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Phenological Relationship Between Mango Hoppers *Idioscopus spp.* and Mango Inflorescence/Fruit

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Abstract: The experiment on the phenological relationship between mango hoppers and mango inflorescence/fruit was conducted at Mir Ghulam Rasool Talpur fruit farm, Tandojam, during 1999-2000. The results showed that mango hoppers were recorded during 30th December (0.06/shoot) on all the mango varieties. The population density increased gradually on the varieties up till second fortnight of February and thereafter populations of mango hopper increased rapidly. The peak populations of mango hopper on Almas (24.23/shoot) and Sindhri (25.66/shoot) were recorded on 23rd March and 30th March, respectively. However, peak population density in Neelum (22.52/shoot) was recorded on 16th March. Thereafter population of hoppers declined towards fruit maturation in all the varieties. Population density of mango hopper and positive significant correlation with the inflorescence phenology in all the mango varieties, however population of hoppers had negative correlation with fruit development. The population of mango hopper had positive significant correlation with temperature in Almas (r=0.668) significant. The relative humidity had negative non-significant correlation with mango hoppers on all the mango varieties. It could therefore be inferred that Sindhri was more prone to the attack of mango hoppers and Neelum was least infested.

Key Words: Mango Hopper, Inflorescence, Fruit, Correlation, Phenology

Introduction

Mango, *Mangifera indica* L. is one of the most important fruits of Pakistan, it is equally liked by both rich and poor because of its delicious taste, flavour and high nutritive value. It has good market value in country as well as foreign countries. Due to export potential of this fruit to Middle East and European countries, there is an over increasing demand for mangoes. Thus more and more area is brought under mango acreage every year. Mango plants suffer from ravages of insect pests right from seed seedlings to their maturity. Tandon (1980) reported that more than 300 insect pests have been recorded to attack mango crop in different regions of the world. Amur (1986) recorded three species of mango hoppers on mango tree, which damaged in blooming stage and during onset of vegetative flush after harvest of mango from August to September. Alam (1962) recorded that the damage due to *Idioscopus clypealis* (Leth.), *Idioscopus niveosparus* (Leth.) is as high as 80 percent. Atwal (1976) mentioned that the damage due to *Idioscopus spp.* to the mango crop would be as high as 60% to young trees would cause retarted growth and in the older trees hardly any bearing of the fruit may be seen. Patil, *et al.* (1988) stated from India that the pest peak activity was confined to flowering season and the loss ranged from 25 to 60%. Soomro (1988) reported from Sindh, that there are about two dozen phytophagous insect pests, and mites. Three species of mango hoppers were recorded as *Amritodus atkinsoni* (Leth.), *Idioscopus niveosparus* (Leth.) and *Idioscopus clypealis* (Leth.). Among all the insects, mango hopper is the worst enemy of mango crop. They attack young fresh foliage, inflorescence and rachis of young fruits and it occurs concurrently on all these parts in the beginning more in inflorescence and then after on the succulent leaves. In Sindh, a number of grafted varieties are grown (early, middle and late). Among the commercially popular verities are Almas (early), Sindhri (medium) and Neelum (late) variety.

Generally, the adult mango hoppers (MHS) after winter season start infesting the young shoots and inflorescence/fruit coming out in the last week of December. Very little work on the infestation of mango hoppers at different developmental stages of inflorescence/ fruits have been reported so for. Therefore, it is important to investigate the population dynamics of mango hoppers at phenological development of inflorescences/fruits of the above commercial varieties. Keeping the above points in view, an experiment was carried out, at Tandojam, District Hyderabad. This preliminary information will be useful for the management of mango hopper on mango in future.

Materials and Methods

The experiment on the phenological relationship between mango hopper and mango inflorescence/fruit was conducted on different commercially popular varieties of mango at Mir Ghulam Rasool Talpur fruit farm, Tandojam, District Hyderabad during December 1999 to May 2000. The observations were taken at weekly intervals from emergence of inflorescence to the harvesting of mango fruit. More than one species of mango hoppers were co-existing, but since their immature stages were looking almost alike, the counts of all the species (adults and nymphs) were taken together as one for mango hopper. All the trees were about 18 to 20 years old and were receiving normal agronomic practices. For this purpose, three varieties of mangos Almas (early), Sindhri (mid) and Neelum (late) were randomly selected. To record mango hoppers population, the experiment was designed as "Complete Randomized Block" system in which five replicates (one tree as replicate) were randomly labeled, and in each replication (tree) ten shoots were labeled for taking observations.

