

EFFECT OF HOST PLANT ON ABUNDANCE OF MANGO HOPPERS, *IDIOSCOPUS CLYPEALIS* (LETHIERRY) (HEMIPTERA: CICADELLIDAE)

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ABSTRACT

A study was carried out during 2016 and 2017 at private mango orchard in Multan to assess the preference of nine mango varieties for mango hoppers. Mango hopper, *Idioscopus clypealis* (Lethierry) (Hemiptera: Cicadellidae) is considered as one of the serious pest of mango that breeds on newly emerged flowers and create interruption in fruit setting and photosynthetic activity of the plant. So, the choice of *I. clypealis* to mango varieties during full bloom season phase is crucial. Nine different varieties of mango viz., 'Retaul-12', 'Sobey De Ting', 'Black Chaunsa', 'Chaunsa', 'White Chaunsa', 'Dusehri', 'Langra', 'Anwar Retaul' and 'Fajri Klan' were assessed for their suitability for mango hoppers. The results indicate that the population density of mango hoppers was higher on variety 'Fajri Klan' (62.12 hoppers/inflorescence) as compared with other varieties and lower on 'Dusehri' (3.84 hoppers/inflorescence) and 'Anwar Retaul' (3.40 hoppers/inflorescence). The ranking positions towards their suitability as host plant for *I. clypealis* was observed: 'Fajri Klan' > 'White Chaunsa' > 'Black Chaunsa' > 'Chaunsa' > 'Langra' > 'Sobey Di Ting' > 'Retaul-12' > 'Dusehri' > and 'Anwar Retaul'. So, it is concluded that the special attention should be given on 'Fajri Klan' for the management of mango hoppers when devising an IPM program for the control of mango hoppers as well as guideline for the horticultural scientists when developing new mango varieties.

Keywords: Feeding preference, host plant resistance, population density, Mango varieties, Pakistan

INTRODUCTION

Mango (*Mangifera indica* Linn.) is a popular fruit globally and is known as king of all fruits. It is leading profitable fruit which can be grown successfully in tropical and sub-tropical countries (Abdullah and Shamsulaman, 2008). Its desirability and being to as it is rich in vitamins A and C. But its quality and production are mostly vulnerable to the damage of insects pests (Peña *et al.*, 1998) especially leafhoppers are of economic importance (Verghese, 2000). Among leaf hoppers, *I. clypealis* (Lethierry) is one of the more important species that is widely distributed in Pakistan and cause significant economic loss to the mango crop during the flowering stage. Mango hopper can cause failure of good crop in cases of severe infestation. The immature and adults of the hoppers puncture and suck the sap from the inflorescence, tender shoots and leaves of the tree, resulting in non-setting of fruits and falling of set fruits, thereby reducing the yield (Anonymous, 2012; Gundappa *et al.*, 2016). Heavy

puncturing and continuous draining of the sap may cause curling and drying of inflorescence. Hoppers not only suck the sap but also excrete honey dew, which encourages the development of fungus, *Meliola mangiferae* (Earle) on leaves and fruits. This black coating interferes with the normal photosynthetic activity of the plant (Peng and Chirstian, 2005). On heavily infested trees, it has been noted that the losses in yield becomes 50% or more (Patel *et al.*, 2004) and quality of fruit and yield is severely affected (Rajkumar *et al.*, 2013).

To control mango hoppers several alternate methods such as like the use of natural enemies (Anonymous, 1993) has been tested, but insecticidal control has remain the only viable strategy that will control the pest efficiently and to prevent the crop loss from the deleterious effect of hoppers. However non-judicious use of insecticides can result in health hazards, environmental pollution and mortality of predators and pollinators calls for the use of alternatives to insecticides such as host plant resistance. In spite of hazards of insecticides,

