Pakistan J. Zool., vol. 36(1), pp. 69-74, 2004.

Response of Various *Brassica* Genotypes Against Aphids Infestation Under Natural Conditions

M. SARWAR, NAZIR AHMAD, M. BUX, AKBAR ALI AND M. TOFIQUE
Nuclear Institute of Agriculture, Tandojam, Pakistan

Abstract.- This field experiment examined the ability of 15 brassica genotypes (*Brassica campestris* and *Brassica juncea*) to hold aphids populations and yield component. To investigate these trends, 2 years average of the collected data was computed. Data inferred that fluctuations existed within the tested genotypes for both the parameters under consideration. Aphids densities were the lowest on Agati Sarson (P) (7.51 aphids/plant) and the highest (38.96 aphids/plant) on TSA-1005/95. For grain yield, Agati Sarson (P) gave the highest yield (1908 g/3.5 m^2) (545 kg/hectare), and TSA-1005/95 yielded the lowest (847 g/3.5 m^2) (2420 kg/hectare). It was concluded that in case of infestation by aphids, the growth of foliage and fruiting bodies, as well as the over all yield of plants were negatively affected due to interference by this notorious pests.

Key words: Aphids, infestation, Sarson, *Brassica*, yield, resistance.

INTRODUCTION

Rape and mustard oil seed crops are the most important sources of vegetable oil grown during the winter season. The area and production level of rape and mustard in Pakistan during 2002-03 were about $649x10^3$ acres, $217x10^3$ tons oil seeds and $69x10^3$ tons oil (Anonymous, 2002-2003). Aphids have been considered a serious pest throughout the rape and mustard growing areas of the country. Aphid *Myzus persicae* (Sulz.) is a serious pest of oileferous *Brassica*, widely distributed throughout the world. Both the nymphs and adults suck cell sap from the green parts of the plant in general, and from the young leaves in particular. The affected leaves curl up and deform in shape, chlorosis occurs and thus leaves become vulnerable to the attack of pathogens, which ultimately affect the plant vigour (Khan and Ahmed, 1967). Aphid *Lipaphis erysimi* (Kaltenback) may become so plentiful during winter that it reduces the yield and quality of rapeseed and mustard. The losses in the yield of this crop have been reported to vary from 27 to 96 percent (Bakhetia, 1979). Graham (1984) reported *Brevicoryne brassicae* (L.) as a common and destructive pest of brassica, causing serious losses to oil seeds in some seasons.

During the recent years, some high yielding varieties have been developed, however, the informations regarding their losses by aphids are scanty. Therefore, the present study was conducted to estimate their infestation level and yield responses.

0030-9923/2004/0001-0069 $ 4.00/0

MATERIALS AND METHODS

During the present investigations, 15 genotypes of *Brassica* species were screened for aphids resistance in the field trial conducted at experimental farm of NIA, Tandojam. The experiments were conducted during successive winter copping seasons of the year 2001 and 2002; the crop was sown during the last week of October and first week of November, respectively. Each genotype was replicated thrice, in plot measuring an area of 3.5 m^2, having three rows sown, 30 cm apart. Recommended and uniform doses of nitrogen and phosphorous were given at the time of sowing, while second fertilization of nitrogen was done when the crop was near to flowering. All the other agronomic practices were kept normal and uniform for whole the experiment.

The experiment was left for natural infestation of insects and incidence of aphids attack, and no insecticide was used against the insect pests to ensure their normal population growth pattern. The data on aphids population was recorded at weekly interval, commencing from first occurrence of pest and continued till the infestation ceased (first week of February to first week of March). Aphid population was recorded from each of 5 randomly

selected plants in every replicate. Population counts were made on per plant basis, by recording the aphids in every replicate. Population counts were made on per plant basis, by recording the aphids number from leaves, stem and inflorescence. Collected data was then transformed to mean values to have the population estimation on per plant basis. Seed yield from each plot within the whole radius of 3.5 m^2 was recorded after the crop was harvested and threshold. The data obtained on both the parameters (aphids population and grain yield) was transformed into mean values, and then subjected to statistical treatment. The sum of score obtained during the two years trials was then calculated for final grading of different genotypes tested. LSD test was applied following the procedure by Steel and Torrie (1980) to analyze different parameters using analysis of variance techniques.

