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A N I N T E R N A T I O N A L J O U R N A L

Occurrence of *Diaretiella rapae* (Mc´Intosh, 1855) (Hymenoptera: Aphidiidae) Parasitising *Lipaphis erysimi* (Kaltenbach, 1843) and *Brevicoryne brassicae* (L. 1758) (Homoptera: Aphididae) in *Brassica napus* in Mato Grosso do Sul

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ABSTRACT

The occurrence of Diaretiella rapae *parasitising* Lipaphis erysimi *and* Brevicoryne brassicae *in canola field* (Brassica napus) *was evaluated through two sample methods in Dourados-MS. The methods, used weekly, were: entomologic sweep net and plants sacking. The aphids population was observed from initial to the senescence plant development. Aphids were more abundant during the flowering phase, and they were usually located in the stems of the inflorescence and development fruits. In this phase the largest parasitism level for* D. rapae *(89,7%) occurred. The sample method with a sweep net captured significantly (t=4,484, P £ 0,01) more* D. rapae *while sacking method captured more parasitise aphids (t=2,199 with P £ 0,05) and active aphids (t=3,513, P £0,01).*

Key words: Canola, *Brassica napus*, *Diaretiella rapae*, Parasitism, *Lipaphis erysimi*, *Brevicoryne brassicae*

INTRODUCTION

Canola (*Brassica napus* L.) was obtained by the genetic improvement of colza (*Brassica oleracea* L. and *Brassica campestris* L.). The insect pests are one of the main limiting factors of its productivity in Brazil, causing economic damages (Dias, 1992).

The inappropriate control of *B. napus* pest has many consequences, such as: population outbreak of certain species by the constant elimination of their predators and parasitoids, toxic residues, populations of resistance pest and pest ressurgence problems. According to Changer and Phadke (1994), many researchers recommended chemical controls system against aphids in order to prevent severe losses in the crop.

Insect pests and natural enemies occurence in colza crops are variable (Silva and Ruedell, 1984). Cruciferous aphid *Brevicoryne brassicae* L.,1758 (Homoptera: Aphididae) and green aphid *Myzus persicae* S.,1776 (Homoptera: Aphididae) are strongly attracted by sinigrin stimulant for the insects (Lara, 1979; Silva and Ruedell, 1984).

Among pests, *B. brassicae* had always been observed, causing accented damages in cabbage (Bortoli and Castellane, 1994). Its occurrence in the maturation phase was observed in small and dispersed colonies (Chouéne, 1986, Dias, 1992 and Domiciano, 1995). According to Link *et al.*, (1982) *B. brassicae* occurred in the stuffing

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siliquas phase in not very numerous colonies, causing small reduction in the seeds yield. Hughes (1963) reported that *B. brassicae* and *Lipaphis erysimi* (Kaltenbach, 1843) were economically important pest, causing considerable damages to cruciferous corps.
Studies in Dourados-MS with the aphids and their natural enemies are important because they supply subsidies for the integrated management pests. *Lipaphis erysimi*, *Brevicoryne brassicae* and *Myzus persicae* have not been mentioned in that area (Souza-Silva and Ilharco, 1995), and *Diaretiella rapae* was described as the main primary parasitoid of cabbage aphid by several authors (Souza and Bueno, 1992, Pimentel, 1961 and Hagen and Van Den Bosch, 1968).
The objective of this was to study the aphids populational fluctuation associated to canola and its relation to the parasitism levels promoted by *D. rapae* in Dourados-MS.

MATERIALS AND METHODS

The research was carried out at São Lourenço farm, highway MS 162, km 07 in Dourados-MS, Brazil (22º 14 ' S and 54º 49' W), in a 1 ha area with soil that originally presented natural vegetation with cultures such as corn, wheat, turnip, alfalfa, soybean, bean, and others. Cultivar CTC-4 seeds were planted on May 15 using 8 kg/ha of seeds (Brasil, 1992). During observation period, no chemical product was used for pest and weeds control.
Observations were made between June to September, reaching all phenological phases: rosette, elongation, flowering and maturation.
Insects were collected weekly at 4 pm with an entomologic sweep net. The samples were made at ten points (repetitions) in a distance of approximately eight meters one from each other. Captured insects were taken to the laboratory for posterior selection and identification.
Another method used for insects evaluation was the sacking plants. Ten plants were aleatorically sacked and totally removed from field. In the laboratory, the plants phenological phase and the insect specimens abundance were observed.
Insect population density was analyzed by calculating the average and the standard deviation of the individuals number in each phenological phase. The data were transformed to $\sqrt{x+0{,}5}$, and "t" Student test was applied. Polinomial regression of the relationship percentage between parasitism in function of plant phenological phase and the average number of active aphids were also analyzed.
Climatic data were obtained by Centro de Pesquisa Agropecuária do Oeste, Embrapa-CPAO Dourados-MS.
Percentage of parasitism was calculated according to this formula:

$$x(y) = \left[\frac{\text{parasitise aphids number}}{\text{parasitise aphids number} + \text{active aphids}}\right] \times 100$$

