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Evaluation of Indigenous and Exotic Mango Germplasm for Resistance to Hopper, *Idioscopus nitidulus* (Walker) and Thrips, *Scirtothrips dorsalis* Hood

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Studies were carried during 2008-09 to 2014-15 to evaluate the indigenous and exotic mango germplasm against hopper, *Idioscopus nitidulus* and thrips, *Scirtothrips dorsalis*. A total of 39 indigenous and exotic mango accessions were screened against these pests and results showed that none of germplasm was found highly resistant against these pests under field conditions. Bombai was found resistant against hoppers and seven accessions *viz.,* T×V, Bombai, CISHM-1 (Ambica), Mahmud Vikarabad, Vellai Kolumban, Mankurad and Ratna were found resistant to inflorescence thrips.

Key Words: Germplasm, Hopper, *Mangifera indica*, Resistant, Susceptibility

Introduction

Mango, *Mangifera indica* L. (Anacardiaceae) is one of the choicest fruit crops of tropical as well as subtropical region of India and is known as "king of fruits" (Vasugi *et al.,* 2012) for its delicious taste, attractive color, savoring flavour and high nutritive value [being rich in vitamins A and C, mineral and fiber content] (Lakshminarayana, 1980). It is cultivated in 2516 thousand hectares with a total production of 18 million tonnes, contributing to 34.90% of the total world mango production (Indian Horticulture database, 2014). More than 400 insect-pest species have been recorded on mango in different parts of the world. Of these, 188 species have been reported in India (Tandon and Verghese 1985). Mango hoppers and thrips are recorded as major pests in the mango ecosystem. Different species of mango hoppers *i.e. Amritodus atkinsoni* (Lethierry), *Idioscopus clypealis* (Lethierry) and *I. nitidulus* (Walker) are serious pests at flowering to fruiting stages (Babu *et al.,* 2002; Patil *et al.,* 1988; Sushil kumar *et al.,* 2005 and Gundappa *et al.,* 2014) and cause significant yield losses in the fields (Gangolly *et al.,* 1957, Wadhi and Batra, 1964 and Rahman and Kuldeep, 2007). Other than hoppers, foliage thrips, *Rhipiphorothrips cruentatus* Hood and inflorescence thrips, *Scirtothrips dorsalis* Hood are also serious pests at new flush, flowering and fruiting stages of mango. Out of these, *I. nitidulus* and *S. dorsalis* are major dominant species and can cause significant damage at flowering stage of the crop. Both nymphs and adults of hoppers aggregate on the underside of leaves, puncture and suck the sap of young leaves and inflorescence (Das *et al*., 1969). Hoppers also excrete honey dew resulting in growth of sooty mould on dorsal surface of leaves, inflorescence, branches and rachis of the fruits. Which further interferes with the photosynthetic activity of the plant, ultimately resulting in non-setting of flowers, dropping of immature fruits and reducing the yield. Similarly, nymph and adult thrips also suck the sap from the young leaves, tender shoots, inflorescence and fruits of the mango which result in silvery shine with upward curling of the leaf edges, stunted growth, discoloration of buds and panicles resulting in malformation and bronzing of the fruit surface with feeding scars on fruits leading to pre-mature fruit drop (Higgins, 1992; Pena *et al*., 2002, Sanap and Nawale, 1987, Grove *et al.,* 2000 and Nault *et al.,* 2003).

For control of these pests, several insecticides have been recommended in the past (Kaushik *et al.,* 2014; Singh *et al.,* 2010; Samanta *et al.*, 2009 and Sushil kumar *et al*., 2005). But, repeated and extreme use of insecticides to control mango hopper and thrips has led to development of resistance and resurgence; besides, leaving excessive residue on edible fruits (Sushil Kumar *et al.,* 2005 and Singh, 2008). So, resistant sources of mango germplasm is one of the best tools in pest management. Hence, in the present study, indigenous and exotic mango accessions were screened to find out their susceptibility to mango hoppers and thrips.

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Materials and Methods

The experiment was conducted at Agriculture Experimental Station (All India Coordinated Research Project (AICRP) on Fruits Centre), Navsari Agricultural University, Paria (22º26' N and 72º58' E with an altitude of 10 meters above sea level) on 8-10 years old different indigenous and exotic mango trees. A total of 39 mango accessions were screened against hopper and thrips incidence over seven consecutive years *i.e.,* 2008-09 to 2014-15. Each accession was replicated twice and maintained at a distance of 8m x 8m (from plant to plant and row to row). The germplasm blocks were kept free from pesticide application during the study period. Population of hoppers, *Idioscopus nitidulus* and thrips, *Scirtothrips dorsalis* (both nymph and adult stages) were counted visually on tagged 10 twigs or panicles/tree at standing height during peak flowering period twice at 15 day interval and thrips population were recorded by tapping the inflorescence on a simple white paper (NICRA team of mango pest surveillance, 2011, Patel *et al.,* 2013 and Sushil Kumar *et al.,* 2005). The arbitrary rating scale (0-5) used to grade the hopper and thrips population was; free (0 hoppers or thrips /panicle), highly resistant (0.1-1.0 hoppers or thrips /panicle), resistant (1.0-2.0 hoppers or thrips/panicle), moderately susceptible (2.0- 3.0 hoppers or thrips/panicle), susceptible (3.0- 4.0 hoppers or thrips/ panicle) and highly susceptible (>4 hoppers or thrips/ panicle) (Anonymous, 2009).