RESULTS AND DISCUSSION

The comparative data of different genotypes related to the aphids population and seed production is presented in Tables I and II. Investigations revealed that prominent resistance responses were observed among sarson genotypes for harbouring aphids attack and grain yield, as discussed in the following text.

Aphids densities

Figures 1 and 2 show the summary of aphids population on different genotypes during the year 2001 and 2002, respectively. As indicated in both the figures, apparently the change in aphids population was occurred when compared the mean values for both the years. Aphids population started appearing on the first weak of February and reached at peak during the second weak of February, but declined during the first weak of March (Fig. 1). Aphids appeared during the first weak of February and reached at maximum level during the third weak of February. Thereafter, its population declined gradually, until it reached at minimum level during the first week of March (Fig. 2). Pooled estimates (2 seasons mean) seemed that aphids appeared during the first weak of February and reached upto peak level during the second and third weeks of February. Thereafter, its population declined gradually, until it reached at lower level during first week of March. At crop maturity stage (third week of March), all the genotypes were relatively free from this insect attack and the population was either not observed or very rarely encountered afterward. Normally, no single factor was responsible for it, it may be due to influence of a number of biotic and abiotic factors. However, complete genotypic resistance to aphids infestation was not noted in any of the genotypes tested. Anyhow, genotype Agati sarson (P) received the least aphids population (7.51 aphids/plant), showing the highest level of resistance. Maximum aphids population (38.96 aphids/plant) was recorded on genotype TSA-1005/95, showing its susceptibility (Table I).

Crop yield

The varying levels of aphids population significantly influenced yield of different rape genotypes during both the growing seasons. The highest yield of 1908.0 g/ 3.5 m^2/plot (5451 kg/hectare), was recorded by genotype Agati sarson (P), followed by A.S-1006/95, S-9 (P) and S-9 1005/95, where recorded yield was 1357, 1187 and 1171 g per plot, (3877, 3391 and 3345 kg/hectare), respectively. The lowest yield was obtained by genotype TSA-1005/95 (847.0 g / plot), (2420 kg/hectare), followed FSD-86028-3 and TSA-752/96 showing 883 and 892 g/plot, (2522 and 2548 kg/hectare), respectively (Table II).

It can be inferred that grain yield of some of the genotypes in general was higher due to the lower aphids population and better genetic potential for yield. But the least grain yield of the few genotypes was probably due to the higher aphids population on them and poor yield potential. So, the aphids populations and genetic capabilities components contributed to produce the varying degrees of grain yield in the tested genotypes. It can be concluded that in case of infestation by aphids, the growth of foliage and fruiting bodies, as well as the overall yield of plants were negatively affected due to interference in the process of photosynthesis by this notorious pest.

It was evident from the results of two years studies that genotype Agate sarson (P), was the most resistant for holding least aphids population and superior in grain yield than the rest of genotypes.

Table I.- Mean aphids population on different sarson genotypes during 2001 and 2002.

Sr. No.	Name of genotypes	Aphids population per plant 2001	Aphids population per plant 2002	Aphids population per plant (Pooled)
1.	Toria Selection-A (P)	15.08 ab	30.17 c	22.63 bc
2.	TSA-752/96	11.83 bcd	40.83 b	26.33 b
3.	TSA-1005/95	20.50 a	57.42 a	38.96 a
4.	S-9 (P)	12.67 bc	20.50 def	16.58 def
5.	S-9-1005/95	9.58 bcd	16.32 fg	12.95 fgh
6.	S-9-1006/95	5.66 d	15.00 fg	10.33 hi
7.	Agati Sarson (P)	8.08 cd	9.65 h	7.51 I
8.	A-S-1004/96	7.58 cd	13.83 g	10.71 ghi
9.	A-S-1006/95	9.33 bcd	24.75 cde	17.04 def
10.	A-S-7517/96	8.66 bcd	21.17 def	14.92 efgh
11.	A-S-10014/96	7.91 cd	19.50 efg	13.71 fgh
12.	Poorbi Raya	8.75 bcd	16.08 fg	12.42 fgh
13.	SMP-67	15.33 ab	22.88 de	19.11 cde
14.	FSD-86028-3	7.16 cd	23.33 de	15.25 efg
15.	FSD-850347	12.75 bc	27.08 cd	19.92 cd
		LSD = 5.87	LSD = 5.87	LSD = 4.15

Table II.- Mean seed yield of different sarson genotypes during the years 2001 and 2002.