scientists still recommend insecticides to overcome hoppers. The insecticides imidacloprid, lambda cyhalothrin and azadiractin are recommended as controls (Verghese, 2000) to save the crop from losses due to Mango hopper damage. Mango is a cross-pollinated crop and the use of insecticides during pollination is hazardous to pollinating insects. (Verghese and Tandon, 1990). So it is necessary to look into some alternate source of control like host plant resistance to save the hazardous effects of insecticides. For example utilization of host plant resistance is one of the most important components of the IPM that discourages the breeding of hoppers population during flowering stage and is safe for pollinators. So, the systematic and intensive studies on the existing varieties of mango against mango hoppers are lacking and need imperative concentration of the researchers. Therefore, the present investigations were undertaken to evaluate resistance or susceptibility in prominent mango varieties which can be used as an alternative management tool in an eco-friendly, cost-effective viable IPM strategy for mango hoppers and are also useful for horticultural scientists for including in breeding programs.

MATERIALS AND METHODS

A study was carried out at a private mango grower fruit farm, situated in Mouza Sair Kharak Tehsil and District, Multan (30.1575° N, 71.5249° E), Punjab-Pakistan on crucial flowering stage in middle of March, 2016 and 2017. Nine

different most popular commercial varieties i.e. Dusehri, Anwar Retaul, Langra early varieties, Chaunsa and Fajri Klan medium whereas Retaul-12, White Chaunsa, Sobey De Ting, Black Chaunsa known late varieties (different time of harvesting) were selected and tagged for recording the data of mango hoppers. The population of both nymphs and adults of the mango hoppers, *I. clypealis* was recorded collectively. All the varieties were planted by square methods in separate blocks on February, 1990. The numbers of trees available were 25 per acre. The age of the trees was about 28 years old. Five trees of each variety were selected and then ten inflorescences were selected at random from each variety and carefully covered with five kg plastic bags (size 2 x 1.5 feet) from a height of 4-5 feet above ground level and then the inflorescence was cut with a scissor. The cut inflorescence was brought to hot and cool chambers and were put in a refrigerator for a period of 4 hours. After this period, the samples were taken out from the refrigerator and spread them on white paper to a plastic tray (1.5 x 1 feet). After spreading, the populations of the hoppers were counted. The data was compiled and subjected to statistical analysis.

Statistical Analysis

The data was subjected to analysis of variance (ANOVA) using Statistix version 9 and means were separated by Tukey's Honestly Significant Difference test.

Table 1

Mango varieties characteristics along with their breeding centers.

Varieties	Breeding center	Parentage	Leaf		Inflorescence		Harvesting
			Colour	Shape	Length	Colour	
Retaul-12	MRS-Shujabad	Chance seedling	Dark Green	Elliptical	Medium long and medium branched	Light green	Mid August
Sobey De Ting	MRS-Shujabad	Chance seedling	Medium Green	Elliptical	Long and medium branched	Yellowish green	End August
Black Chaunsa	MRS-Shujabad	Chance seedling	Medium Green	Elliptical	Medium long and medium branched	Yellowish pink	Mid August
Chaunsa	MRS-Shujabad	Chance seedling	Dark Green	Elliptical	Long medium branched	Light pink	2 nd week July
White Chaunsa	MRS-Shujabad	Chance seedling	Dark Green	Elliptical	Long	Pinkish Yellow	End August
Dusehri	MRS-Shujabad	Chance seedling	Medium Green	Elliptical	Medium long	Light green	2 nd week June
Langra	MRS-Shujabad	Chance seedling	Light Green	Elliptical	Medium long	Yellowish pink	3 rd week June
Anwar Retaul	MRS-Shujabad	Chance seedling	Medium Green	Elliptical	Short to medium long	Pink	3 rd week June
Fajri Klan	MRS-Shujabad	Chance seedling	Medium Green	Elliptical	Medium long and medium branched	Yellowish pink	2 nd week July

RESULTS

Population of mangooppers on different mango varieties during 2016

The data regarding the fitness of host plant on mangooppers populations revealed a highly significant differences (F = 214.53; df = 16, 26; P<0.01) (Table 2) among treatments. The data revealed that average maximum mangooppers i.e. 55.00oppers/inflorescence were recorded on variety 'Fajri Klan' which differed significantly from those of recorded on all other varieties of mango followed by 'White Chaunsa' (36.00oppers/inflorescence). The varieties 'Chaunsa' and 'Black Chaunsa' exhibited statistically similar population of

