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Population fluctuation of mango hoppers under various Dapoli locations

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Abstract

The present research was carried out to study the population fluctuation of mango hoppers at different phenological stages under various Dapoli locations during 2015-16 and 2016-17. During the year 2015-16, the overall mean hopper population at different phenological stages was in the range of 0.13 to 29.27 hoppers per panicle. The maximum (29.26) hopper population was recorded at flowering stage in PA (PHM orchard-Alphonso) and minimum (0.13) at the egg stage in HK (Horticulture Nursery-Kesar). During the year 2016-17, the overall mean hopper population at different phenological stages was in the range of 0.07 to 17.05 hoppers per panicle. The maximum (17.05) hopper population was recorded at flowering stage in Pa USA (Pangari Bock-Unsprayed Alphonso) and minimum (0.07) was observed at the egg stage in HK (Horticulture Nursery-Kesar).

Keywords: Population fluctuation, phenological stages, mango hoppers, alphonso

Introduction

Mango (*Mangifera indica* Lin.) is the main fruit of Asia and this fruit has developed its own importance all over the world. It is the national fruit of Indian and since long it is the choicest fruit in India. This fruit has been under cultivation in Indian sub-continent over 4000 years and has been the favorite of the kings and commoners because of its nutritive value, taste, attractive fragrance and health promoting qualities. In many parts of the country mango serves as staple food for several months during the year because of its fine quality and taste as raw fruit. It is now recognized as one of the best fruits in the world market; hence it is called as the 'King of the fruits'. It occupies relatively the same position in the tropical region as is enjoyed by apple in temperate region.

In consideration of area, production and productivity of various states, Andhra Pradesh stands at the top considering the area (31.57 M ha) under mango cultivation. The other important mango growing states are Karnataka, Telangana, Bihar, Tamil Nadu, Maharashtra, West Bengal, Gujarat, Madhya Pradesh, Orissa and Kerala (Anonymous, 2015) [2].

In Maharashtra, the area under mango cultivation is 0.485 M ha with a total production of over 1.212 MT of mango fruits and productivity is 2.5 MT per ha. Konkan is the major mango producing region on the West Coast of Maharashtra, occupies an area of 0.182 M ha which comprises five mango growing districts viz., Thane, Palghar, Raigad, Ratnagiri and Sindhudurg and is emerging as one of the largest mango growing belts in the country. Konkan region accounts for about 10 per cent of the total area under mango cultivation in the country, out of which almost 90 per cent area is covered by a single cultivar Alphonso, which is locally called as 'Hapus' (Anonymous, 2014) [1].

The reasons for low productivity of 'Alphonso' variety in Konkan region are high incidence of pests and diseases due to hot and humid climate. Among the insect-pests, mango hopper is the number one serious and destructive pest of mango. Apart from causing menace in various states of India, the hopper pest has been found prevalent in most of the tropical and sub-tropical countries in South East Asia. Damage is caused by the nymphs and adults by sucking sap from tender leaves, inflorescence as a consequence of which inflorescence and fruit if any set, fall prematurely. Mango hoppers secrete honey dew which facilitates the development of sooty mold on the leaves, twigs and inflorescence. Due to sooty mold the photosynthetic adversely activity is hampered and ultimately fruit setting is also affected.

Many researchers had worked on seasonal incidence and influence of weather parameters on the development of the hoppers, but still there is vast scope.

Hence there is need to carry out detailed study to determine the effect of some abiotic factors on hopper population in different sites as well as different stages in mango plant. Similarly, it is necessary to find out the intensity of the population of mango hopper according to phenological stages. This will give clear cut indication about intensity of the pest and helps in application of selective pesticides at a particular stage only which will reduce the pesticide load in the ecosystem.

In view of this, the present investigations were undertaken for the management of mango hoppers by studying population fluctuation in relation to different phenological stages and on different varieties of mango.

Materials and Methods

The field observation on mango hopper population to study population fluctuations were undertaken under different Dapoli locations at different phenological stages and on different varieties of mango.

For conducting studies on population fluctuation of hopper hoppers, different orchards were selected under Dapoli locations. The list of locations of mango orchards and their code are given below.