Results and Discussion

The mango germplasm differed greatly in terms of susceptibility to mango hopper and thrips (Table 2). None of the genotypes were found free or highly resistant against these pests. The mean hopper population varied from 1.86 to 14.71 hoppers/twig or panicle (Table 1). Lowest hopper population was recorded in Bombai (1.86 hoppers/twig or panicle) and categorized as resistant germplasm. Whereas, Himsagar (2.40 hoppers/twig or panicle), Shebar (2.53hoppers/twig or panicle) and Mankurad (2.81 hoppers/twig or panicle) were observed moderately susceptible against mango hopper. Keitt was found to be highly susceptible to mango hopper (14.71 hoppers/twig or panicle) followed by Maya (13.15 hoppers/twig or panicle), Mahmood Vikarabad (12.59 hoppers/twig or panicle) and Vellai Kolumban (11.20 hoppers/twig or panicle). Thus, on the basis of overall susceptibility index, one accession was found resistant, three accessions were found moderately susceptible, five as susceptible and 30 were found to be highly susceptible to mango hopper.

Against thrips, lowest population was recorded in Mahmooda Vikarabad (1.09 thrips/twig or panicle) followed by CISHM-1 (Ambica) (1.32 per twig or panicle), Bombai (1.44/twig or panicle), T×V (1.61 / twig or panicle), Mankurad (1.76/twig or panicle), Vellai Kolumban (1.77/twig or panicle), Ratna (1.79/twig or panicle) and Kent (1.84 /twig or panicle). Whereas, maximum thrips population was recorded in Mallika (6.19 /twig or panicle) followed by Chandram (5.56/ twig or panicle) and Bappakai (5.41/twig or panicle). Based on susceptibility index eight accessions were found resistant to thrips, 14 accessions were categorized moderately susceptible [*viz.,* Gulabkhas, Hybrid-13-3, Shebar, Apple, Fernandin, Lilly, Maya, Muvandan, Ajod Sindurio, Kensington, Arka Anmol, Himsagar, Karel (Rewa) and Goa manchur] and seven mango accessions were found highly susceptible (Gajiria, Malviabhog, Keitt, Mallika, Hybrid-10, Chandram and Bappakai). The results of the present investigation are in conformity with Reddy and Dinesh (2005) who evaluated ten exotic mango germplasm on the basis of four susceptibility groups [*viz.,* least susceptible (0-2 hoppers/panicle), moderately susceptible (2-6), susceptible (>6-10) and highly susceptible (>10)] and found that Kensington and Ostin were susceptible and Sensation was recorded moderately susceptible against *I. nitidulus*. Devi Thangam *et al.,* 2013 screened 392 mango accessions against *I. nitidulus* on the basis of 0-3 grading scale and found that Himsagar, Sensation, Goa Mankurad, Ratna and Keitt moderately susceptible to hopper.

Viraktamath *et al.* (1996) studied the varietal influences against mango hopper and reported that maximum hopper population was recorded in Neeleshan followed by Neeluddin, Mallika and Rumani. Singh and Singh (2007) screened 23 cultivars of mango and reported that none of the cultivars showed immune reaction, though two cultivars, *viz.,* Bangalora and Amebela were rated as resistant and five *viz.,* Gillas, Gulabkhas, Chandra Karan, Mallika and Gourjeet as tolerant to the hoppers. Eleven cultivars *viz.,* Safeda Lucknow, Bombay Green, Totapuri, Deshi, Himsagar, Shukul, Langra, Kakori, Barahmasi, Banarsi Langra, SB Chausa and Sundraza were rated as susceptible and five *viz.,* Dashehari, Nisar pasand, Zardalu, Ratul and Neelum as highly susceptible against mango hopper in field conditions.