26.33 and 23.67oppers/inflorescence, respectively. Similarly varieties 'Langra' and 'Sobey De Ting' demonstrated a population density of 17.33 and 17.00oppers/inflorescence. The average minimum population density of mangooppers were observed on varieties 'Retual-12' (5.67oppers/inflorescence), 'Dusehri' (2.00oppers/inflorescence) and 'Anwar Retaul' i.e. (1.67oppers/inflorescence). The position of cultivars in descending order was as 'Fajri Klan' > 'White Chaunsa' > 'Chaunsa' > 'Black Chaunsa' > 'Langra' > 'Sobey Di Ting' > 'Retual-12' > 'Dusehri' > 'Anwar Retaul' (Table 2).

Table 2.

Mean abundance of mangooppers per inflorescence during 2016 & 2017.

Varieties	Mean number of mangooppers per inflorescence during	
	2016	2017
Retaul-12	5.67 e	9.23 ef
Sobey De Ting	17.00 d	21.11 de
Black Chaunsa	23.67 c	34.56 bc
Chaunsa	26.33 c	29.87 cd
White Chaunsa	36.00 b	46.71 b
Dusehri	2.00 e	5.14 f
Langra	17.33 d	24.39 cd
Anwar Retaul	1.67 e	5.67 f
Fajri Klan	55.00 a	69.23 a
F-value	214.53	75.24
TUKEY HSD @5%	5.97	12.19

*Means followed by similar letters are not significantly different by HSD at P < 0.05 HSD = Honestly Significant Difference

Population of mangooppers on different mango varieties during 2017

The data regarding the suitability of host plant on mangooppers populations revealed significant differences (F = 75.24; df = 16, 26; P<0.01) (Table 2) among treatments. The data revealed that average maximum mangooppers (69.23oppers/inflorescence) were recorded on variety 'Fajri Klan' which differed significantly from those of recorded on all other varieties of mango followed by 'White Chaunsa' (46.71oppers/inflorescence) and 'Black Chaunsa' (34.56oppers/inflorescence). 'Chaunsa' and 'Langra' have statistically similar population of mangooppers of 29.87oppers/inflorescence and 24.39oppers/inflorescence, respectively. Similarly, 'Sobey De Ting' exhibited a population density of 21.11oppers/inflorescence followed by 'Retual-12' with 9.20oppers/inflorescence. The average minimum population of mangooppers were observed on varieties 'Dusehri' (5.67oppers/inflorescence) and 'Anwar Retaul' (5.14oppers/inflorescence). The position of cultivars in descending order was 'Fajri Klan' > 'White Chaunsa' > 'Black Chaunsa' > 'Chaunsa' > 'Langra' > 'Sobey Di Ting' > 'Retual-12' > 'Dusehri' > 'Anwar Retaul' (Table 1).

Average population of mangooppers on cumulative basis both years' studies

The data regarding mangooppers on different varieties of mango during both the study years are graphically shown (Fig. 1). The results reveal that the variety 'Fajri Klan' was found susceptible exhibiting mean infestation of 62.12

oppers/inflorescence which differed significantly from those observed in all other varieties. The minimum hopper infestation was observed on Retual-12 (7.45oppers/inflorescence), Dusehri' (3.84oppers/inflorescence) and 'Anwar Retaul' (3.40oppers/inflorescence). Furthermore, all the cultivars differed significantly with each another. The descending positions these varieties are 'Fajri Klan' > 'White Chaunsa' > 'Black Chaunsa' > 'Chaunsa' > 'Langra' > 'Sobey Di Ting' > 'Retual-12' > 'Dusehri' > and 'Anwar Retaul'.