Sr. No.	Name of genotypes	Yield/plot ($3.5m^2$) (Gram) 2001	Yield/plot ($3.5m^2$) (Gram) 2002	Yield/plot ($3.5m^2$) (Gram) Pooled	Yield Kg/Hectare Pooled
1.	Toria Selection-A (P)	1027 ef	940 f	983 f	2808
2.	TSA-752/96	906 h	878 g	892 g	2548
3.	TSA-1005/95	958 g	736 h	847 h	2420
4.	S-9 (P)	1160 c	1213 d	1187 c	3391
5.	S-9-1005/95	981 fg	1360 c	1171 c	3345
6.	S-9-1006/95	1255 b	1067 e	1161 cd	3317
7.	Agati Sarson (P)	1387 a	2430 a	1908 a	5451
8.	A-S-1004/96	973 fg	1190 d	1082 e	3091
9.	A-S-1006/95	1247 b	1467 b	1357 b	3877
10.	A-S-7517/96	1090 d	1175 d	1133 d	3237
11.	A-S-10014/96	1002 efg	1098 e	1050 e	3000
12.	Poorbi Raya	1043 de	1050 e	1047 e	2991
13.	SMP-67	1203 bc	896 fg	1050 e	3000
14.	FSD-86028-3	990 efg	776 h	883 gh	2522
15.	FSD-850347	1230 b	673 I	951 f	2717
		LSD = 51.03	LSD = 51.03	LSD = 36.09	

Genotype TSA-1005/95 was the most susceptible against aphids population and inferior in yield components. Field screening of these genotypes against aphids infestation indicated that aphids population and yield performance varied with germplasm. In general, these results agreed with the findings of other workers such as Kundu and Pant (1968), Lal (1969), Teotia and Lal (1970), Dunn and Kempton (1971), Bakhetia and Sandhu (1973), Brar *et al.* (1976), Singh *et al.* (1982, 1993), Hussain (1983), Dutta and Saharia (1987), Yadav *et al.* (1991), Bhadauria *et al.* (1992), Kher and Ratual (1992), Lipadhia *et al.* (1992), Upadhyay *et al.* (1992), and Alipieva and Nankova (1996), who have reported significant interactions between aphids population and crop yield. But the conflict exists with the results and findings of Pettersson *et al.* (1990), who reported that there were no any significant differences. Different research workers to determine the resistance or susceptibility among

Fig. 1. Weekly aphids population on different Sarson genotypes during 2001.

Fig. 2. Weekly aphids population on different Sarson genotypes during 2002.

the oilseed brassica against aphids during the past have used various methods. Among those Pathak (1961) and Jarvish (1970), used the percentage of seedling survival as criterion for screening. Bakhetia and Sandhu (1974), in their studies included the aphids population and seed yield as main criteria to determine response in oleiferous brassica. Bakhetia and Bindra (1977), reported that brassica germplasm might be screened against aphids at any stage, provided the optimum level of aphids population is used. Lehmann *et al*. (1985) concluded that the best method to assess the resistance to aphids is to measure their multiplication rate. Singh (1986) reported that seedling stage, however, might be preferred owing to its ease in handling and also it required less time to observe aphids population. Chatterjee and Sengupta (1987) observed the maximum aphids colony length of 8-80 cm on stem and plants beard 0-58% aphids colony Amjad and Peters (1992) noticed that insect populations with higher rates of increase have greater potential for causing plant injury size and percentage plant infestation under field conditions.

Field screening data of rapeseed on aphids population and crop yield basis was fully discussed by the authors Hamed and Khattak (1993), Khan *et al*. (1995), and Anwar and Shafique (1999) in our region.

From the present investigations, it can be inferred that for developing integrated pest management programme in olieferous brassica crops, a good knowledge of insect pest and plant interactions is an important pre-requisite. And the use of host plant resistance is the most economical and practical method for the growers, with the belief that it may help as an effective control component in insect pest management.