We considered active aphids those that were active (mainly feeding and locomotion) and parasitise aphids were those with low activity and difficult to locomotion, due to parasitoid development. Aphids species observed in the samples were counted together.

RESULTS AND DISCUSSION

The observed and identified aphids were: *Lipaphis eysimi* and *Brevicoryne brassicae*. Aphids population collected by entomologic sweep net increased during the elongation and flowering period (Figure 1) probably because of the low fecundity of winged individuals at the beginning of the invasions. These results agree with Wratten´s (1977) observations.
The absence of rain and temperatures around 22ºC during the increased period favored the reproduction and the populational growth of aphids; although predators such as coccinellids (*Cycloneda sanguinea*, *Eriopis connexa*, *Coleomegilla maculata* and *Allograpta exotic*) and the parasitoid *D. rapae* had been identified in the area.
D. rapae was the most common parasitoid during the aphids colonies installation period. According to Zuniga-Salinas (1982), this species prefers aphids from *Brassica* plants, although they have been observed in wheat. *D. rapae*, when closing to the aphid, touches it with antennas in different body areas. According to Hagen and Van Den Bosch (1968) that behavior had been observed in most Aphidiidae and the acceptance of the hosts for some parasites of that family required aphid movement.

It was observed that parasitoids emergence in the attacked aphids occurred usually in the posterior region of the body (aphid abdomen), cutting the abdominal cuticle with the mandibles in a rotative movement. The same process was also observed by Bueno and Souza (1992).

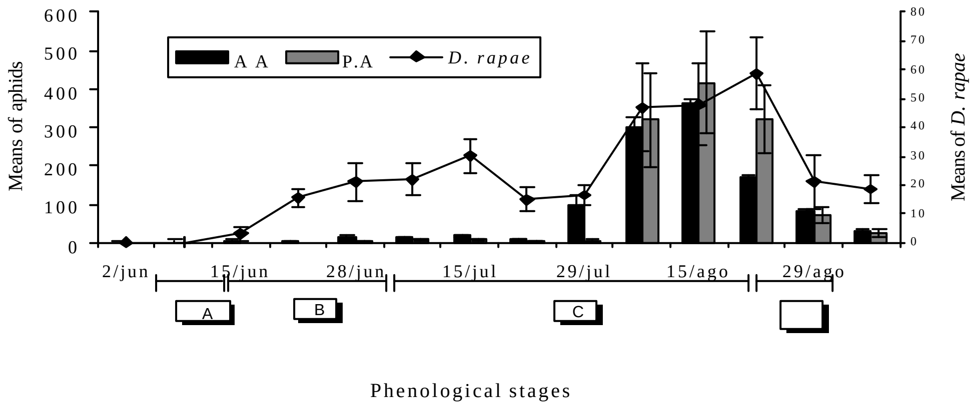

Figure 1 - Means of active aphids (A A) and parasitise aphids (P.A) and *D. rapae*, collected by entomologic sweep net, during plant phenological stages considering the two aphid species together, *L. erysimi* and *B. brassicae.* A = rosette; B = elongation; C = flowering; D=maturation. Dourados-MS.