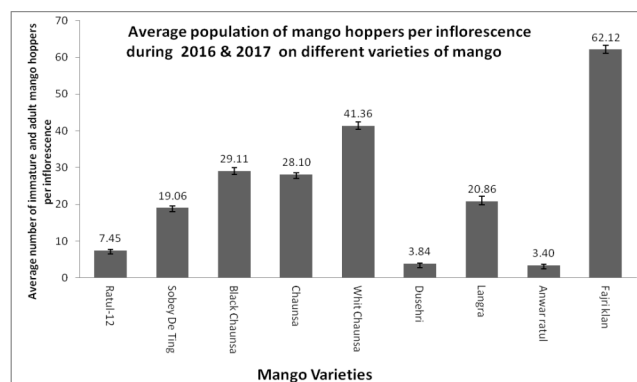


Fig. 1
Average mangooppers populations per inflorescence (average of two years).

DISCUSSION

Resilient varieties are one of the vital components of the pest management strategy which determine the success of Integrated Pest Management (IPM). By the use of such type of practice one can decrease the use of broad spectrum insecticides resulting in decreased soil and water contamination and reduced negative effects on non-target organisms including insect parasitoids and predators and farm workers (Krattiger, 1997). Plants that are less susceptible to injury by insect pests are important for increasing yield and quality of crops. The practice of growing resistant varieties of agricultural crop is considered environmentally, naturally and economically beneficial. In this way the crop is saved from insect pest and yield can be protected without or minimum use of insecticides. Integrated Pest Management is considered one of the best practices which can keep insect pest injury population below levels of economic significance.

Keeping in mind the significance of IPM, the nine varieties of mango i.e. Dusehri, Langra, Anwar Retaul (Early varieties), Chaunsa, Fajri Klan (Medium varieties), Retaul-12, Sobey De Ting, Black Chaunsa and White Chaunsa (Late varieties) were assessed for infestation of mango hoppers. From the results it was concluded that some varieties are susceptible to mango hoppers while others are tolerant, as there were significant differences among different varieties of mango. Our results suggests that the variety 'Fajri Klan' sustains higher populations levels of the mango hopper (62.12 hoppers/inflorescence) and is considered to be the most susceptible and preferred host whereas 'Dusehri' and 'Anwar Retaul' varieties has minimum populations (3.84 and 3.40 hoppers/ inflorescence, respectively) and are considered tolerant varieties. Our results are in line with those of Nachiappen and Bhaskaran (1984) who have tested nine varieties of mango and found Banglora, Beneshan, Cinnarasam and Khader as resistant varieties against mango hoppers whereas Neelum, Mulgoa, Padri, Peter and Sinduri were found susceptible. Similarly, Singh *et al.* (1997) screened 100 varieties of mango and found only some varieties susceptible to hoppers. Whereas, Kaushik (2009) observed the mango variety Mallika and Sundarja and reported that these varieties are least susceptible to mango hoppers (*Amritodus atkinsoni* Lath. and *Idioscopus clypealis* Lath). Purohit and Kumar (2008) screened fifteen mango cultivars and noted that Totapuri cultivar was least susceptible whereas Alphanso remained more susceptible. The other scientist like Khaire *et al.* (1987) reported that two varieties of mango i.e. Rajmanu and Vanraj proved relatively less susceptible to mango hoppers out of 19 mango varieties. The results of present study are partially in conformity to those of Talpur and Khuro (2003) who reported that the Langra and Sarolee were relatively susceptible showing population of 5.65 and 4.91 individuals per shoot, respectively whereas Neelum, Zafran and Dusehri, harbored less numbers of mango hoppers/shoot. The results are not inconformity with those of Anonymous (2012) who recorded maximum population of leaf hoppers on mango varieties, Dusehri and Alfonso. There are reports that different crops varieties respond differently to insect pests. For example Karar *et al.* (2012) reported that pecan varieties responded different to pecan black aphids. Similarly Karar *et al.* (2013; 2015; 2016)

