize which were free from any pesticide applications. Samples of the plant parts which were heavily infested with the previous aphid species were taken twice a week, and transferred to the laboratory in tightly closed plastic bags. The sample size of each crop was fifteen shoots from broad bean, ten shoots from cowpea, five leaves from cabbage, twenty five shoots from wheat and fifteen leaves from corn. All individuals of each aphid species found on the host plant samples were counted and recorded.

Aphids were fed on their natural hosts and kept in Petri dishes (50 aphid /Petri dish) until the formation of mummies(parasitized aphids). The mummies of each aphid species were daily isolated and kept separately in small glass tubes until the emergence of adult parasitoids. The emerged parasitoids were primarily classified, counted and preserved in 50% ethyl alcohol. Parasitoid specimens were mounted and confirmation of identification was completed by aid of the biological control laboratory, Ministry of Agriculture, Egypt. The percentages of parasitism caused by different parasitoids to the most dominant aphid species, *A. craccivora* on broad bean and cowpea were calculated according to the formula of Farrell and Stufkens (1990).

RESULTS AND DISCUSSION

1.1. Survey of common parasitoids associated with aphid species

The data in Table 1 indicate that *Aphis craccivora* was the dominant aphid species infesting broad bean and cowpea crops. Three parasitoids were emerged from its mummies, namely *Lysiphlebus fabarum*, *Dieretiella rapae* and *Ephedrus* sp. However, Selim et al. (1987) and Abdel-Samad (1996) in Egypt, recorded *L. fabarum* as a parasitoid of *A. craccivora*. There are no previous records for *D. rapae* as a parasitoid on *A. craccivora* in Egypt. Therefore, the present study is the first record of this species as an important parasitoid on *A. craccivora*. Ragab (1996) and Abdel-Samad (1996) recorded *Trioxys angelicae* as a parasitoid of *A. craccivora*. This latter parasitoid was not recorded on the same aphid species during the present investigation.

Brevicoryne brassicae was the main aphid species infesting cabbage crop and the parasitoid. *D. rapae* emerged from its mummies. These results agree with those of Ibrahim and Fayed (1984), El-Maghraby (1993), and Abdel-Magid (1999).

Sitobion avenae was the major aphid infesting wheat plantations. The parasitoids emerged from its mummified individuals were *Aphidius sp.* and *D. rapae*. Ghanim and El-Adl (1983), Ibrahim and Afifi (1991) and El-Serafay (1999) also recorded many species in Egypt belonging to the genus *Aphidius* parasitizing *S. avenae* in wheat fields.

Rhopalosiphum maidis and *R. padi* were the main aphid species infesting corn plantations. The two parasitoids *D. rapae* and *Praon sp.* were emerged from their mummified (Table 1). These results are in agreement with those of Polgar (1984) in Hungary, Feng *et al.* (1992) in USA and Al-Hag *et al.* (1996) in Saudi Arabia. All these investigators recorded *D. rapae* and *Praon spp.* as parasitoids of *R. maidis* and *R. padi* in corn fields.

Table 1. Aphid parasitoids associated with five aphid species on different host plants.

Host plant	Aphid species	Parasitoids
Broad bean	<i>Aphis craccivora</i> (Koch)	1. <i>Diaeretiella rapae</i> (M'Intosh) 2. <i>Lysiphlebus fabarum</i> (Marshall) 3. <i>Ephedrus sp.</i> (Haliday)
Cowpea	<i>Aphis craccivora</i> (Koch)	<i>Lysiphlebus fabarum</i> (Marshall)
Cabbage	<i>Brevicoryne brassicae</i> (L)	<i>Diaeretiella rapae</i> (M'Intosh)
Wheat	<i>Sitobion avenae</i> (Fabricjus)	1. <i>Apidius sp</i> (Nees) 2. <i>Diaeretiella rapae</i> (M'Intosh)
Corn (maize)	<i>Rhopalosiphum maidis</i> (Fitch)	<i>Diaeretiella rapae</i> (M'Intosh)
Corn	<i>Rhopalosiphum padi</i> (L.)	<i>Praon sp.</i> (Haliday)

1.2. Population density of *Aphis carccivora* and its common parastoid species on broad bean :

Fig (1 and 2) show the population density of *A. carccivora*; mummified aphids and percentages of parasitism during the two years of study on broad bean crop at Mansoura district.