REFERENCES

ALIPIEVA, M. AND NANKOVA, T., 1996. The resistance of *Brassica oleracea* var. *capitata* L. to *Brevicoryne brassicae* L. *Crucif. News*, **18**: 100-101.

AMJAD, M. AND PETERS, D.C., 1992. Survival, development and reproductive of turnip aphids (Homoptera: Aphididae) on oilseed brassica. *J. econ. Ent*., **85**: 2003-2007.

ANONYMOUS, 2002-2003. *Economic survey, Government of Pakistan*, Finance Division, Islamabad. pp. 19.

ANWAR, M. AND SHAFIQUE, M., 1999. Relative development of aphids on different *Brassica* cultivars. *Pakistan J. Zool*., **31**: 357-359.

BAKHETIA, D.R.C., 1979. Insect pest problems and their management in rape and mustard crops. XV Anal. Workshop-Cum-Seminar on rapeseed and mustard, held at CSAU Agric. Technol. Khanpur, September 12-13, 1979.

BAKHETIA, D.R.C. AND SANDHU, R.S., 1973. Differential response of *Brassica* species / varieties to aphids, *Lipaphis erysimi* Kalt. Infestation. *J. Res. Punjab Agric. Univ*., **10**: 272-279.

BAKHETIA, D.R.C. AND BINDRA, O.S., 1977. Screening technique for aphid resistance in *Brassica* crop. *SABRAO, J.*, **9**: 91-107.

BAKHETIA, D.R.C. AND SANDHU, R.S., 1974. Differential response of *Brassica* spp. / varieties to the aphid (*Lipaphis erysimi* Kalt.) infestation. *Pl. Breed. Abst*., **7966**: 44.

BHADAURIA, N.S., BAHADUR, J., DHAMODHERE, S.V. AND JAKHMOLA, S.S., 1992. Screening of some mustard cultivars for resistance to mustard aphid, *Lipaphis erysimi* (Kalt.). *J. Insect Sci*., **5**: 185-486.

BRAR, K.S. AND SANDHU, G.S., 1978. Comparative resistance of different brassica species / varieties to the mustard aphid (*Lipaphis erysimi* Kalt.) under natural and artificial condition. *Indian J. agric. Res*., **12**: 198-200.

BRAR, K.S., RATUAL, H.S. AND LABANA, K.S., 1976. Differential reaction of mustard aphid, *Lipaphis erysimi* Kalt. To different rapeseed and mustard varieties under natural and artificial infestation. *J. Res. Punjab Agric. Univ*., **13**: 14-18.

CHATTERJEE, S.D.A ND SENGUPTA, K., 1987. Observations on reaction of mustard aphid to whitepetal and glossy plants of Indian mustard. *J. Oilseed Res*., **41**: 125-127.

DUNN, J.A. AND KEMPTON, D.P.H., 1971. Difference in susceptibility to attack by *Brevicoryne brassicae* Linn. On Brussels Sprouts. *Anal. appl. Biol*., **68**: 121-134.

DUTTA, S.K. AND SAHARIA, D., 1987. Reaction of certain mustard varieties to *L. erysimi* (Kalt.) (Aphididae: Homoptera). *Pl. Breed. Abst*., **10053**: 57.

GRAHAM, C.W., 1984. *Cabbage aphid, leaflet*. Ministry of Agriculture, Fisheries and Food, U.K., **269**: 8 pp.

HAMED, M. AND KHATTAK, S.U., 1993. Screening of resistance oil seed brassicae against *Brevicoryne brassicae* L. aphids. *Proc. Pakistan Congr. Zool*., **13**: 353-358.

HUSSAIN, T., 1983. Evaluation of some oleiferous brassicae for resistance to cabbage aphid, *B. brassicae* L. (Aphididae: Homoptera). *Pakistan J. Zool*., **15**: 95-99.

JARVISH, J.S., 1970. Relative injury to some cruciferous oilseeds by turnip aphid. *J. econ. Ent*., **63**: 1498-1502.

KHAN, A., KHATTAK, S.U. AND ALAMZEB, 1995. Screening rapeseed mutants against aphids under field conditions. *Proc. Pakistan Congr. Zool*., **15**: 15-21.