Since the trees were big enough, i.e. about 12 to 15 ft. tall but the shoots fixed for observation were at the height of about 4.00 to 5.00 ft. Shoots were scanned thoroughly for the measurement of inflorescence/fruit and for the count of mango hoppers.

The observations were recorded weekly at 8 to 9 a.m. and counts of mango hoppers were recorded. The measurement of length of inflorescence (in cm.) and count of mango hoppers of fixed shoots were recorded from 30th December up to 16th March. After 16th March 2000 the weight of the fruit (in gm.) and number of mango hoppers were recorded up to the harvesting of the fruit. For investigating the relationship of mango hopper with abiotic factors the meteorological record of abiotic factors was obtained from Drainage and Research Center (DRC), Tandojam. The data were analyzed which included correlation between mean length of inflorescence (in cm.) and number of mango hopper and correlation between weight of fruits (in gm.) and mango hoppers. The correlations between mean population of mango hoppers with temperature and relative humidity were also computed. The mean temperature °C and mean R.H% were recorded.

Results and Discussion

Population Fluctuation of Mango Hoppers: The results on mean per shoot population of mango hopper *Idioscopus spp.* on different mango varieties as influenced by inflorescence and fruit phenology are presented in Table 1. The data revealed differential response of mango varieties towards the infestations of mango hoppers. The detailed results on incidence and population buildup of hopper species on various varieties of mangos are discussed in seriatim.

Almas: The incidence of hoppers infestation on this variety was recorded during 30th December with initial population of (0.06 / shoot). The population build up of mango hopper was gradual upto 10th February (2.60 / shoot) and thereafter the pest multiplied very rapidly. The population of hoppers reached its peak (24.23 / shoot) during 23rd March and thereafter hopper population started declining gradually. The decline in hopper infestation was gradual up to 27th April, thereafter hopper population decreased rápidly and this insect pest practically disappeared during 18th May. The analysis of variance for hopper infestation on Almas revealed that population density of mango hopper varied significantly with the inflorescence and fruit phenology of this mango variety. The population density of mango hoppers was significantly the highest on 23rd March (24.23 / shoot) however, the variations amongst the hopper population on 30th March (24.22 / shoot), 16th March (23.26 / shoot) and 5th April (22.32 / shoot) were statistically non-significant. Similarly, the difference in the hopper density per shoot on 9th March (12.82 / shoot) and 13th April (20.98 / shoot) were also statistically non-significant. The mango hopper density on Almas variety during 2nd March (9.00 / shoot) and 4th May (9.94 / shoot) did not vary significantly. The hopper density/shoot during January and first fortnight of February was statistically at par. The correlation coefficients between inflorescence/fruit phenology and mango hopper population agro climatic factors are presented in Table 2. It is evident from these parameters for Almas variety that mango hopper density had positive significant correlation with inflorescence phenology (r = 0.854). This showed that mango hopper populations increased as the length of the inflorescence grow in size. However, the mango hopper density/shoot had negative significant correlations with the fruit weight (Table 2 and 3). The agrometerological parameter i.e. temperature and relative humidity also affected the mango hopper population. Mango hopper density/shoot had positive significant correlation with the prevailing temperature however population density of mango hopper/shoot had negative non-significant correlation with the relative humidity.