As indicated in Figs (1 and 2), in the first season four peaks of *A. carccivora* were recorded on broad bean plants.. These peaks occurred in the third weak of January (650 individuals), third week of February (500 individuals), first and second weeks of March (650 individuals) in each. The average mean temperatures and relative humidity in this time were 13.3°C,67.17%RH;12.69°C,63.63%RH;13.75°C,61.17%RH and 15.88°C,67.8%RH, respectively (Fig. 1). Nine peaks of *A. carccivora* in the second season were recorded on broad bean plants. These peaks occurred in the second week of January (800 individuals), third week of January (900 individuals), fourth week of January (600 individuals), first week of February (900 individuals), second week of February (800 individuals), third week of February (686 individuals), fourth week of February (758 individuals), first week of March and the second week of March (593 individuals).

The corresponding average temperatures and relative humidities during these periods were 16.89°C, 67.88 % RH; 19.92°C, 67.88 % RH; 17.99°C, 70.75% RH; 17.67°C, 60.17% RH; 15.99°C, 71.89% RH; 16.29°C, 68.04% RH; 13.44°C, 63.25% RH; 17.0°C, 64.17% RH and 15.67°C, 64% RH, respectively (Fig. 2).

The three parasitoids, *L. fabarum*, *D. rapae* and *Ephedrus sp.* of *A. craccivora* on broad bean showed five peaks in the first season and six in the second.

In Figure 1, it may be clear that the maximum number of mummified aphids was recorded in the first week of March (75 individuals), when the temperature and relative humidity were 13.75°C and 61.17% RH in the first season and 94 individuals in the second season during the fourth week of January, when the temperature and relative humidity were 17.99°C and 70.75 % RH (Fig. 2).

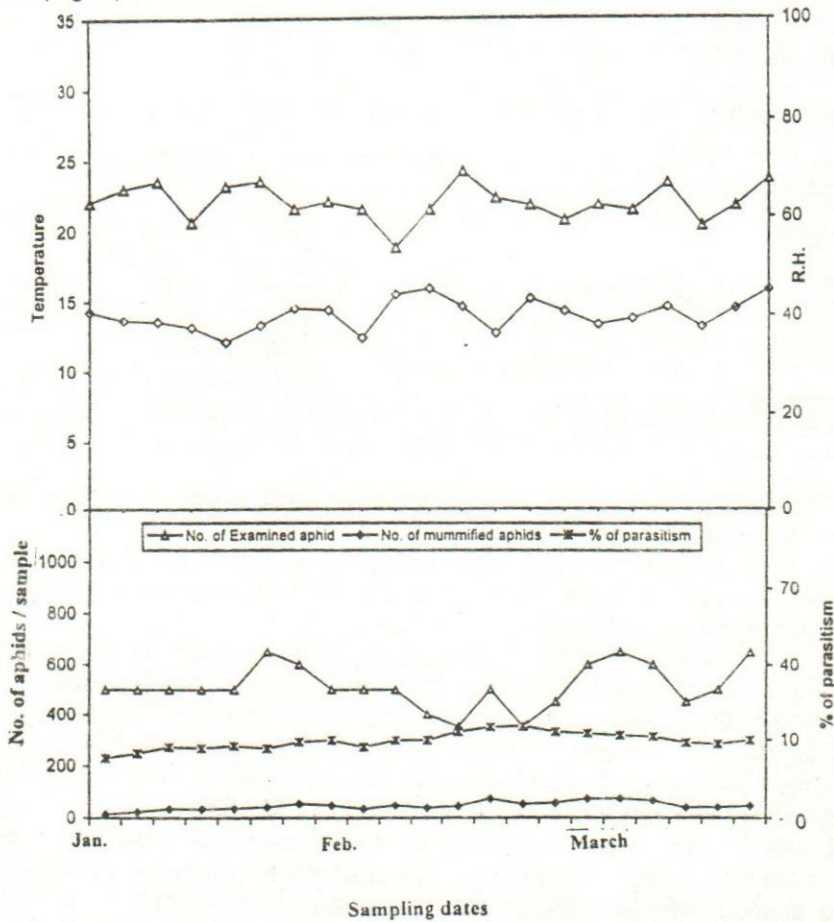


Fig. 1. Population density of *A. craccivora*, number of mummified individuals and percentage of parasitism in broad bean fields during 1998 season .

