SCREENING OF MULBERRY VARIETIES FOR RELATIVE RESISTANCE TO MULBERRY LEAF ROLLER, *MARGARONIA PYLOALIS* WALK.

Ghulam Ali Bajwa[1] and M. N. Ashiq[2]

Abstract

Five exotic mulberry varieties viz. Kanmasi (Japanese) *Morus latifolia* (Japanese), Garyansuban (Korean), Qumji (Korean), Husang (Chinese) and one local variety PFI-I were screened for relative resistance against leaf roller (*Margaronia pyloalis*) at the Pakistan Forest Institute, Peshawar. Mean percentage of larval infestation of leaves was recorded following analysis of variance and LSD test.

Screening results revealed that local variety was relatively the most resistant variety with mean infestation of 25.9%. Other varieties, e.g. Garyansuban showed 65.7%, *M.latifolia* 59.1% and Qumji 50.9% infestation and so were relatively least resistant varieties. Husang gave 35.5% and Kanmasi 42.5% infestation and were relatively moderate in resistance. The results of sampling methodology showed that there were variations in larval infestation on four sides of a tree. However the variation was statistically non-significant.

Key words: Screening, mulberry, relative resistance, Kanmasi, *M. latifolia*, Garyansuban, Qumji, Husang, PFI-I, sampling methodology.

Introduction

The development of insecticide resistant insect populations and public awareness on the use of insecticides have caused increased interest in developing plants resistant to insects (Gallun *et al.*, 1975). However, use of insecticides and entomopathogenic microbes against insect pests of mulberry is restricted because these control agents are harmful to silkworm as well. Therefore, resistance in

[1] Assistant Forest Entomologist, Pakistan Forest Institute, Peshawar.

[2] Director Sericulture, Pakistan Forest Institute, Peshawar.

mulberry varieties against insect pests should be a fundamental element in integrated pest management programme.

Mulberry is the backbone of sericulture cottage industry. Cost of leaves of mulberry works out to about 60 percent of the total cost of production of silk (Rangaswami *et al.*, 1976). Though insect pests attack is limited on mulberry trees due to frequent harvest of leaves; even then about 200 insect pests species attack mulberry plantations (Kikuchi, 1976). Among these *Margaronia* (synonym. *Glyphodes/Diaphania*) *pyloalis* Walk. Lepidoptera; Pyralidae are very serious pests. This pest has multiple impact on sericulture industry. Heavy infestation not only retards the growth of the trees but also impairs the quantity and quality of foliage. The impaired or low quality foliage has profound influence on the growth and development of silkworm larvae and subsequently cocoon crop production (Krishnaswami *et al.*, 1971).

More serious aspect is that *M. pyloalis* serves as vector of silkworm diseases. Takahashi *et al.* (1995) found two groups of ice nucleation-active bacteria-*Pseudomonas syringae Pv. mori* and *Erwinia herbicola (ananas)*, on mulberry leaves as well in the larvae of mulberry pyralid *Glyphodes pyloalis*. Similarly, Watanabe *et al.*, (1988) have reported non-occluded viruses in *G. pyloalis* which were serologically indistinguishable from the densonucleosis viruses (DNV-I, DNV-2) and the infectious flacherie virus (IFV) of the silkworm Bombyx mori. They confirmed that Bombyx DNV-1, DNV-2 and IFV originated from the *Diaphania* non-occluded viruses and *D.pyloalis* is common habitual host of these non-occluded viruses. Moreover, Watanabe, (1981) suggested that epizooting of densonucleosis virus has two major causes viz. rearing of susceptible silkworm strains and infestation of mulberry used for food by infected *G. pyloalis* Walk.

In present study mulberry varieties grown at the Pakistan Forest Institute, Peshawar as mother germplasm were screened for relative resistance against leaf roller. Also sampling methodology for realistic assessment of larval infestation was developed.

Materials and Methods

Five exotic mulberry varieties, i.e. Garyansuban (Korean), Husang (Chinese), Kanmasi (Japanese) *Morus latifolia* (Japanese), Qumji (Korean) and one local variety PFI-1 were evaluated for relative resistance against leaf roller *Margaronia pyloalis* Walk. (Lepidoptera; Pyralidae) at the Pakistan Forest Institute, Peshawar. The distance between trees was 2m with 1.5m from row to row. Observations on percentage larval infestation of leaves of mulberry varieties

were recorded from May to July at fortnight interval. Four trees per replication were selected at random and from each tree four observations were recorded from 1.5-2.0cm circumference branches. There were five replications per variety in randomized complete block design. Total and infested leaves per branch were counted and percentage infestation was worked out.