worked on varietal resistance against mango mealy bug, onion thrips, insect pest of cotton and reported that the female of mango mealy bug behaved differently when feeding on different varieties of mango, onion and insect pest of cotton. Similarly Bhusal *et al.* (2013) worked on host plant resistance against onion thrips and found that there is difference in attack of insects on different varieties. So the current findings add significantly to those of Carvalho *et al.* (1996) who worked on host plant resistance against fruit flies and found that there is significant difference in varieties regarding attack of fruit flies. Similarly, Dhaliwal and Dilawari (1996) emphasized the importance of host plant resistance. Whereas Salem *et al.* (2006) worked on susceptibility of *Icerya seychellarum* to different varieties of mango and found that there is significant difference regarding their preference. Similarly, Nazeer *et al.* (2018) studied cabbage varieties against aphids and found that cabbage cultivar 'Yuanbao' was resistant to *M. persicae*. However, a further study is needed for the analysis of biochemical compositions of resistant and tolerant varieties.

CONCLUSION

The cultivars 'Fajri Klan' medium was found to be susceptible for mango hoppers whereas 'Dusehri' and 'Anwar Retaul' early varieties were found to be the resistant. It was concluded that special attention should be given on susceptible cultivars of mango when devising IPM program for the control of this pest. Further the differences in abundance of insects do not imply that the plant is more resistant and more susceptible to injury by the insect. There needs to be a measurement of yield or quality or plant growth to correlate to the lower and higher levels of insects on the plants.

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AUTHORS' CONTRIBUTION

Haider Karar conceive idea of research, conducted experiments, statistically analyzed the data and writing the manuscript. Malik Allah Bakhsh critically review the manuscript.

REFERENCES

- Abdullah, F. and K. Shamsulaman, 2008. Insect pests of *Mangifera indica* plantation in Chuping, Perlis, Malaysia. *J. Entomol.*, 5(4): 239-251.
- Anonymous, 1993. Leafhoppers and their natural enemies. Project Directorate of Biological Control, Indian Council of Agricultural Research, Bangalore - 560024, India, 1-65.
- Anonymous, 2012. Recorded of leaf hopper population on different varieties of mango. Annual Progress report, TCB College of Agriculture and Research Station,