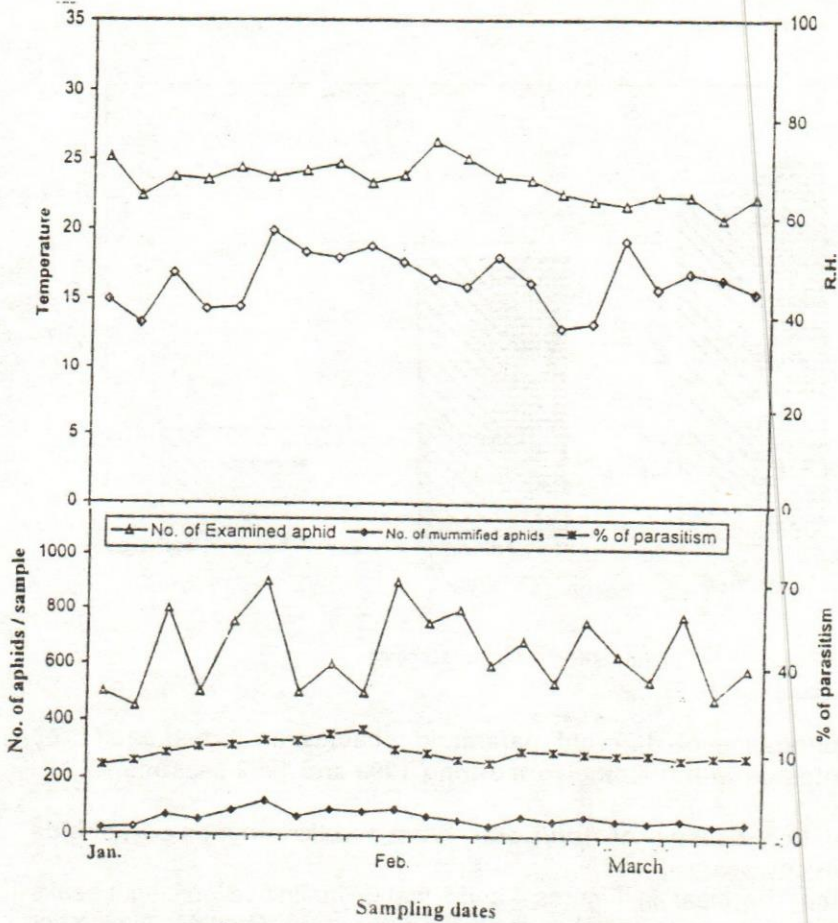


Fig. 2. Population density of *A. craccivora*, number of mummified individuals and percentage of parasitism in broad bean fields during 1999 season.

Figure 3 shows the abundance of *L. fabarum*, *D. rapae* and *Ephedrus* sp.as percentages of the total catches of these parasitoids during the two years of study. These percentages were 50.05, 38.11 and 11.84% in the first season and 46.22, 37.79 and 15.99% in the second season respectively.

Percentages of parasitism:

The highest total percentages parasitism was 15.14% which was recorded in the third week of February in the first season at 15.17°C and 62.17 % RH. Meanwhile it was 17.4 % in the fourth week of January in the second season at 18.84°C and 59.5 % RH. However, Abdel-Samad (1996) in Egypt, reported that the rate of parasitism varied from 15.4 and 22.0 in March on the same aphid species.

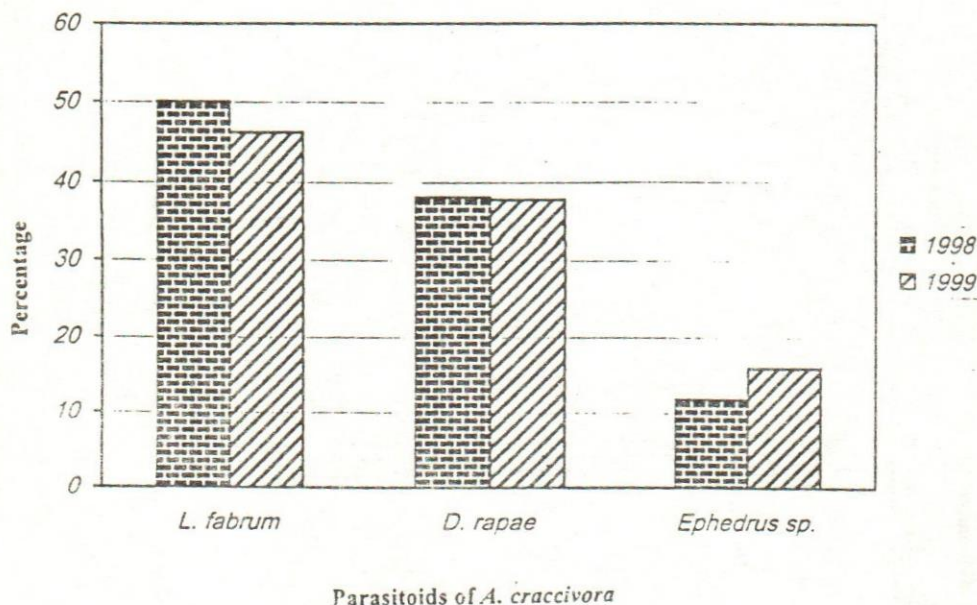


Fig.3. Abundance of different parasitoid species on broad bean crop infested with *A. craccivora* during 1998 and 1999 seasons.