Mango Orchards Selected For the Study of Hopper Specie Composition at Dapoli Locations

S. No.	Name of Location	Location code
1	Indo-Israel Project (Alphonso)	IIA
2	Indo-Israel Project (Pruned Alphonso)	IIPA
3	Indo-Israel Project (Jumbo Kesar)	IJK
4	Agronomy farm (Alphonso)	AA
5	Horticulture Nursery (Alphonso)	HA
6	Horticulture Nursery (Kesar)	HK
7	Horticulture Nursery (Ratna)	HR
8	PHM orchard (Alphonso)	PA
9	Pangari Block (Sprayed Alphonso)	PaSA
10	Pangari Block (Unsprayed Alphonso)	PaUSA
11	Indo-Israel Project (Goa Mankur)	GM

Methods of Recording Observations

For recording population of mango hoppers, five plants per location were selected and ten panicles per tree were tagged location wise. The total numbers of mango hoppers (nymphs and adults) per panicle were counted at weekly interval and at different phenological stages on different mango varieties. Data thus collected were averaged to number of hoppers per panicle and analyzed statistically.

Statistical Analysis

Data thus obtained was analyzed statistically by calculating the average hopper population per panicle and presented phenological stage wise.

Results and Discussion

Population fluctuation of mango hoppers at different phenological stages and on different varieties of mango under Dapoli locations

The results on population fluctuation of mango hoppers at different phenological stages and on different varieties of mango are presented herewith.

Population of mango hoppers per panicle at different phenological stages during year 2015-16

The data pertaining to the mean population of mango hoppers per panicle at different phenological stages and on different

varieties of mango under Dapoli locations during year 2015-16 are presented in Table 1.

The results on mean population of mango hoppers at different stages of mango in IIA (Indo-Israel Project-Alphonso) revealed that the mean hopper population was in the range of 1.73 to 12.43. The maximum (12.43) hopper population was recorded at flowering stage whereas, minimum (1.73) was observed during egg stage. During marble stage, mean hopper population was 11.68 whereas, vegetative stage recorded 7.62 mean hopper population per panicle.

The mean hopper population was in the range of 1.32 to 6.03 in IIPA (Indo-Israel Project-Pruned Alphonso). The mean population was highest (6.03) at the marble stage while, vegetative stage recorded lowest (1.32) hopper population. At flowering stage, mean hopper population was 1.48 whereas, egg stage recorded 2.07 hopper per panicle.

The data on mean hopper population in IJK (Indo-Israel Project-Jumbo Kesar) indicated that the population was in the range of 0.54 to 2.56 during different stages of mango. The marble stage recorded maximum (2.56) mean hopper population whereas, minimum (0.54) was at vegetative stage. At the flowering stage mean population was 0.66 hoppers per panicle while at egg stage 0.72 hoppers per panicle.

In AA (Agronomy farm-Alphonso), mean population of hoppers ranged from 0.62 to 10.91. At marble stage highest (10.91) hopper population was observed and at vegetative stage least (0.62) hopper population was recorded. The flowering stage and egg stage recorded 10.67 and 2.32 mean hoppers per panicle, respectively.

The data on mean hopper population in HA (Horticulture Nursery-Alphonso) showed that the population was in the range of 1.57 to 12.92. The maximum (12.92) hoppers were recorded at flowering stage whereas, minimum (1.57) at egg stage. At marble stage population was 3.51 while, at vegetative stage 1.78 hoppers per panicle.

The results on hopper population in HK (Horticulture Nursery-Kesar) revealed that the mean hopper population was very low and was in the range of 0.13 to 1.13 hoppers per panicle. The maximum (1.13) hoppers were recorded at flowering stage whereas minimum (0.13) at egg stage.

The data on mean hopper population in HR (Horticulture Nursery-Ratna) indicated that the population was in the range of 0.16 to 9.00. The highest (9.00) hoppers were observed at flowering stage whereas, lowest (0.16) was at vegetative stage. At marble stage and egg stage population was 2.31 and 0.62 hoppers per panicle, respectively.

The mean population was in the range of 2.28 to 29.26 hoppers per panicle in PA (PHM orchard-Alphonso). The results revealed that the maximum (29.26) population was noticed at flowering stage whereas, minimum (2.28) at vegetative stage. The population was 24.57 hoppers per panicle at marble stage while at egg stage population was 3.97 hoppers per panicle.

