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PESTS AND PREDATORS RECORDED IN BRASSICA ECOSYSTEM

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ABSTRACT

To assess the pests and predators' population in brassica ecosystem, the six varieties of brassica were sown on 1st November 2008. The population of insect pests on all varieties was highest (101.79) per plant on 16th February with increasing rate of 11.814X and r^2= 0.89.Thereafter, the population was minimum (14.63) per plant on 8th March with a decreasing rate of -14.18X and r^2= 0.93 and there was a highly significant correlation between population and dates (r^2=0.96). Pest population decreased when temperature reached upper threshold limit 23 to 35°C and it depicted that there was a significant negative correlation between cumulative degree-days and pest population with a slope of line- 0.002DD and r^2 = 0.97. The population of predators on all varieties was highest (1.583) per plant on 9th February with increasing rate of 0.126X and r^2= 0.88.There was a positive and highly significant correlation between predator population and cumulative degree-days with a slope of line 0.002DDand r^2 =0.91. Its population decreased when temperature reached upper threshold limit.

Keywords: Biological control, resistant verities.

INTRODUCTION

The brassica is not new in Pakistan but for its expansion there is lack of utilization of production technology, marketing problems and insect pest/ diseases. In Sindh, the growers of brassica crops face a lot of problems from insect pests, particularly whitefly, thrips, aphid and painted bug. The control of pest insects has relied heavily on chemical insecticides which are often overused or misused. The brassica group and its pests present a good case for the use of biological control to reduce the level of insecticide applied to the plants. The beneficial species, such as parasites and predators are used to control pest insects that established a solid foundation for environmentally safe system for brassica farmers.

The research work continues to develop and implement sustainable

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management strategies that would reduce the hazards of pesticide use and effectively control the insect pests in brassica and be acceptable to growers. In Pakistan, however, it has not received due attention in the past and consequently no serious attempts have been made to incorporate this factor in pest control programs. The researcher like Naqvi (1975) has reported that the use of resistant verities and biological control is one of the promising methods for pest control. Keeping in view the above factors, this study was carried out to examine the population of sucking insect pests of the main brassica varieties, in order to establish at what pest population levels growers should take action. The role of beneficial species in suppressing brassica pest populations has been assessed and responsibility of resistant verities has been determined.

MATERIALS AND METHODS

Field experiments were conducted during rabi season (2008) to determine the population of pests and predators in brassica crop. Six varieties of brassica viz., (V_1) Taramira (Jambo selection),(V_2) Mustard (P-78), (V_3) Mustard (AH-2001), (V_4) Mustard (P-53-48), (V_5) Mustard (S-9) and (V_6) Canola (Shirallee) were sown on 1st November in a randomized complete block design with four replicates. Each replicate comprised of 10 sub plots for respective varieties and each subplot had ten meter long rows spaced at 30 cm distance. Standard agronomic practices were carried out throughout the experiment under insecticide free conditions.

Population counts were made on 10 randomly selected plants from each of the 10 subplots. For counting the pest and predators number on leaves, of upper middle and lower part of the plant were selected from each plant sampled and at the fruiting stage, one fruiting terminal per plant was also observed. The observations were taken on weekly basis. The data obtained were subjected to statistical analysis. The MSTATC software programme was used to perform the analysis and means were compared by DMRT (Steel *et al*., 1997). Relationship between insect pest and predator's population with meteorological factors (Temperature and Humidity) were also established.

Population growth and cumulative degree-days was analyzed by simple logistic model (Southwood, 1978) as given in equation 1.

$$Nt_i = Nt_0 \quad eRT \text{----------} \quad (1)$$

Nt_i = number of pest and predators at time interval i, Nt_0, number of pests and predators at time interval zero. e the base of natural logarithm R the rate of increase, T the time elapsed in days.

$$\ln Nt_i = \ln Nt_0 + RT \quad n \; r \; s \; F \text{----------} \quad (2)$$

Nt_i = natural log of pests and predator at time interval i, Nt_0 the intercept of y on natural log pests and predators population, R the slope of curve and T the time in days, n the observations used in calculation, r the correlation coefficient, s standard deviation from regression and F – statistics.

