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Comparison of Resistance of Five Oilseed Rape Varieties to the Cabbage Aphid *Brevicoryne brassica* (*Homoptera:aphididae*) in the Greenhouse

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Abstract: The cabbage aphid, *Brevicoryne brassica* was reported from Iran by Afshar in 1317. This pest caused economic damage to cabbage family. The antibiosis mechanism of the resistance was investigated at 4-6 phenological leaf stage, in Uorica, Hayola 401, Hayola 308, Parkland and PF (7045, 91) under glasshouse conditions of 24°C±1, with 65-75% R.H. and photoperiod of 16: 8 (L:D) periods. Antibiosis was determined by studying the percentage survival of the nymphs, duration to their development time, fecundity (total number of progeny per female produced within the first 10 and 15 days reproductive cycle) and finally calculating the relevant intrinsic rate of natural increase (r_m values). The analysis of variance indicated that, there were significant differences ($p<0.05$) between the varieties. At 4-6 leaf stage, the highest mean r_m value (0.3229±7.516E - 0.3 and 0.3210±7.783E - 0.3) was estimated for rearing on Hayola 401 with the smallest (0.1958±1.645E - 0.2 and 0.1957±1.461E - 0.2) on the Pf (7045,91) within the first 10 and 15 day periods respectively. Thus in this study, Hayola 401 is regarded as the most susceptible and the Pf (7045, 91) as the most resistant variety in relation to the aphid.

Key words: Antibiosis, biological responses, cabbage aphid, host plant resistance, oilseed rape

Introduction

Among those agricultural plants that their seed is used for producing oil,(Colza) is prominent because of its special agricultural properties as resistance against cold, waterlessness, bearing salinity, controlling the weeds, variety in the kind of producing oil and its eatable quality (Alyari *et al*., 2000; Sojoodi, 2000). And after producing the oil of conjale, it is also full of proteins which is suitable for domesticated animal s nourishment. Cabbage waxy aphid which is also called Rape aphid is one of the most important pests of cabbage family. This aphid can attack to the host plant s leaf, stem and flowers and causes the lack of some flower s collination in the end of the season, small seed s production, production s reduction, lating all of the bush and most important it causes transportation of virus diseases that could cause the most dangerous damages for the host plant (Blodgett and Grey, 2001; Burges *et al*., 2000; Ellis *et al*., 1996; Jayma *et al*., 2003; Smith *et al*., 1994). While absorbing saliva herbaceous sap, the aphid comes into the host plant and make necrotic ring's in the feeding region's (Blackman and Eastop, 1984; Cole, 1993). Waxy aphid is spread in the world and is known as Colza calamity in most areas of Iran. Its damage on Colza is economically great so that it causes 9 to 77% reduction of the seed and up to 11% reduction of oil containing (Ellis, 1993; Ellis *et al*.,1996; Kazemi *et al*., 1988; Kazemi and VanEmden, 1992). It should be noted that economical importance of this aphid in spring agricultural figures is more than the autumn agricultural kinds (Dodd, 1976). because in the begin of cold weather, reproduction degree of aphid is decreased because of reducing the extent of metabolism in host plant (Ballanger, 1999; Hughes, 1963). Whereas agricultural Colza is

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experiencing its profiting and benefiting stage in Iran, we should avoid some critical and incorrect actions by using suitable methods for controlling the pests. The present study was done for studying the existence of resistance and also the way of some spring Colza response against Colza waxy aphid.

The cabbage aphid prefer the varieties that has more wax in the surface of the leaves. In some crop's for example cabbage the aphid's were hidden between leaves. Thus in the application of chemical control the wax inhibit scattering of the pesticides on the surface of the leaves. So we must use the systemic pesticides (Eigenbrode *et al*., 2000; Schroeder and Dombleton, 2001; Umeda and Mcneil, 2000).

Experiments show that application of pesticides produce high rate and faster offspring. Thus the insect fluid was occur (Umeda and Mcneil, 2000).

The aim of this study was inspection the existence of resistance and it's phonological phase. By using the result's of this study we will use the resistance varieties in the large commercial purposes.

Materials and Methods

In this study, the permanence degree and fecundity of cabbage waxy aphid were studied on five Colza varieties named Uorica, Hayola 401, Hayola 308, Parkland, Pf (7045/91) during 4-6 leaf phonological stage, in the research unit of the Plant Protection and Enthomology Department of Tabriz University in 2004. After disinfecting the seeds in 3/1000 Mancozeb solution The seeds were planted in greenhouse. Because the root of Colza is sensitive against every kind of obstacle in soil like stone (Alyari *et al*., 2000). Usable soil mixed of farm soil, sand and animal fertilizer was selected equally and was placed in autoclave with 120°C and 1 atmosphere pressure in order to be disinfection. Primary colonies of cabbage waxy aphid were produced from cabbage farms of Tabriz and was confirmed by the experts of classification from the institude of plant diseases of Tehran. Prior to the study for deletion the effect of nutrition from cabbage, we use one sensitive variety (Hayola 420).