For accurate information on infestation, six trees irrespective of the variety were selected at random. From each tree four samples in each of the direction viz. East, West, North and South were recorded. Sampling unit was 1.5 to 2 cm thick branch where total and infested leaves were counted for calculating percentage infestation. There were again five replications in randomized complete block design.

Data on percent larval infestation and sampling methodology were mean of five and six trees, respectively. Data were analyzed statistically by applying Analysis of Variance (ANOVA) and differences among means were tested for significance by Least Significant Difference (LSD) test.

Results and Discussion

Data on percentage larval infestation of *M. pyloalis* recorded on mulberry varieties from May - July are presented in Table 1. The results revealed a heavy infestation on all mulberry varieties except PFI-1 local variety which had least infestation.

Table 1. Mean percentage larval infestation of *M. pyloalis* on six mulberry varieties

Varieties	Date of observation				Mean (%)
	May 27 (%)	June 10 (%)	June 24 (%)	July 8 (%)	
Kanmasi (Japanese)	39.6* b	45.3* c	46.3* c	39.1* bc	42.5* c
Qumji (Korean)	46.7 c	52.6 d	55.8 d	46.2 c	50.9 d
M. latifolia (Japanese)	57.6 d	66.3 e	67.9 e	44.6 c	59.1 e
Husang (Chinese)	37.2 b	35.4 b	38.2 b	31.4 b	35.5 b
Garyansuban (Korean)	62.6 e	72.0 f	70.4 e	57.6 d	65.7 f
PFI-1 (Local)	24.3 a	29.4 a	30.1 a	19.8 a	25.9 a
LSD	4.646	3.721	7.288	8.294	4.306

* = Significant at P=0.01 level

Figures sharing same alphabets in the same column are non-significant (P = 0.05).

Maximum infestation of 62.6% on Garyansuban and minimum of 24.3% on PFI-I had been recorded, in May. In addition, larval infestation on all varieties varied significantly except Husang and Kanmasi where it was non-significant. In the first half of June level of infestation increased on all varieties except Husang where it decreased marginally (4.8%). Increase in the level of infestation was in the range of 12.6% (Qumji) to 21.0% (PFI-1). Larval infestation to the magnitude of 72.0% (maximum) and 29.4% (minimum) was recorded on Garyansuban and PFI-1, respectively. The second highest infestation (66.3%) was on *M. latifolia*. The difference among all test varieties was statistically significant. In early June, fresh sprouting of leaves and also fresh larval infestation on leaves was registered. In the second half of June nearly the same pattern of infestation was witnessed. However, the difference in infestation between Garyansuban (70.4%) and *M. latifolia* (67.9%) was non-significant. A slight increase in larval infestation (2.4-7.9%) was recorded except Garyansuban with nominal (2.2%) reduction. In July leaf infestation level was reduced considerably. The highest reduction (34.3%) was in *M. latifolia* followed by PFI-1 (34.2%), Garyansuban (18.2%), Husang (17.8%), Qumji (17.2) and Kanmasi (15.6%). In July, all varieties sprouted profusely due to rains and there was a minor fresh larval infestation. That's why level of infestation was dropped noticeably. The Garyansuban variety had highest larval infestation (57.6%) on leaves while local variety had the lowest (19.8%). Moreover, there was no significant difference between Husang and Kanmasi as well as among *M. latifolia*, Qumji and Kanmasi. The overall mean larval infestation was in the array of Garyansuban (65.7%) > *M. latifolia* (59.1%) > Qumji (50.9%) > Kanmasi (42.5%) > Husang (35.5%) > PFI-1 (25.9%).

Resistance of plants to insect attack is a relative amount of heritable qualities possessed by the plants which influence the ultimate degree of damage done by the insects (Painter, 1951). The plant resistance is normally measured through the effect of the exposure of plants or plant parts to insects. This effect can be evaluated in terms of the plant as a percentage of damage to foliage or to fruiting parts, reduction of the stand percentage of yield reduction and impact on general vigour of plants (Kogan, 1994). It can also be measured in terms of the insects as number of eggs oviposited, aggregation, food preference, growth rate, food intake and utilization, mortality and longevity (Miller & Miller, 1994). In present studies relative resistance was measured on the basis of percentage larval infestation of mulberry foliage.