Pests and predator population was also correlated with physiological time expressed as cumulative degree-days.

$$\ln Nt_i = \ln Nt_0 + RT^* \; n \; r \; s \; F \text{ ----------(3)}$$

Degree-days were calculated by:

$$DD = \frac{(\text{maximum} + \text{minimum})}{2} - \text{base temperature} \ldots \ldots (4)$$

The regression equations were computed using stat graphics (1991) and the data transformed in log.

RESULTS AND DISCUSSION

Comparative population of pests

The results on the comparative pests population recorded on different brassica varieties are presented in Table 1.

Table1. Comparative population of different pests on different varietiesof brassica.

Pests	Varieties					
	V_1	V_2	V_3	V_4	V_5	V_6
Whitefly	14.19±1.4	15.15±1.2	14.52±2.4	13.85±1.8	8.18±1.12	16.6±2.4
Thrips	10.79±1.8	10.55±1.32	7.18±1.32	9.81±1.21	5.01±1.21	13.02±0.2
Aphid	11.02±3.1	12.48±3.12	15.15±2.32	12.76±2.32	7.73±3.24	14.92±2.9
Painted bug	0.14±1.2	0.16±1.3	0.14±2.14	0.14±1.44	0.13±1.04	0.18±0.34

Whitefly, *Bemisia tabaci* (Gennadivs)

The statistical analysis showed significant difference between varieties (*F*= 3.78, df =5, *P*< 0.01). However, ANOVA results further showed highly significant difference between date intervals (F=38.96, df =12, P< 0.01).The maximum (16.20) population of whitefly was observed on Canola variety followed by P-78 (15.15), AH-2001 (14.550), S-9 (14.16), P-53-48 (13.85) and Jambo (8.17), respectively. The data revealed that the Canola remained susceptible as compared to other varieties and further indicated that Jambo was less susceptible.

Aphid, *Lipaphis erysimi* (Kalt.)

The analysis (ANOVA) revealed that aphid population varied highly significantly with dates(F=17.50, df=12, P< 0.01). However, the infestation of aphid was statistically non-significant (F=1.64, df=5, P>0.05) between varieties. The data revealed that overall mean population of aphid in varieties was (12.27) per plant on Canola followed by S-9 (10.20), P-78 (9.97), P-53-48 (9.29) and AH-2001 (6.8), respectively.

Thrip, *Thrips tabaci* (Linderman)

A highly significant difference in analysis of variance was showed between the thrip population and dates (F=13.67, df=12, P< 0.01). However, the infestation between varieties was statistically non-significant (F=1.95, df=5, P>0.05).The data showed that overall mean population of thrip was maximum in variety AH-2001 (14.54), followed by Jambo (7.47), S-9 (10.63), P-78 (12.11), P-53-48 (13.44) and canola (14.26) per plant, respectively.

Painted bug, *Bagrada hilaris* (Burmeister)

The % infestation of painted bug also varied highly significantly with dates (F=11.9, df=12, P< 0.01) and non significantly with varieties (F=2.04, df=5, P> 0.05). The overall mean population of painted bug in varieties was P-78 (0.30), AH-2001 (0.29), S-9 (0.28), Canola (0.27), P-53-48 (0.22) and Jambo (0.21), respectively.

Comparative population of predators

The results on the comparative predatorspopulation recorded on different brassica varieties are presented in Table 2.

Table 2. Comparative population of different predators on different varieties of brassica.

Predators	varieties					
	V_1	V_2	V_3	V_4	V_5	V_6
Predatory beetle	0.31±3.01	0.30±1.12	0.29±2.20	0.29±1.18	0.23±2.22	0.35±2.18
Chrysoperla	0.17±0.10	0.23±0.18	0.19±0.18	0.20±0.1	0.16±0.11	0.19±0.01
Wasp	0.16±0.03	0.18±0.02	0.17±0.01	0.18±0.04	0.18±0.05	0.16±0.04
Spider	0.14±0.02	0.16±0.02	0.13±0.05	0.15±0.01	0.13±0.07	0.17±0.02

Eleven spotted beetle, *Coccinella undecimpunctata* (Linnaeus**)**

The analysis revealed that the date intervals were highly significant with population (F=24.37, df=12, P< 0.01) and predatory beetle varied significantly with varieties (F=2.72, df=5, P> 0.05). The data revealed the

overall mean population of predatory beetles in varieties was Canola (0.35), followed by S-9 (0.32), P-78 (0.32), P-53-48 (0.30), AH-2001 (0.29), and Jambo (0.24) per plant, respectively.