Contaminating Pot Plants

Contaminating the studied varieties, according to Kazemi *et al*. (2003), Kazemi and VanEmeden (1996), Smith *et al*. (1994) and Jamshidi *et al*. (2006), with small modification had performed. The experiment was performed as the compeletely randomized design with five treatment and 15 repeat in the greenhouse with the condition of 24±1°C temperature, 70±5% proportional moisture and 16:8 period of light - darkness. Evaluating parameters for determining antibiosis power in experimented entries were the survival rate of nymphs, developmental time duration of nymphs, fecundity and intrinsic rate of population increase which could be evaluated by $\sum e^{-rm2} LxMx = 1$ formulae (Eastop and Van Emden, 1972; Kazemi, 1988; Minks and Harrewijn, 1989). This study was performed on the basis of computer program STATSPAK (Van Emden, 1966) for statistical management of data other computer packages for example SAS, STATISTICA and EXCEL had applied.

Results and Discussion

Testing the normality of the data was done by statistical software STATISTICA and analyzing the variance and comparing the average of evaluated properties was performed by SAS softwares.

Survival Rate and Developmental Time Duration of Nymphs

The data obtain on duration of developmental period indicated that there was significant differences between treatment means. Comparisons made between significant differences ($p<0.05$). Data presented in table one shows that Hayola 401 compared with others is considered sensitive and

Table 1: Mean of the survival rate and developmental time duration of nymphs of cabbage waxy aphid on 4-6 leaves stage in the five variety of Colza (at p<0/01 was significant)

Growth indicator	Survival rate	Developmental time mean (days) $\overline{X}$ ±SD	Variety
8/33	66/66	1/8619±8$_b$	Uorica
13/21	93/33	1/0998±7/06$_a$	Hayola 401
9/25	73/33	1/228±7/93^b	Hayola 308
8/13	66/66	1±8/2$_b$	Parkland
6/11	53/33	1/5055±8/73^b	Pf(7045/91)

Table 2: Mean fecundity of adult aptera cabbage waxy aphid within 10 and 15 day periods of its rearing on five cilza varieties (at p<0/01 was significant)

Variety	10 day $\overline{X}$ ±SD	15 day $\overline{X}$ ±SD
Uorica	35/3333±5/924^a	47/6±5/6417^b
Hayola 401	42/60±3/247^c	52/2±8/0463^c
Hayola 308	41/40±5/7296^{bc}	55/40±8/087^c
Parkland	36/2667±10/9183^{ab}	41/2±11/7668^{ab}
Pf(7045/91)	32/533±8/0611^a	38/60±12/135^a

Table 3: Iintrinsic rate of increase of cabbage waxy aphid in its rearing on five cilza varieties for 10 and 15 day periods under glasshouse condition/(at p<0/01 was significant)

Variety	10 day $\overline{X}$ ±SD	15 day $\overline{X}$ ±SD
Uorica	0/2415±2/327E-02^b	0/2465±2/062E-02^b
Hayola 401	0/3210±2/327E-03^e	0/3229±7/516E-03^e
Hayola 308	0/2619±1/346E-02^d	0/2659±1/165E-02^d
Parkland	0/2464±2/495E-02^c	0/2486±2/402E-02^c
Pf(7045/91)	0/1957±1/461E-02^a	0/1985±1/645E-02^a

has been placed in first group because of having the least averaged length the survival rate and developmental time duration of nymphs. But Uorica, Hayola 308, Parkland and Pf (7045 /91) varieties don't have any significant differences with each other and are placed in the second group. According to the obtained results the survival rate of nymphs in contrast with each other is fully different, so that its most extent was allocated to Hayola 401 and its least extent was allocated to Pf (7045 /91). Because of having the low growth indicator, this variety is more sensitive (Table 1).

Assessing the resistance by this parameters also has done by Kazemi *et al*. (2001), Moharramipour *et al*. (2003) and Zandi Sohani *et al*. (2003).

Assessment between SLMO46, Consol, Mohikan and Likord showed that Likord variety had significant difference with others. Thus our result's in the case of existence of resistance difference between varieties of cabbage aphid was similar to that.