Overall mean leaf infestation showed invariably the same trend of relative resistance in six mulberry varieties. PFI-I was relatively the most resistant variety to mulberry leaf roller (*M. pyloalis*) followed by Husang. Whereas, Garyansuban was relatively the least resistant variety followed by *M. latifolia*, Qumji and Kanmasi.

Measurement of resistance is a problem of sampling. Therefore, the general principles involved in sampling insect populations and in evaluating plant damage also apply to the measurement of plant resistance (Kogan, 1994). Thus for accurate and precise estimation of larval infestation of leaves, number of samples and cardinal direction of trees were also fixed. Data taken from the four sides (East, West, North and South) of mulberry trees are depicted in Table 2.

Table 2. Mean percentage larval infestation of *M. pyloalis* on the sides of six mulberry variety

Sides	Date of observations				Mean (%)
	May 27 (%)	June 10 (%)	June 24 (%)	July 8 (%)	
East	43.6 ns	48.3 ns	53.9 ns	41.6 ns	46.9 ns
West	47.8	51.7	49.2	39.9	47.2
North	40.6	50.6	52.9	39.4	45.9
South	46.1	49.8	49.9	39.4	46.8
LSD	10.622	4.077	6.165	5.712	2.925

ns = non-significant

Variation in the level of larval infestation of mulberry leaves on the four sides of a tree was haphazard. The mean larval infestation on eastern, western, northern and southern aspects of a tree though varied but was statistically non-significant. Nevertheless, larval infestation on the western side was slightly more followed by eastern side. Keeping this fluctuation in view, it is recommended to take at least two samples per tree for more accurate and precise estimation of larval infestation on foliage.

Conclusion

From the results it is inferred that PFI-I is relatively the most resistant variety and Garyansuban, *M.latifolia* and Qumji are the least resistant to *M.pyloalis* attack. Husang and Kanmasi varieties have relatively moderate resistance. It is, therefore, recommended that the local mulberry variety PFI-I should be encouraged in new mulberry plantations. This will not only provide good quantity and quality leaves for rearing silkworm but will also minimize chances of silkworm infections by various pathogens carried out through *M.pyloalis*. Propagation of resistant varieties will result in less use of pesticides resulting in low cost of leaf production as well as providing clean environment. To reduce the sampling fluctuation, at least two samples per tree from any two sides of a tree should be taken.

References

Gallun, R. L. Starks, K. J. and W. D. Guthrie. 1975. Plant resistance to insects attacking cereals; Ann. Rev. Ent. 20: 337-57.

Kikuchi, M. 1976. Control of insect pests of mulberry in Japan. Japan Pesticide Inform. 29: 9-11.

Kogan, M. 1994. Plant resistance in pest management: In introduction to insect pest management. Metcalf, R. L. and W. H. Luckmann (eds.). John Wiley and Sons, Inc., New York. pp. 650.

Krishnaswami, S., S. Kumaraj, K. Vijayaraghavan and K. Kasiviswanathan. 1971. Silkworm feeding trials for evaluating the quality of mulberry leaves as influenced by variety, spacing and nitrogen fertilization. Ind. Jour. Seri. 9: 79-89.

Miller, J.R. and T.A. Miller. 1994. Insect-plant interactions: In introduction to insect pest management. Metcalf, R. L. and W. H. Luckmann (eds.). John Wiley and Sons, Inc., New York. pp. 650.

Painter, R.H. 1951. Insect resistance in crop plants. The Macmillan Co., New York. pp. 520.

Rangaswami, G., M. N. Narasimhana, K. Kasiviswanathan, C. R. Sastry and M. S. Jolly. 1976. Sericulture Manual, 1-mulberry cultivation. FAO, Agri. Serv. Bull. No. 15/1. pp. 150.

Takahashi, K., K. Watanabe and M. Sato. 1995. Survival and Characteristics of ice nucleation-active bacteria on mulberry trees (*Morus* spp.) and in mulberry pyralid (*Glyphodes pyloalis*). Ann. Phytopath. Soc. Jap. 61(5): 439-443.

Watanabe, H. 1981. Characteristics of densonucleosis in the silkworm, *Bombyx mori*. JARQ 15(2): 133-136.

Watanabe, H., Y. Kurihara, Y. X. Wang and T. Shimizu. 1988. Mulberry pyralid, *Glyphodes pyloalis*: habitual hosts of non-occluded viruses pathogenic to the silkworm, *Bombyx mori*. Jour. Invert. Path. 52(3): 401-408.