Green lacewing, *Chrysoperla carnea* (Stephens)

The analysis of data showed that population of lacewing was highly significant with respect to the observation dates ($F=2.65$, $df=12$, $P< 0.01$) and non significant with respect to varieties ($F=1.06$, $df=5$, $P> 0.05$). The overall mean population of lacewing in varieties was AH-2001 (0.25), Canola (0.20), P-78 (0.29), P-53-48 (0.17), S-9 (0.16) and Jambo (0.14), respectively.

Wasp, *Polistus herbroeus* S.

The % population of wasp varied highly significantly with the dates ($F=5.08$, $df=12$, $P< 0.01$) and non-significantly with varieties ($F=0.22$, $df=5$, $P> 0.05$).The overall mean population of wasp in varieties was P-53-48 (0.19), P-78 (0.18), Jambho (0.18), AH-2001 (0.17), S-9 (0.16) and Canola (0.16) per plant, respectively.

Spider, *Tibellus oblongus* L.

The data revealed that the overall mean population of spider in varieties was Canola (0.17), P-78 (0.16), P-53-48 (0.15), S-9 (0.14), AH-2001 (0.13) and Jambho (0.13) per plant, respectively. The % population of spider varied highly significantly with dates ($F=3.52$, $df=12$, $P< 0.01$) and non-significantly with varieties ($F=1.04$, $df=5$, $P> 0.05$).

Predator prey ratio

The pest and predator ratio has been plotted in Figure 1.The results suggest that the pests and the predators appeared in the crop at the same time. The predatorpest ratio was 1:1.95, when there were 0.49 predators against 0.95 pests on 15th December. Thereafter, it reached 1.58 predator against 98.07 on 9th February with a rate of 9.480X and r^2 = 0.87. The predator ratio was 1:22.96 on 8th March, when there were 0.63 predators against 14.63 pests.

DISCUSSION

The results have shown that all six varieties of brassica were attacked by sucking insect pests i.e., aphid, thrip, whitefly and painted bug. Similarly, the previous workers have also reported that brassica crop is severely attacked by a number of insect pests which suck the cell sap of plants and damage the process of photosynthesis (Lohar, 2001). It was observed in the present study that whitefly population was the highest among all sucking pests on brassica varieties. The overall mean population of whitefly on all varieties was 13.67 per plant. Similarly

Ramsey *et al*. (1996) mentioned that whitefly is a major pest of brassica. After whitefly the second largest population of thrips was observed on all varieties of brassica (12.07 per plant). The same results were reported by Bjorn (1995); Shelton *et al*. (1995) and McCall *et al.* (1999). During present studies, the population of aphids was lower (8.89 per plant). The same results were observed by Lal and Singh (1993); Awasthi (1998); Siddiqui *et al*. (1999) who reported that an average loss of 21.88% in seed yield, in addition to a negative effect on plant height, branching, test weight, oil content and viability of seeds was observed due to *L. erysimi* infestation. In this study, the overall population of painted bug was (0.26 per plant). Similar results were reported by Singh *et al*. (1993); Vekarta and Patel, (1999) who reported that the painted bug, *B. hilaris* attacked on brassica varieties.

Figure 1. Predator prey ratio on different varieties of brassica

In the present study, the activity of many predators was noted in presence of sucking insect pests on brassica varieties. The results showed that overall maximum number of coccinellid predator was 0.3 per plant in February. It was followed by *Chrysoperla* sp., (0.56) Wasp (0.17) and spider (0.14). According to Gautam *et al*. (1995) the beetle was active in 2nd week of February. Similar results were reported by Awasthi (1998); Debaraj and Singh (1998); Siddiqui *et al*. (1999) and Devi *et al*. (1999). They reported the presence of predators on brassica correlated with sucking insect pests is in the line to our study.

The pest and predators appeared at same time in 3rd week of December. Sewify *et al.* (1996) reported that the predator populations coincided with the abundance of their prey and predators population increased with an oscillating predator prey ratio. Elliott *et al.* (2000) reported that the population of predators increased with that of aphids. Similar results were reported by Evans and Youssef (1994) who found the populations of sucking insect pests and their coccinellid predators in lucerne. The predator-prey ratio was the lowest on 1st week of March as the crop matured.