Fecundity

Comparisons made on mean fecundity (Table 1 and 2) indicated significant difference ($p<0.05$) in mean fecundity of the aphid on five oilseed varieties within the two periods. In evaluating the resistance by this parameter and the results of average comparision during 10 days reproduction period, it is cleared that Uorica and Pf (7045 /91) varieties are proportionally resistant and Hayola 401 is a sensitive one. During 15 days reproduction period, Hayola 401 and Hayola 308 varieties were known as sensitive because of producing the high average of fecundity of cabbage waxy aphid in this living stage. compared with them, the other entries are considered resistant (Table 2). By this property, we can calculate the larviposition period of cabbage waxy aphid on these varieties during any 15 days reproductive period (Fig. 1 to 5). According to these graphs, the highest reproduction of this insect was during the 6 th to 9 th days. Table 2 shows mean of fecundity of cabbage waxy aphid's wingless adult insects during 10 and 15 days reproductive periods.

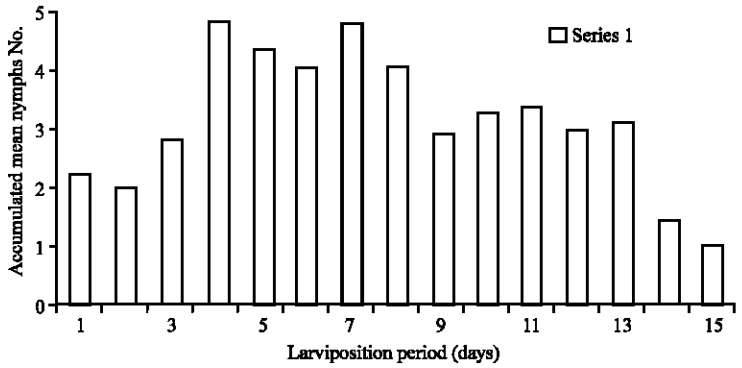

Fig. 1: Daily cumulative means of larviposition for 15 days during 4-6 leaves stage (Uorica)

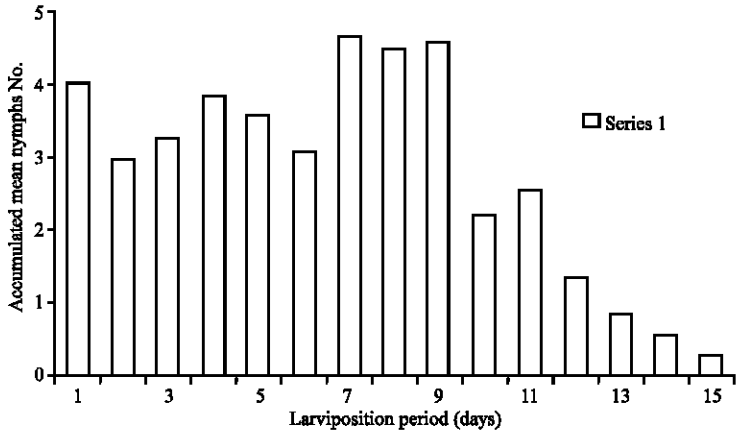

Fig. 2: Daily cumulative means of larviposition for 15 days during 4-6 leaves stage pf (7045/91)

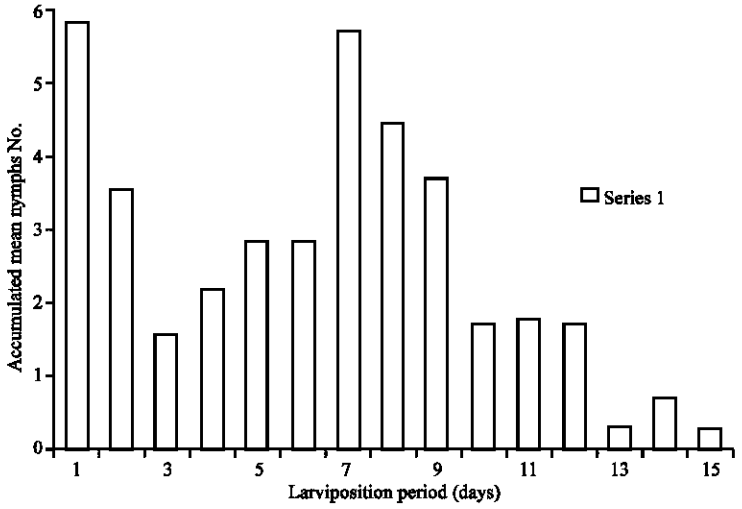

Fig. 3: Daily cumulative means of larviposition for 15 days during 4-6 leaves stage parkland