The data on mean hopper population in PaSA (Pangari Block-Sprayed Alphonso) indicated that the population was in the range of 0.73 to 6.73 during different stages of mango. The flowering stage recorded maximum (6.73) mean hopper population whereas, minimum (0.73) was at vegetative stage. At marble stage mean population was 2.38 hoppers per panicle while, at egg stage 1.91 hoppers per panicle.

In PaUSA (Pangari Block-Unsprayed Alphonso), mean population of hoppers ranged from 0.14 to 11.31. At flowering stage highest (11.31) hopper population was observed and at vegetative stage least (0.14) hopper population was recorded. The marble stage and egg stage

recorded 7.37 and 2.86 mean hopper per panicle, respectively. The GM (Indo-Israel Project-Goa Mankur) orchard was in vegetative stage throughout the year of study. The mean population of hoppers at vegetative stage was 0.16 hoppers per panicle. The results on overall mean hopper population at different

phenological stages during year 2015-16 revealed that the population was in the range of 0.13 to 29.27 hoppers per panicle. The maximum (29.26) hopper population was recorded at flowering stage in PA (PHM orchard-Alphonso). The minimum (0.13) population was observed at the egg stage in HK (Horticulture Nursery-Kesar).

Table 1: Mango hoppers per panicle at different phenological stages and on different mango varieties under Dapoli locations during year 2015-16

Sr. No.	Location code	Average number of mango hoppers per panicle													
		Vegetative stage			Flowering Stage				Marble stage			Egg stage			
		WK 1	WK 2	Mean	WK 1	WK 2	WK 3	Mean	WK 1	WK 2	Mean	WK 1	WK 2	WK 3	Mean
1	IIA	6.62	8.62	7.62	11.54	12.66	13.10	12.43	11.02	12.34	11.68	3.66	1.17	0.36	1.73
2	IIPA	1.48	1.16	1.32	1.42	1.74	1.28	1.48	5.20	6.86	6.03	4.28	1.30	0.64	2.07
3	IIJK	0.58	0.50	0.54	0.56	0.68	0.74	0.66	1.42	3.70	2.56	1.30	0.48	0.38	0.72
4	AA	0.62	0.62	0.62	12.60	9.14	10.26	10.67	11.3	10.52	10.91	4.88	1.68	0.40	2.32
5	HA	0.94	2.62	1.78	6.24	17.40	15.12	12.92	3.92	3.10	3.51	1.88	1.52	1.32	1.57
6	HK	0.2	0.26	0.23	1.14	1.14	1.10	1.13	0.26	0.88	0.57	0.24	0.08	0.08	0.13
7	HR	0.16	0.16	0.16	2.45	11.03	13.53	9.00	1.66	2.96	2.31	1.20	0.50	0.16	0.62
8	PA	2.18	2.38	2.28	16.3	32.58	38.90	29.26	36.20	12.94	24.57	6.46	3.24	2.20	3.97
9	PaSA	1.08	0.38	0.73	6.36	7.2	6.62	6.73	3.34	1.42	2.38	4.86	0.50	0.38	1.91
10	PaUSA	0.18	0.10	0.14	15.32	10.43	8.18	11.31	5.62	9.12	7.37	5.24	2.98	0.36	2.86
11	GM	0.15	0.16	0.16	-	-	-	-	-	-	-	-	-	-	-

IIA: Indo-Israel Project (Alphonso) IIPA: Indo-Israel Project (Pruned Alphonso) IIJK: Indo-Israel Project (Kesar)
 AA: Agronomy farm (Alphonso) HA: Horticulture Nursery (Alphonso) HK: Horticulture Orchard (Kesar)
 HR: Horticulture Nursery (Ratna) PA: PHM orchard (Alphonso) PaSA: Pangari Block (Sprayed Alphonso)
 PaUSA: Pangari Block (Unsprayed Alphonso) GM: Indo-Israel Project (Gao Mankur)

Population of mango hoppers per panicle at different phenological stages during year 2016-17

The results on mean population of mango hoppers per panicle

at different phenological stages and on different varieties of mango under Dapoli locations during year the 2016-17 are presented in Table 2.