CONCLUSION

It is concluded from the present study that whitefly was the major pest of brassica in Tandojam, Sindh followed by thrips, aphid and painted bug. The natural enemy activities also occur on brassica in presence of sucking insect pests.Among the predators maximum population of coccinellid was observed followed by lacewing, wasp and spider. It is suggested that timely sowing and resistant varieties of *B. campestris* provides less attack of insect pests.

REFERENCES

Awasthi, A. K. 1998. Incidence of major insect pests and a coccinellid predator at different times of sowing on Indian mustard. Insect Environment, 3(4):95-96.

Bjorn, G. K. 1995. Varieties of winter white cabbage. SP-Rapport-Statens-Planteavlsforsog, pp. 13, 39.

Debaraj, Y. and T. K. Singh. 1998. Studies on some aspects of prey-predator interaction with reference to cabbage aphid, *Brevicoryne brassicae* (Linnaeus) and its predatory insects. J. Adv. Zool., 19(1):50-54.

Devi, P. B., T. K. Singh and H. J. Singh. 1999. Studies on the natural enemy complex of the green peach aphid, *Myzus persicae* (Sulzer) on knol-khol, *Brassica oleracea* gongylodes. Annals of Plant Prot. Sci., 7(1):37-40.

Elliott, N. C., R. W. Kieckhefer and D. A. Beck. 2000. Adult coccinellid activity andpredation in small grain fields. Biocontr., 17:218-226.

Evans, E.W. and N. N. Youssef. 1994. Numerical responses of aphid predators to varying prey density among Utah alfalfa fields. J. Kansas Ent. Soc., 65(1):30-38.

Gautam, R.D., C. Subhash, V. K. Sharma and S. Ram. 1995. Aphids infesting safflower, their predatory complex and effect on oil content. Annal. Plant Protec. Sci., 3 (1): 27-30.

Lal, O. P. and B. Singh. 1993. Outbreak of the painted bug, *Bagrada hilaris* (Burm.) (Hemiptera: Pentatomidae) on mustard in northern India. J. Entomol. Res., 17(2):155-157.

Lohar, M. K. 2001. Applied Entomology. Second Edition. Biological Control. Published by Dr. Kashif Raza under Kashif Publication, Hyderabad. pp. 147-167.

McCall, D., G. K. Bjorn and K. Henriksen. 1999. Varieties of winter white cabbage. DJF-Report, Havebrug, pp. 5-12.

Naqvi, K. M., A. G. Kanzada and F. D. Abbasi. 1975. Field evaluation of systematic insecticides, their comparative efficacy against patato sucking insect pest. Sindh J. Agric. Res., 10:7-14.

Ramsey, A. D., P. R. Ellis, J. S. Dias (ed.), I. Crute (ed.), and A. A. Monteiro. 1996. Resistance in wild brassicas to the cabbage whitefly, *Aleyrodides proletella*. Int. Symposium on brassicas. Ninth Crucifer Genetics Workshop, 15-18 Nov.,1994. Lisbon, Portugal. Acta-Horticulturae, pp. 507-514.

Sewify, G. H., S. A. El-Arnaouty and M. H. Belal. 1996. The effect of cotton late planting on population densities of sucking insects and their associated predators in Giza region, Egypt. Bulletin Faculty Agri. Uni. Cairo, 47(4):665-675.

Shelton, A. M., B. L. Parker (ed.), M. Shinner (ed.), and T. Lewis. 1995. Temporal and spatial dynamics of thrips population in a diverse ecosystem: theory and management. Thrips biology andmanagement: Proc. Of the 1993 Int. Conf. on Thysanoptera. pp. 425-432.

Siddiqui, A., A. Kumar, N. Kumar and C.P.M. Tripathi. 1999. Prey-predator relationship between *Lipaphiserysimi* Kalt. (Homoptera Aphididae) and *Coccinellaseptempunctata* Linn. (Coleoptera: Coccinellidae): Biol Agri. Hort., 17(1):11-17.

Singh, H., V. S. Malik and H. Singh. 1993. Biology of painted bug (*Bagrada cruciferarum*). Indian J. Agri. Sci., 63(10):672-674.

Southwood, T. R. E. 1978. Ecological Methods. Chapman and Hall. London. pp 524.

Vekarta, M. V. and G. M. Patel. 1999. Succession of important pests of mustard in North Gujrat. Indian J. Ent., 61(4):356-361.

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