Sindhri: The data on mean per shoot population of mango hoppers on Sindhri variety as influenced by inflorescence and fruit phenology (Table 1) showed that the incidence of mango hoppers was very low (0.06 / shoot) during 30th December when variance for hopper population density on Sindhri variety showed that hopper density varied singnificantly with the inflorescence and fruit phenology. It is evident from the data after application of LSD test (P= 0.05) that population of mango hoppers was statistically at par during January as the growth of inflorescence was gradual. The population of mango hoppers also increased gradually upto first fortnight of February. Thereafter rapid multiplication of mango hoppers resulted in increased population density/shoot when the inflorescence was at full bloom. The population of mango hoppers was significantly the highest (25.66 / shoot) a peak population during 30th March, however, the population density on 16th March (23.88 / shoot) and 5th April (22.74 / shoot) was statistically at par when fruit formation established. Thereafter, hopper population declined towards the end of May. It is evident from the data analysis that hopper density varied significantly with the inflorescence and fruit phenology however certain non-significant differences amongst population levels were observed at certain experimental dates of data recording. The regression analysis and correlation coefficient of inflorescence/fruit phenology and agromenterological parameters with population of mango hopper (Table 2 and 3) on Sindhri variety indicated that the population density of mango hoppers/shoot had a positive significant correlation with the length of inflorescence phenology (r = 0.911). However, mean number of mango hoppers/shoot had negative significant correlation with the increase in the fruit weight of mango variety Sindhri (r = 0.988). This indicated that the population of mango hoppers decreased as the size of the fruit increased. The hopper population density/shoot of Sindhri had positive non-significant correlation with the prevailing temperature during the experimental period. Similarly the correlation coefficient of mango hopper with relative humidity showed negative non-significant correlation between these two parameters.

Neelum: The results on the population density of mango hoppers/shoot on Neelum mango variety (Table 1) showed that the infestation of this insect pest was variable with the phenology of mango inflorescence and fruit of Neelum. It is evident from the data that incidence of mango hopper was recorded during 30th December (0.06 / shoot) along with the initiation of inflorescence growth. The population density of mango hoppers

increased gradually as the phenology of flowering shoot progressed up till 24th February (5.88 / shoot). Thereafter, the mango hoppers multiplied rapidly, which resulted in population, build up of this insect pest. The peak population of mango hoppers on Neelum variety was recorded on 16th March (22.52 / shoot) and thereafter a gradual decline in hopper population density was observed as the fruit development started. The population of mango hoppers disappeared in the second fortnight of May. The analysis of hopper population data for variance showed that variation in hopper population was statistically significant with the progress in mango shoot development. However, non-significant (P=0.05) differences were evident amongst certain population levels of different dates of observation. The correlation coefficients and regression analysis of mango hopper population with inflorescence/fruit development in length and size and agrometeorological parameters (Table 2 and 3) revealed that population of mango hoppers had positive significant correlation (r = 0.905) with the increase in the growth of mango inflorescence. However, population of mango hoppers decreased as the fruit formation and its size increased. Population density of mango hopper had negative (r = -0.043) non-significant (P = 0.05) correlation with fruit size. Further, more hopper density/shoot had positive (r = 0.477) but non-significant (P = 0.05) correlation with the prevalent temperature during the experimental period. However, mean per shoot population of mango hopper had negative (r = -0.284) non-significant (P = 0.05) correlation with the prevailing relative humidity of the experimental period the regression equation (Y=a+bx) also supported the said correlation coefficient. The pooled analysis of variance for population densities of mango hoppers in different mango varieties showed that hopper infestations varied significantly in three mango varieties.

Generally, the adult mango hoppers remain present in the mango gardens during December and then start breeding in blooming stage. Therefore it is advisable for the mango growers to spray with suitable insecticides as a preventive measure before onset of inflorescence during December to January to avoid mango hoppers attack. The availability of three species mango hoppers on the mango was recorded throughout the year. However, *Amritodus atkinsoni* was recorded on trunk during mid day hot months of summer. All species were correlated with onset of new flush of leaves. The results of present studies are in agreement with those of Kumar, *et al.* (1983), Shukla and Prasad (1984) and Shekh, *et al.* (1993).