Table 1. Screening of indigenous and exotic mango germplasm against hopper, *Idioscopus nitidulus* and thrips, *Scirtothrips dorsalis* under field condition from 2008-09 to 2014-15

S. No.	Germplasm	Hopper population/ twig or panicle								Thrips population/ twig or panicle							
		2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Mean	2008-09	2009-10	2010-11	2011-12	2012-13	**2013-14**	**2014-15**	**Mean**
1	Gajiria	2.75	4.00	8.30	7.00	8.00	10.60	9.60	7.18	2.30	8.05	4.10	2.70	2.50	6.00	2.50	4.02
2	Ostin	6.90	4.60	4.90	1.90	1.50	1.50	1.85	3.31	2.50	1.00	1.60	7.00	7.50	1.70	1.45	3.25
3	Palmer	3.30	11.50	11.20	4.00	4.00	9.40	6.70	7.16	3.90	2.50	2.20	4.40	4.50	4.90	4.15	3.79
4	Lilly	4.25	9.15	10.90	2.90	2.50	3.40	4.00	5.30	2.95	2.15	3.90	1.70	1.50	3.00	2.20	2.49
5	Maya	14.55	18.10	20.40	3.50	3.50	18.80	13.20	13.15	4.15	2.00	1.90	2.20	2.00	1.90	3.05	2.46
6	Malviyabhog	5.55	17.35	17.50	2.90	3.00	3.30	14.45	9.15	2.95	6.30	8.00	3.60	3.50	3.90	4.15	4.63
7	Muvandan	18.50	10.10	9.20	3.80	3.50	17.60	13.95	10.95	1.50	2.45	2.80	2.50	2.50	3.20	2.60	2.51
8	Ajod Sindurio	2.20	9.70	7.80	6.40	6.00	14.50	4.20	7.26	1.20	4.00	5.00	1.60	1.50	4.10	2.55	2.85
9	Kensington	2.70	17.25	14.80	3.30	3.00	10.40	12.45	9.13	1.55	1.90	2.20	2.80	2.50	1.50	1.90	2.05
10	Keitt	1.20	15.40	23.30	10.00	10.50	23.60	18.95	14.71	1.50	2.90	2.70	8.30	8.50	5.80	3.15	4.69
11	Madhukrupa	3.55	10.95	8.20	1.80	2.00	3.20	7.35	5.29	2.00	5.00	1.00	1.60	1.50	5.00	5.50	3.09
12	Kent	19.90	2.95	5.00	5.80	5.50	10.30	12.35	8.83	2.70	1.70	2.50	1.90	2.00	1.40	0.70	1.84
13	Arka Neelkiran	13.40	12.15	12.60	5.20	5.00	11.30	9.75	9.91	3.05	2.95	3.60	3.30	3.00	4.00	4.10	3.43
14	Arka Anmol	18.40	8.05	18.30	3.90	3.50	12.10	8.60	10.41	2.80	2.85	5.90	0.90	1.00	0.60	0.90	2.14
15	T × V*	5.80	13.00	9.00	2.00	2.00	3.80	4.40	5.71	2.05	2.65	2.60	0.60	0.50	1.70	1.20	1.61
16	Sensation	3.65	6.30	5.10	5.80	5.50	10.00	11.00	6.76	1.45	1.20	1.80	4.00	4.00	4.90	4.75	3.16
17	Himsagar	3.00	3.05	2.10	1.20	1.50	2.80	3.15	2.40	3.05	2.65	2.60	2.80	2.50	2.10	1.55	2.46
18	Bombai	2.40	3.15	2.20	1.20	1.00	1.90	1.20	1.86	2.35	0.95	0.70	1.70	3.00	0.80	0.55	1.44
19	Karel (Rewa)	5.80	3.95	11.90	6.80	6.50	5.80	7.30	6.86	4.05	1.10	3.10	3.20	1.50	1.40	2.70	2.44
20	CISHM-1 (Ambica)	13.10	14.05	4.60	4.00	4.00	14.40	12.35	9.50	2.15	0.65	1.30	1.80	1.50	1.40	0.45	1.32
21	Mahmood Vikarabad	16.80	16.30	18.20	6.90	8.50	12.40	9.05	12.59	2.00	1.05	0.90	0.90	1.00	0.70	1.05	1.09
22	Kishanbhog	12.05	2.45	17.00	2.00	2.00	2.50	9.30	6.76	1.85	3.30	3.90	5.00	5.00	3.90	2.95	3.70
23	Vellai Kolumban	3.95	2.95	6.10	13.70	14.50	21.50	15.70	11.20	3.00	0.70	1.70	2.10	2.00	1.50	1.40	1.77
24	Mankurad	2.85	5.85	1.80	2.20	2.00	2.80	2.15	2.81	2.60	1.50	2.10	1.50	1.50	1.30	1.85	1.76
25	Goa manchur	2.90	7.80	6.80	3.00	3.00	3.80	5.80	4.73	2.10	2.65	3.90	3.50	3.50	2.70	2.30	2.95
26	Kokan Ruchi	3.85	13.25	2.90	6.10	6.00	11.60	13.40	8.16	2.65	3.30	3.40	3.40	3.50	3.00	2.95	3.17
27	Hybrid -10	16.30	10.95	1.80	2.10	2.00	3.60	11.25	6.86	3.95	3.80	4.90	5.30	5.50	4.00	3.95	4.49
28	Pusa Arunima	4.60	12.95	6.90	2.80	3.00	2.10	2.90	5.04	2.20	4.30	3.50	3.00	3.00	2.70	2.65	3.05
29	Gulab Khas	2.05	11.60	6.00	1.40	1.50	1.30	2.50	3.76	2.15	3.60	3.00	3.00	3.00	2.60	1.85	2.74
30	Ratna	3.95	22.45	13.10	3.40	3.50	19.00	15.05	11.49	1.45	2.30	1.70	2.00	2.00	1.50	1.60	1.79
31	Zardalu	3.40	2.15	16.60	1.10	1.00	1.80	1.10	3.88	2.00	2.40	2.80	3.90	4.00	4.00	3.95	3.29
32	Mallika	1.95	13.10	5.40	2.70	2.50	2.50	2.35	4.36	2.30	5.80	7.80	8.00	8.00	5.70	5.70	6.19
33	Hadgood Seedling	2.40	5.00	1.60	4.20	4.50	11.80	14.40	6.27	2.90	3.00	3.90	3.90	4.00	3.30	2.80	3.40
34	Hybrid -13-3	7.00	2.20	3.70	1.80	1.50	3.30	6.90	3.77	1.70	2.40	1.30	2.20	4.00	2.00	2.40	2.29
35	Shebar	5.85	2.85	1.00	2.00	2.00	1.50	3.65	2.69	1.50	2.05	2.10	2.00	4.00	1.20	1.30	2.02
36	Chandram	7.35	5.80	13.00	6.00	6.00	13.70	9.35	8.74	1.90	4.95	7.10	6.10	6.50	5.70	6.70	5.56
37	Apple	6.65	4.00	15.60	3.90	4.00	16.50	14.10	9.25	2.40	1.90	2.00	2.70	2.50	2.40	1.90	2.26
38	Bappakai	3.75	3.60	7.00	2.50	2.50	2.90	2.80	3.58	2.35	6.95	7.90	6.00	6.00	4.90	3.80	5.41
39	Fernandin	2.75	2.60	6.00	4.90	5.00	11.30	10.60	6.16	2.80	2.40	3.10	2.80	2.50	2.50	2.50	2.66