- Sarkanda, Bilaspur, Chhattisgarh, 20-22.
- Bhusal, S.J., G.L. Jiang, K.J. Tilmon, and L.S. Hesler, 2013. Identification of soybean aphid resistance in early maturing genotypes of soybean. *Crop Sci.*, 53: 491-499.
- Carvalho, R.S., A. Nascimento, J. Morgante and N. Fonseca, 1996. Susceptibility of different mango cultivars to the attack of the fruit fly, *Anastrepha obliqua*. In: B. McPherson and G. Steck (eds.), *Fruit Fly Pests: A world assessment of their biology and management*. St Lucie Press, Delray Beach. pp. 325-331.
- Dhaliwal, G.S. and V.K. Dilawari, 1996. Host plant resistance in integrated pest management. In: R.K. Upadhyay, K.G. Mukherjee and R.L. Rajak (eds.), *IPM System in Agriculture*, Vol. 1. Aditya Books (Pvt.) Ltd., New Delhi, India; pp.264-315.
- Gundappa, T. Adak and P.K. Shukla, 2016. Seasonal dynamics of mango hoppers and their management under subtropics. *GERF Bull. Biosci.*, 7(1):6-9.
- Karar, H., M. Shahid and S. Ahmad, 2016. Evaluation of innovative cotton genotypes against insect pest prevalence, fiber traits, economic yield and virus incidence in Pakistan. *Cercetări Agronomice în Moldova*, Vol. XLIX, No. 1(165): 29-39
- Karar, H., G. Abbas and J.D. Dutcher, 2012. Pecan cultivar differences in aphid reproduction and abundance. *J. Entomol. Sci.*, 47(1):86-91.
- Karar, H., G. Abbas, A. Hameed, M.F. Shahzad, G. Ahmad, A. Ali and M. Saleem, 2013. Relative susceptibility of onion (*Allium cepa*) genotypes of Pakistan to onion Thrips (*Thrips tabaci*) (Thysanoptera: Thripidae). *Pak. J. Agric. Sci.*, 50(3):351-357.
- Karar, H., M.J. Arif, M. Arshad, A. Ali and Q. Abbas, 2015. Resistance/ susceptibility of different mango cultivars against mango mealybug (*Drosicha mangiferae* G.). *Pak. J. Agric. Sci.*, 52(2):367-377.
- Kaushik, D.K., 2009. Relative preference of different mango varieties by major insect pests with special reference to mango hopper and its management through new insecticide molecules. Ph.D. thesis, Indra Gandhi Krishi Vishwavidyalaya, Raipur, 222-223pp.
- Khaire, V.A., D.S. Kolhe and J.D. Patil, 1987. Relative susceptibility of mango varieties to mango hoppers and powdery mildew. *Haryana J. Hort. Sci.*, 16 (3-4): 214-217.
- Krattiger A.F., 1997. Insect resistance in crops: a case study of *Bacillus thuringiensis* (Bt) and its transfer to developing countries. *ISAAA Briefs*, 2: 42.
- Nachiappen, R.M. and P. Bhaskaran, 1984. Quantum of feeding and survival of mango leaf hopper adults on the inflorescence of certain varieties of mango. *Indian J. Agric. Sci.*, 54(4): 312-314.
- [Nazeer, A., H. Lunuwilage, C. Darshane, W.Y. F. Xiang-Shun, H. Yongliang, F.T.X. Liu](#), 2018. Resistance of seven cabbage cultivars to green peach aphid (Hemiptera: Aphididae). *J. Econ. Entomol.*, 20(10):1-8.
- Patel, J.R., A.M. Shekh, and H.C. Ratanpara, 2004. Seasonal incidence and effect of minimum temperature and vapour pressure on the population of mango hoppers in middle Gujarat. *Gujrat Agric. Univ. Res. J.*, vol. 20, pp. 5-8.
- Pena, J. E., A.I. Mohyuddin, and M. Wysoki, 1998. A review of the pest management situation in mango agroecosystems. *Phytoparasitica*, 26(2): 129-148.
- Peng, R.K. and K. Chirstian, 2005. The control efficacy of the weaver ant, *Oecophylla smaragdina* (Hymenoptera: Formicidae) on the mango leafhopper, *Idioscopus nitidulus* (Hemiptera: Cicadellidae) in mango orchards in the northern territory. *Int. J. Pest Manag.*, 51(40): 297-304.
- Purohit, M.S. and S. Kumar, 2008. Screening of mango cultivars for resistance against hopper complex. National Conference on Eco-friendly Approaches in Sustainable Agriculture and Horticulture production, at Lucknow. p. 130.
- Rajkumar, B. G., R.M. Khan and H.K. Kumar, 2013. Integrated pest management for enhancing quality production of subtropical fruits under high density planting with canopy modification. In: Singh V.K., H. Ravishankar (eds.), *Canopy Management and High Density Planting in Subtropical Fruit Crops*. CISH, as Central Institute of Subtropical Horticulture, Lucknow, India Lucknow. p. 269.
- Salem, M.S., M.I. El-Said, A.M. Abd-El-Ghany and M.M. Abd-El-Rahman, 2006. Susceptibility of five mango cultivars to *Icerya seychellarum* (Westwood) (Homoptera: Margarodidae) in relation to leaf quality, nutrients and inhibitors. *Egypt. J. Agric.*, 84:697-702.
- Singh, G., 1997. Resistance studies in mango against *Amritodus atkinsoni* (Leth.). *Acta Hort.*, 455 (4): 829-835.
- Talpur, M.A. and R.D. Khuhro, 2003. Relative population of mango hopper species on different mango varieties. *J. Asia Pacific Entomol.*, 6 (2): 183-186.
- Vergheese, A., 2000. Effect of Imidacloprid on mango hopper, *Idioscopus niveosparsus* (Leth.) (Homoptera: Cicadellidae). *Acta Hort.*, 509(2): 733-736.
- Vergheese, A. and P. L. Tandon, 1990. Pollination behavior of *Apis florea* on mango. In: *Social Insects. An Indian Perspective*. International Union for Study of Social Insects, Bangalore, India. Pp.60-63.