Table 1: Mean per Shoot Population of Mango Hoppers on Different Mango Varieties as Influenced by Inflorescence and Fruit Phenology During 1999-2000

Month/Date	Mean per Shoot Mango Hoppers on:			Mean Length of Inflorescence (in cm.)			Mean Weight of Fruit (in gm.)		
	Almas	Sindhri	Neelum	Almas	Sindhri	Neelum	Almas	Sindhri	Neelum
Decmber									
30th	0.06	0.06	0.06	1.27	1.27	0.10	-	-	-
January									
6th	0.15	0.38	0.12	3.06	2.29	0.92	-	-	-
13th	0.23	0.98	0.30	6.23	4.85	2.02	-	-	-
20th	0.68	1.22	0.96	9.33	6.74	4.78	-	-	-
27th	1.42	2.26	1.84	12.45	9.57	7.21	-	-	-
February									
3rd	1.80	3.34	2.74	16.20	13.21	10.29	-	-	-
10th	2.60	3.88	3.34	19.86	15.85	14.85	-	-	-
17th	5.08	5.60	4.24	22.93	18.72	16.55	-	-	-
24th	6.86	6.66	5.88	25.80	22.22	20.85	-	-	-
March									
2nd	9.00	10.60	8.98	27.28	24.63	22.52	-	-	-
9th	12.82	13.68	12.58	30.22	27.71	25.41	-	-	-
16th	23.26	23.88	22.52	31.72	29.51	27.48	40	15	3
23rd	24.23	25.20	20.70	-	-	-	85	45	15
30th	24.22	25.66	18.80	-	-	-	110	70	35
April									
5th	22.32	22.74	17.50	-	-	-	150	105	60
13th	20.98	20.10	14.42	-	-	-	210	150	80
20th	18.02	16.36	11.86	-	-	-	300	210	115
27th	13.22	10.04	6.90	-	-	-	360	290	140
May									
4th	9.94	7.22	5.50	-	-	-	480	360	175
11th	4.06	4.24	4.64	-	-	-	520	410	200
18th	0.00	3.80	4.02	-	-	-	570	425	220
Total	200.95	207.90	167.90	206.35	167.00	152.98	2825	2080	1043
Mean	9.56	9.9	7.99	17.19	13.91	12.74	282.5	208.0	104.3

Mean values with similar letters in respective columns show non-significant differences (P=0.05).

Table 2: Phenological Correlation Between Mango Hoppers and Inflorescence/Fruit of Different Mango Varieties Agrometerological Factors

Parameters	Correlation Coefficient	Regression Equation Y=a+bx
ALMAS		
Length of inflorescence vs MHS	0.854*	-175.276 + 24.925x
Fruit weight vs MHS	-0.969*	1404.721 + 2.097x
Temperature vs MHS	0.668*	-495.927 + 44.028x
Relative humidity vs MHS	0.258NS	1460.346 + 14.530x
SINDHRI		
Length of inflorescence vsMHS	0.911*	-124.044 + 27.991x
Fruit weight vs MHS	-0.988*	1384.206 + 2.827x
Temperature vs MHS	0.497NS	-243.205 + 31.914x
Relative humidity vs MHS	-0.332NS	1671.109 + 17.789x
NEELUM		
Length of inflorescence vs MHS	0.905*	-84.477 + 26.238x
Fruit weight vs MHS	-0.043NS	436.06 + 0.228x
Temperature vs MHS	0.477NS	-163.399 + 24.828 x
Relative humidity vs MHS	-0.284NS	1235.036 + 12.5117x

* = Significant at 5% level
NS = Non-significant

Table 3: Weekly Mean Temperature and Relative Humidity of the Experimental Period for Mango Hoppers During 1999-2000

Month/Date	Average Temperature (°C)	Average Humidity (%)
December		
30th	15.8	81.0
January		
6th	14.5	58.5
13th	15.15	67.0
20th	15.25	70.5
27th	12.25	60.5
February		
3rd	15.5	65.0
10th	21.25	57.5
17th	22.75	62.5
24th	18.25	75.5
March		
2nd	22.75	65.0
9th	23.25	60.0
16th	24.25	64.5
23rd	26.50	76.0
30th	28.25	43.5
April		
5th	31.5	57.5
13th	29.5	62.5
20th	33.5	61.0
27th	33.0	64.5
May		
4th	32.5	74.5
11th	31.0	59.0
18th	32.5	76.5

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