Table 2: Mango hoppers per panicle at different phenological stages and on different mango varieties under Dapoli locations during year 2016-17

Sr. No.	Location code	Average number of mango hoppers per panicle															
		Vegetative stage					Flowering Stage				Marble stage			Egg stage			
		WK 1	WK 2	WK 3	WK 4	Mean	WK 1	WK 2	WK 3	Mean	WK 1	WK 2	Mean	WK 1	WK 2	WK 3	Mean
1	IIA	2.30	1.60	-	-	1.95	2.04	16.18	12.58	10.27	4.16	4.62	4.39	4.04	2.02	0.68	2.25
2	IIPA	0.58	0.70	-	-	0.64	1.08	2.90	1.42	1.80	0.66	0.88	0.77	0.84	1.64	0.34	0.94
3	IIJK	0.24	0.44	-	-	0.34	0.30	0.86	0.44	0.53	0.30	0.60	0.45	0.34	1.14	0.24	0.57
4	AA	1.06	2.18	2.70	4.94	2.72	8.84	15.08	13.78	12.57	6.80	1.48	4.14	0.26	0.18	0.18	0.21
5	HA	0.22	1.04	1.6	2.48	1.34	4.02	8.34	10.30	7.55	5.90	3.72	4.81	0.36	0.24	0.00	0.20
6	HK	0.28	0.22	0.52	0.32	0.34	1.64	2.40	0.76	1.60	0.72	0.36	0.54	0.12	0.10	0.00	0.07
7	HR	0.32	0.46	0.40	0.46	0.41	0.42	0.44	0.52	0.46	0.82	1.24	1.03	0.24	0.00	0.00	0.08
8	PA	0.74	1.26	1.96	1.62	1.40	4.24	5.92	6.60	5.59	2.38	1.60	1.99	0.34	0.28	0.38	0.33
9	PaSA	0.52	1.84	2.70	3.80	2.22	15.86	12.36	13.94	14.05	11.48	9.82	10.65	4.98	1.24	0.82	2.35
10	PaUSA	0.34	1.62	3.22	4.38	2.39	18.52	17.42	15.2	17.05	12.48	9.66	11.07	3.38	0.28	0.16	1.27
11	GM	0.10	0.14	0.34	0.22	0.20	-	-	-	-	-	-	-	-	-	-	-

IIA: Indo-Israel Project (Alphonso) IIPA: Indo-Israel Project (Pruned Alphonso) IIJK: Indo-Israel Project (Kesar)
 AA: Agronomy farm (Alphonso) HA: Horticulture Nursery (Alphonso) HK: Horticulture Orchard (Kesar)
 HR: Horticulture Nursery (Ratna) PA: PHM orchard (Alphonso) PaSA: Pangari Block (Sprayed Alphonso)
 PaUSA: Pangari Block (Unsprayed Alphonso) GM: Indo-Israel Project (Gao Mankur)

The results on the mean population of the mango hopper at different phenological stages of mango in IIA (Indo-Israel Project-Alphonso) noticed that the mean hopper population was in the range of 1.95 to 10.27. The maximum (10.27) hoppers were recorded at flowering stage whereas, minimum (1.95) was observed at vegetative stage. During marble stage, mean hopper population was 4.39 whereas, egg stage recorded 2.25 mean hoppers per panicle.

The mean hopper population was in the range of 0.64 to 1.80 in IIPA (Indo-Israel Project-Pruned Alphonso). The mean population was highest (1.80) at flowering stage while, vegetative stage recorded lowest (0.64) hopper population. At marble stage mean hopper population was 0.77 whereas, egg stage recorded 0.94 hopper per panicle.

The data on mean hopper population in IIJK (Indo-Israel Project-Jumbo Kesar) revealed that the population was very low and was in the range of 0.34 to 0.57 during different stages of mango. The egg stage recorded maximum (0.57) mean hopper population whereas, minimum (0.34) was at vegetative stage. At flowering stage mean population was 0.53 hoppers per panicle while, at marble stage 0.45 hoppers per panicle.