Temperature is a decisive factor in the biology of the aphids parasites, especially during the adult life, when it influences directly the longevity, mating and oviposition (Stary, 1970). From Figure 1, a synchronism between aphids population and the parasitoids could be observed. The increase of the aphids populational density favored the increase of *D. rapae* populational density. We observed an improvement in the parasitic activity of *D. rapae* reaching a level of 65.3% during the elongation phase. In this period, the mean temperature was 24.7ºC. In the flowering period (July 22), these occured a reduction in the mean temperature (from 21.8ºC to 12.2ºC), which might be responsible for a decreasing in the parasitoid population with the parasitism level dropped from 31.5% to 18.52%. During the same period (July 29), when the registered mean temperature was 24ºC, an increase in the active aphids density (AA) and a decrease in the parasite (PA) activity (Figure 1) was observed. *D. rapae* should probably be at a quiescence state, previously induced by the falls of the mean temperature (12.2ºC) (Figs 1 and 2). Probably another factor that increased the populational density of *D. rapae* was the presence of the surrounding vegetation that maintained natural enemies reservoirs. *D. rapae* is a parasitoid of several aphids in grassland, cruciferous and ornamentals. The experimental area was surrounded by a corn field, turnip and wheat, probably part of *D. rapae* population migrated from those field to canola. The variation in the host number species was recognized as a strategy,

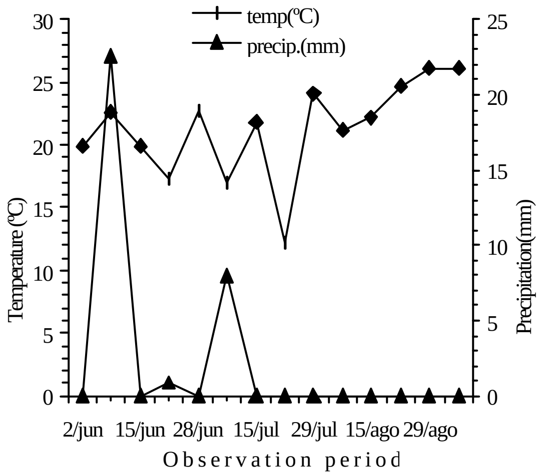

Figure 2 - Temperature and precipitation data, obtained at EMBRAPA-CPAO the station of Dourados-MS.1995.

allowing the parasites to occupy several microhabitats and not to suffer drastic populational reductions in the absence of a preferential host. It is important to point out that the percentage of native and diversified vegetation must be used for maintenance and protection of the natural enemy.

For sacking method reductions in aphid and protection of parasitoid populations were observed during flowering (July 22) with identical values for sweeping method, probably due to low temperature (Figure 3). This promoted leaves drying, resulting in an increase in the number of winged morphs individuals that when reached the adult phase, migrated and caused a reduction in the aphids numbers. By the sacking method, the attack of *D. rapae* reached 89.7% at the end of culture cycle. During this period there were not abrupt falls in temperature and this was a favorable factor to the multiplication of *D. rapae* and for which the reduction of the aphids population was attributed. Once with the end of the culture cycle, the senescence leaves no longer served as habitat.

Significant differences were observed between the results obtained by the sweeping method and the sacking one (Table 1). The method used for capturing the insects can be influenced by the insects behaviour and their location on the plant, besides the phenological culture stage. The sample method with a sweep net captured significantly more *D.rapae* while the sacking method provided satisfactory estimates of aphids populations that lived in groups and presented low mobility. This occurs because *D. rapae* has only free life in its adult phase which is winged and aphids have a low number of winged forms besides a low mobility or flight cited below.

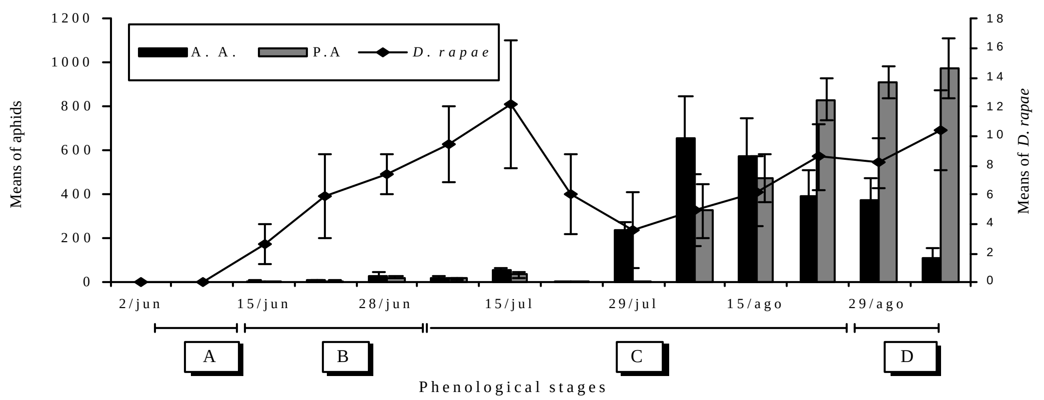

Figure 3 - Means of active aphids (A A) and parasitise aphids (P.A) and *D. rapae*, collected by sacking plants method, during plant phenological stages considering the two aphid species together, *L. erysimi* and *B. brassicae.* A = rosette; B = elongation; C = flowering; D = maturation. Dourados-MS.