KHAN, D.U. AND AHMAD, A.K., 1967. *Aphids and their control in Peshawar region*. Deptt. Of Agric. N.W.F.P.

Tech. Bull., **63**: 139 pp.

KHER, S. AND RATAUL, H.S., 1992. Screening of some *Brassica* species and their strains for resistance to mustard aphid II. Based on aphid population. *Indian J. Ent*., **54**: 217-221.

KUNDU, G.G. AND PANT, N.C., 1968. Studies on *Lipaphis erysimi* Kalt. with special reference to insect plant relationship I. Susceptibility of different varieties of *Brassica* and *Eruca sativa* to the mustard aphid infestation. *Indian J. Ent*., **29**: 241-251.

LAL, O.P., 1969. Field studies for varietal resistance in rape and mustard against mustard aphid, *Lipaphis erysimi* Kalt. *Z. angew. Ent*., **64**: 394-400.

LEHMANN, W., KARL, K. AND SCHLIEPHAKE, E., 1985. Comparison of methods of testing for aphid resistance in crop plants. *Pl. Breed. Abst*., **55**: 782.

LIPADHIA, S., AGRAWAL, R.K., KANDALKAR, V.S. AND NIGAM, K.B., 1992. Screening of Indian mustard (*Brassica juncea*) varieties resistant to mustard aphid (*Lipaphis erysimi*) in infested and protected environments. *Indian J. agric. Sci*., **62**: 684-687.

PATHAK, M.D., 1961. Preliminary notes on the differential response of yellow and brown sarson and rai to mustard aphid (*Lipaphis erysimi* Kalt.). *Indian Oilseed J*., **5**: 39-44.

PETTERSSON, J., BRISHAMMAR, S., MELIN, G., RONQUIST, F., STEPHANSON, D., WEIBULL, J. AND AHMAD, I., 1990. Management of mustard aphid. In: *Research on rapeseed and mustard*. Proc. Indo-Swedish Symp., 4-6 September 1989, Uppsala, Sweden (Eds. I. Ohlsson, P.R. Kumar), pp. 102-108.

PHADKE, K.G. AND PRASAD, S.K., 1984. Yield losses due to mustard aphid, *Lipaphis erysimi* (Kalt.) in promising genotypes of *Brassica juncea. Indian J. Ent*., **46**: 486-487.

PRASAD, Y.K. AND PHADKE, K.G., 1985. Effect of mustard aphid, *L. erysimi* (Kalt.) infestation on the seed yield of different varieties of *Brassica* species. *Pl. Breed. Abst*., **1933**: 55.

SINGH, D.P., 1986. Source of resistance and methods of testing for resistance. In: *Breeding for resistance to diseases and insect pests*. Crop Protection, Monographs, Germany, pp. 90-120.

SINGH, R.N., GANGASARAN, R.D. AND SINGH, R., 1982. Differential response of mustard varieties to aphid *Lipaphis erysimi* Kalt. *Indian J. Ent*., **44**: 408.

STEEL, R.G.D. AND TORRIE, J.H., 1980. *Principles and procedures of statistics. A. biometric approach*. McGrawn Hill Book Co. Inc. New York.

TEOTIA, T.P.S. AND LAL, O.P., 1970. Differential response of different varieties and strains of oleiferous *brassica* to aphid, *Lipaphis erysimi* (Kalt.). *Labdev. J. Sci. Tech*., **8-B**: 219-226.

UPADHYAY, S., AGRAWAL, R.K., KANDALKAR, V.S. AND NIGAM, K.B., 1992. Screening of Indian mustard (*Brassica juncea*) varieties resistant to mustard aphid (*Lipaphis erysimi*) in infested and protected environment. *Indian J. agric. Sci*., **62**: 684-687.

YADAV, A.K., SINGH, H. AND SINDH, H., 1991. Combining ability analysis of resistance to mustard aphid, *Lipaphis erysimi* (Kalt.) in Indian mustard, *Brassica juncea* L. Czem and Coss. *J. Oilseed Res*., **8**: 3-34.

(Received 2 July 2003, revised 20 September 2003)