1.3 Population density of *Aphis craccivora* and its common parasitoids on cowpea:

It may be clear in Figures 4 and 5 that in the first season eight peaks for *A. craccivora* were recorded during the months from August to November. They fluctuated between 350 in August and 1000 individuals in the first week of September. These peaks took place under the average temperatures and relative humidities given in (Fig.4).

In the second season *A. craccivora* showed only five peaks on cowpea plants. These peaks occurred during the period from July to August and varied from 500 to 700 individuals, under average temperatures varying between 15.99 and 30.07°C and relative humidities differing from 60.17 to 71.89% (Figure 5).

It may be clear in both Figures 4 and 5 that *L.fabrum* as parasitoid of *A. craccivora* on cowpea had nine peaks in the first season, and six in the second.

It can be also noted that the maximum number of mummified aphids was recorded in the first week of September (101 individuals), under the conditions of 27.31° C and 64.03 % RH in the first season (Fig. 4) .In the second season (Figure 5),the numbers of mummies dropped to 42 individuals in the first week of August under 28.94°C and 65.63% RH.

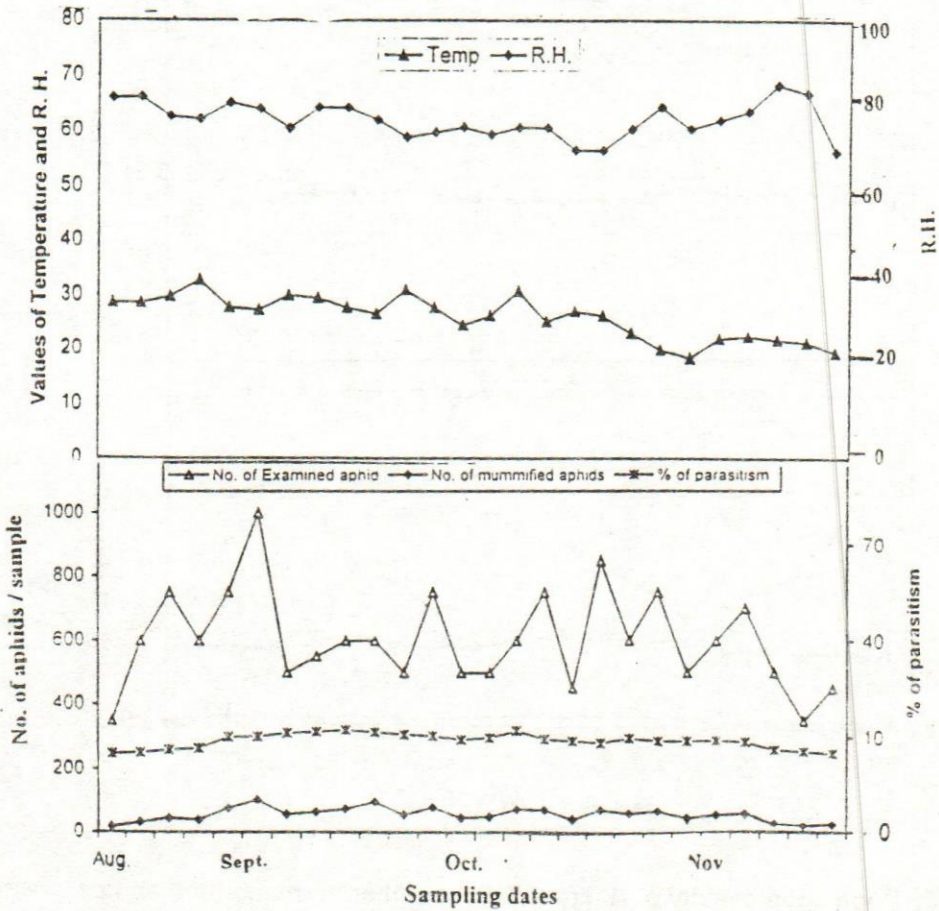


Fig.4. Population density of *A. craccivora*, number of mummified aphids and percentage of parasitism in cowpea fields during 1998 season .