Table 1 - Means, variance (%) and "T" test for the sample methods, with entomologic sweep net and sacking the plants, for *D. rapae* and aphids (parasitise and active), considering the two aphid species together, *L. erysimi* and *B. brassicae*.

	Diaretiella rapae		Parasitise aphids (*L. erysimi* and *B. brassicae*)		Active aphids (*L. erysimi* and *B. brassicae*)	
	Sweeping	Sacking	Sweeping	Sacking	Sweeping	Sacking
Means	4,326	2,428	6,024	11,045	6,759	10,063
(%)Variance	4,507	0,765	52,210	147,000	36,790	81,366
T	4,484**		2,199*		3,513**	
	$P \leq 0{,}01$		$P \leq 0{,}05$		$P \leq 0{,}01$	

It was observed that *D. rapae* population increased in agreement with the populational growth of its host, indicating that a positive correlation existed in the populational development of the two species (Figure 4). A positive correlation was also observed between the plant phenological phase and the percentage of parasitism caused by *D. rapae* (Figure 5).

With the plant growth an increase in flowers, fruits number, and aphids population was observed providing then an increase of the *D. rapae* population with an increment in the percentage of parasitism. The largest aphids population was observed during the flowering phase.

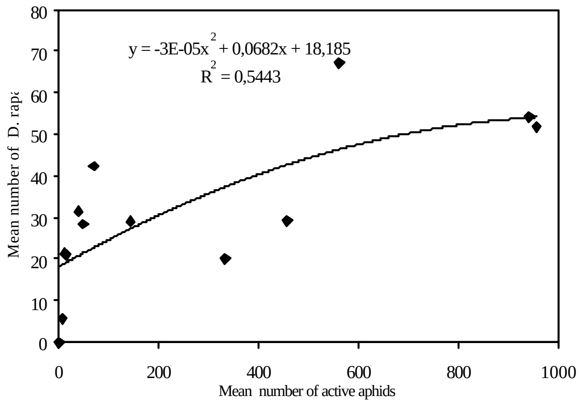

Figure 4 - Means of *D. rapae* in function of the number of found active aphids, considering the two sample method.

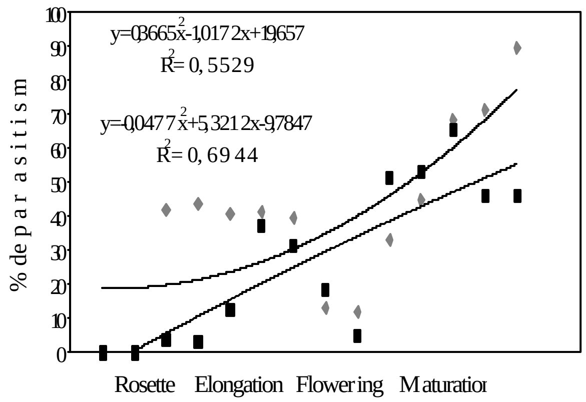

Figure 5 - *D. rapae* percentage of parasitism in function of the phenological phase of the culture in entomologic sweep net (R^2= 0,6944) and sacking plants method (R^2=0,5529).

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RESUMO

Os índices de parasitismo de *Diaretiella rapae* em *Lipaphis erysimi* e *Brevicoryne brassicae* em uma cultura de canola *(Brassica napus*), foram avaliados através de dois métodos de amostragem em Dourados-MS. Os métodos utilizados, semanalmente, foram a varredura com rede entomológica e o ensacamento das plantas. A população de afídeos foi observada desde a fase de elongação até a senescência das plantas. Os afídeos foram mais abundantes no estádio de florescimento, sendo que nesta fase, localizavam-se preferencialmente nas hastes das inflorescência e frutos em desenvolvimento. Nesta fase ocorreram os maiores índices de parasitismo por *D.rapae* (89,7%). O método de varredura com rede entomológica capturou significativamente mais *D.rapae* (t = 4,484, P ≤ 0,01) enquanto que o método do ensacamento capturou maior número de afídeos parasitados (t=2,199, P≤ 0,05) e afídeos ativos (t=3,513, P ≤0,01).

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