In AA (Agronomy farm-Alphonso), mean population of hoppers ranged from 0.21 to 12.57. At flowering stage highest (12.57) hopper population was observed and at egg stage least (0.21) hopper population was recorded. The vegetative stage and marble stage recorded 2.72 and 4.14 mean hoppers per panicle, respectively.

The data on mean hopper population in HA (Horticulture Nursery-Alphonso) indicated that the population was in the range of 0.20 to 7.55. The maximum (7.55) hoppers were recorded at flowering stage whereas, minimum (0.20) at egg stage. At marble stage population was 4.81 while, at vegetative stage 1.34 hoppers per panicle.

The results on hopper population in HK (Horticulture Nursery-Kesar) revealed that the mean hopper population was in the range of 0.07 to 1.60 hoppers per panicle. The maximum (1.60) hoppers were recorded at flowering stage whereas minimum (0.07) at egg stage. The vegetative stage and marble stage recorded 0.34 and 0.54 mean hopper per panicle, respectively.

The data on mean hopper population in HR (Horticulture Nursery-Ratna) showed that the population was in the range of 0.08 to 1.03. The highest (1.03) hoppers were observed at marble stage whereas, lowest (0.08) was at egg stage. At vegetative stage and flowering stage population was 0.41 and 0.46 hoppers per panicle, respectively.

The mean population was in the range of 0.33 to 5.59 hoppers per panicle in PA (PHM orchard-Alphonso). The results revealed that the maximum (5.59) population was noticed at flowering stage whereas, minimum (0.33) at egg stage. The population was 1.40 hoppers per panicle at vegetative stage while, at marble stage population was 1.99 hoppers per panicle.

The data on mean hopper population in PaSA (Pangari Block-Sprayed Alphonso) noticed that the population was in the range of 2.22 to 14.05 during different stages of mango. The flowering stage recorded maximum (14.05) mean hopper population whereas, minimum (2.22) was at vegetative stage. At marble stage mean population was 10.65 hoppers per panicle while, at egg stage 2.35 hoppers per panicle.

In PaUSA (Pangari Block-Unsprayed Alphonso), mean population of hoppers ranged from 1.27 to 17.05. At flowering stage highest (17.05) hopper population was observed and at egg stage least (1.27) hopper population was recorded. The vegetative stage and marble stage recorded 2.39 and 11.07 mean hoppers per panicle, respectively.

The GM (Indo-Israel Project-Goa Mankur) orchard was in vegetative stage throughout the year of study. The mean population of hoppers at vegetative stage was 0.20 hoppers per panicle.

The results on overall mean hopper population at different phenological stage during the year 2016-17 revealed that the population was in the range of 0.07 to 17.05 hoppers per panicle. The maximum (17.05) hopper population was recorded at flowering stage in Pa USA (Pangari Block-Unsprayed Alphonso). The minimum (0.07) population was observed at egg stage in HK (Horticulture Nursery-Kesar).

The results of present findings are in accordance with the findings of Kumar *et al.* (2005)^[4]. The studies on population dynamics revealed that the hopper population was comparatively higher during flowering stage and had a peak during the second fortnight of March coinciding with the marble stage of the fruit.

Kaushik (2008)^[3] reported the incidence of the mango hopper during flushing, flowering and fruiting stage, however, high incidence was observed during flowering stage (March-April).

Namni *et al.* (2017)^[5] reported that the total insect species abundance was highest during April to May, following flushing of inflorescence and fruit set. Mango hopper population was highest in May and synchronized to fruit set.

Conclusion

During the year 2015-16, the overall mean hopper population at different phenological stages was in the range of 0.13 to 29.27 hoppers per panicle. The maximum (29.26) hopper population was recorded at flowering stage in PA (PHM orchard-Alphonso) and minimum (0.13) at the egg stage in HK (Horticulture Nursery-Kesar). During the year 2016-17, the overall mean hopper population at different phenological stages was in the range of 0.07 to 17.05 hoppers per panicle. The maximum (17.05) hopper population was recorded at flowering stage in PaUSA (Pangari Block-Unsprayed Alphonso) and minimum (0.07) was observed at the egg stage in HK (Horticulture Nursery-Kesar). The study of phenological stage wise population fluctuation will give the idea about an increase or decrease of population according to stage of the crop and that will be useful for the farmers to take the decision of management practices.

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