T×V* (cross between Totapuri and Vanraj)

Table 2. Susceptibility ratings of mango germplasm against hopper and thrips during 2008-09 to 2014-15

Susceptibility category	Pest population/ twig or panicle	Hopper		Thrips	
		Accession	No. of entries	Accession	No. of entries
Free/Escape	0	Nil	00	Nil	00
Highly resistant	0.1-1.0	Nil	00	Nil	00
Resistant	1.0-2.0	Bombai	01	Kent, T×V, Bombai, CISHM-1 (Ambica), Mahmud Vikarabad, Vellai Kolumban, Mankurad and Ratna	08
Moderately susceptible	2.0-3.0	Himsagar, Mankurad and Shebar	03	Gulabkhas, Hybrid-13-3, Shebar, Apple, Fernandin, Lily, Maya, Muvandan, Ajod Sindurio, Kensington, Arka Anmol, Himsagar, Karel (Rewa) and Goa manchur	14
Susceptible	3.0-4.0	Ostin, Gulabkhas, Zardalu, Hybrid -13-3 and Bappakai	05	Madhukrupa, Sensation, Kishanbhog, Ostin, Palmer, Arka Neelkiran, Kokan Ruchi, Arunima, Zardalu, and Hadgood seedling	10
Highly susceptible	> 4.0	Madhukrupa, Malviabhog, Lily, Hybrid -10, Goa manchur, T×V, Arunima, Kishanbhog, Mallika, Gajiria, Palmer, Maya, Muvandan, Ajod Sindurio, Kensington, Keitt, Kent, Arka Neelkiran, Arka Anmol, Sensation,CISHM-1 (Ambica), Karel (Rewa), Mahmood Vikarabad, Vellai Kolumban, Kokan Ruchi, Ratna, Hadgood seedling, Chandram, Fernandin and Apple	30	Gajiria, Malviabhog, Keitt, Mallika, Hybrid-10, Chandram and Bappakai	07

On the basis of present studies, it is concluded that mango accession, Bombai can be one of the resistant sources against mango hopper and accessions *viz.,* T×V, Bombai, CISHM-1 (Ambica), Mahmud Vikarabad, Vellai Kolumban, Mankurad and Ratna could be used as resistance sources for thrips in future breeding programmes.

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