Percentage of parasitism:

The highest percentage of parasitism was 12.17% which was recorded in the second week of September in the first season at 27.75°C and 64.33 % RH (Fig. 4), while it was 9.33% in the first week of August in the second season at 28.08°C and 66.17 % RH (Fig. 5).

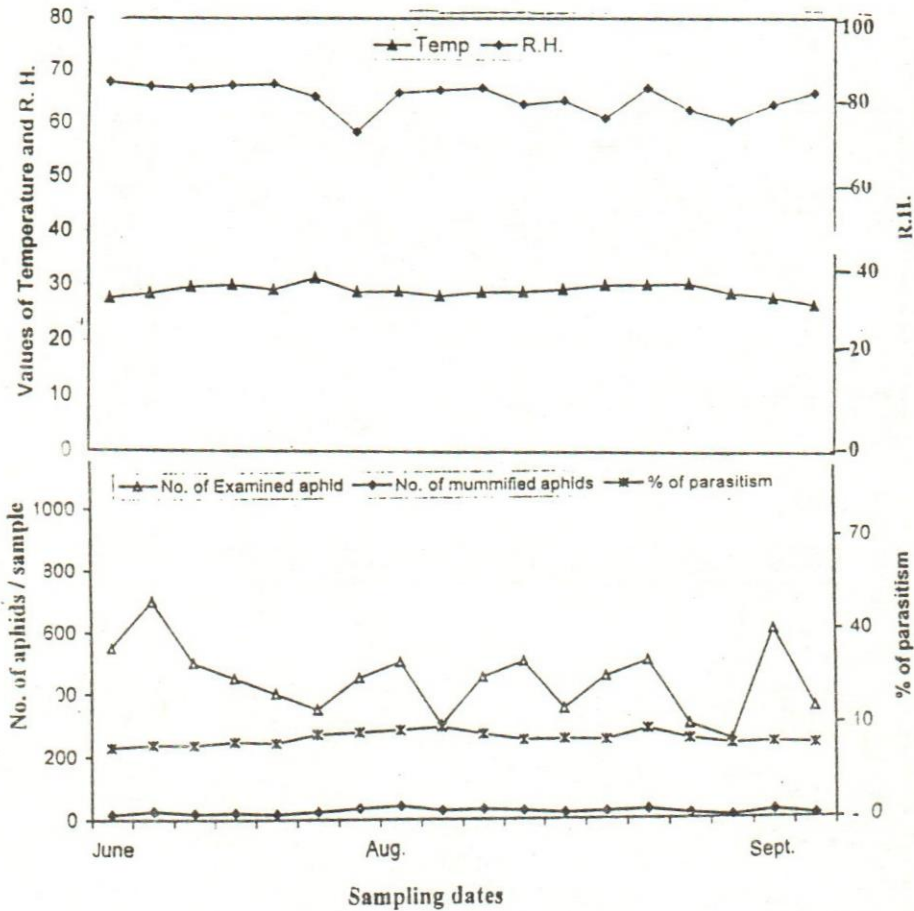


Fig.5. Population density of *A. craccivora*, number of mummified aphids and percentage of parasitism in cowpea fields during 1999 season.

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دراسات إيكولوجية على بعض طفيليات المن وبصفة خاصة من البقوليات
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أجريت دراسات حقلية ومعملية بمنطقة المنصورة وذلك لحصر أهم الطفيليات الحشرية المرتبطة بأنواع المن المختلفة الذي يصيب خمسة أنواع مختلفة من المحاصيل وهي الفول البلدى واللوبياسا والكرنب والذرة والقمح وذلك خلال موسمي ١٩٩٨-١٩٩٩ .

وقد أسفرت تلك الدراسات عن حصر خمسة أنواع من الطفيليات الهامة وكان الطفيل *Diaeretia lae rapae* أكثرها تواجدا على أنواع المن المختلفة حيث تم تسجيله على أربعة أنواع مختلفة من المن منها من البقوليات وهذا يعتبر أول تسجيل لهذا الطفيل على من البقوليات في مصر .

تم كذلك دراسة الكثافة العددية لمن البقوليات حيث أنه كان أكثر أنواع المن تواجدا وخاصة على محصولي الفول البلدى واللوبياسا كما تم تقدير نسب التطفل بالطفيليات المختلفة على هذا النوع من المن على كلا المحصولين وذلك خلال موسمين متتاليين ١٩٩٨-١٩٩٩ . وقد أوضحت الدراسة أهمية تلك الطفيليات فسي الحد من الكثافة العددية لهذا النوع من المن مما يؤكد أهمية استخدامها بيولوجيا في برامج مكافحة المتكاملة للمن .