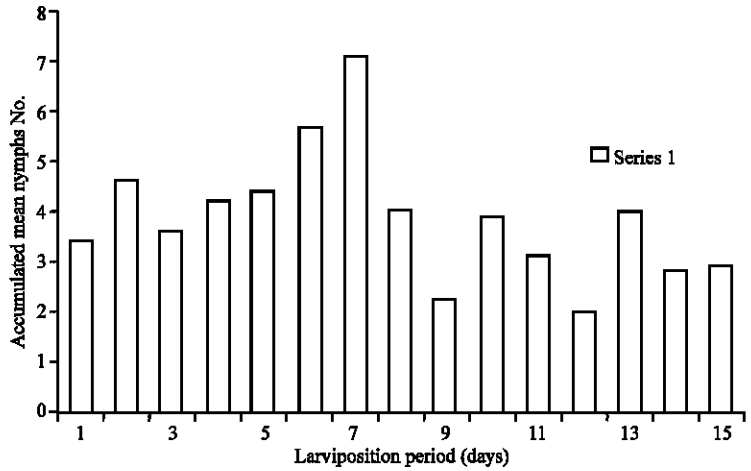

Fig. 4: Daily cumulative means of larviposition for 15 days during 4-6 leaves stage. Hayola401

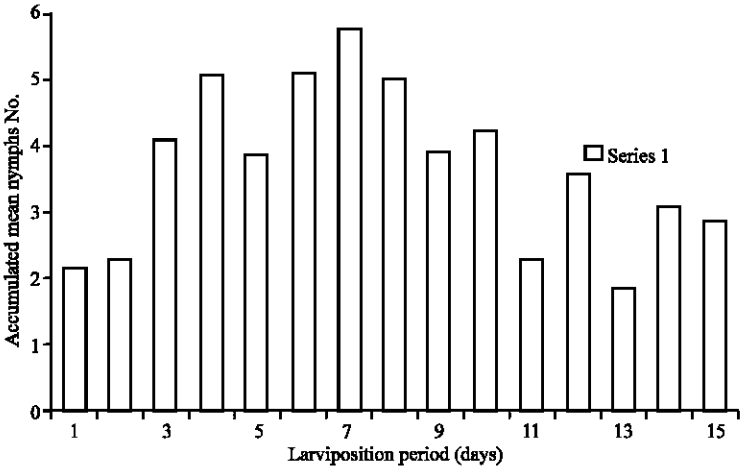

Fig. 5: Daily cumulative means of larviposition for 15 days during 4-6 leaves stage. Hayola308

Intrinsic Rate of Population Increase (r_m value)

Data indicated significant differences between r_m values at ($p<0.05$). Aphid's intrinsic rate increase, shows that the evaluated varieties during first ten days of larviposition are similar to 15 days larviposition and are placed in five groups. According to the inserted results in Table 3, Hayola 401 is sensitive became of having the highest value r_m.

Moharamipour *et al*. (2003) in the study of the antibiosis of four rape variety to cabbage aphid outlined this character as important component of resistance. They found also, the different resistance level in some of rape variety.

We know that in the resistance plant, the phenomenon of resistance might occur in the different growth season phases. Present result's show that different colza variety were different in the case of resistance to cabbage aphid. Cause of the higher rate of fertility rate of the first generation in this aphid than second generation, in addition, the mortality rate of first generation is lower than second one, Thus if the resistance to aphid was express in the beginning of the season, not only was useful, but also might use as a high quality control method (Dodd, 1976; Schroeder and Dombleton, 2001).

Antibiosis is a special type of resistance so has imposed negative effect in the invading insect biology. Effect of antibiosis in the size of insect, longer duration of growth and development of larvae and decrease of fecundity of the adult ones. Where as the value of r_m is depended to three important parameters as, the percentage of nymph survival, length of developmental time duration of nymphs and daily fecundity of insect. So it is a favorable property for separating the antibiozical effects and determining the degree of testing entries resistance. In this study the comparison of r_m value in the 4-6 leaves stage of plant growth Hayola401 and PF(7045/91) varieties were in tern sensitive and resistance varieties. For this study was performed in greenhouse condition and to got insurance the result's it's better to performing the experiment in the field condition in several years and places.

To investigate the genetic component of resistance in future additional studies had to perform.

This might be chemical, physical and molecular studies. Latest development of molecular markers in the applied biological science made new horizons in order to reaching our many hard question's. in this case we recommend first using arbitrairy marker's and then we can design sequence tagges.

According to results of flowering phonological stage studies PF(7045/91) variety in contrast to other varieties was the most resistance, So it is recommended that if this variety had good yield, it can be used as commercial variety (Jamshidi *et al*., 2006).

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