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RESEARCH ARTICLE

Evaluation of Mango Germplasms for Resistance against Mango Shoot Gall Psylla, *Apsylla Cistellata* Ruckton (Homoptera: Psyllidae)

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Mango shoot gall psylla, *Apsylla cistellata* Buckton (Psyllidae: Homoptera) is one of the region specific serious pest of mango in India. The pest forms hard conical shaped green shoot galls in place of axillary and apical buds which hampers the initiation of inflorescences and retard the growth. A total of 100 mango genotypes were screened and evaluated against *A. cistellata* infestation during years 2011-12 to 2014-15. Genotype, Himayuddin, Lal Sinduria, Mulgoa Hill and Hybrid- 11/4 were found resistant against *A. cistellata* in field conditions. These genotypes can further be utilized for shoot gall psylla resistant breeding programmes.

Key Words: Mango, Shoot gall psylla, Resistance, Screening

Introduction

Mango, *Mangifera indica* L. the "king of fruits" is one of the main commercial tropical and sub-tropical grown fruit species in the world (Vasugi *et al*., 2012). Mango is believed to be originated from India and this country is considered as the home of several mango germplasms (Butani, 1979). More than 188 insect-pest species have been reported to attack on mango from India (Tandon and Vergheses, 1985). Among them, mango shoot gall psylla, *Apsylla cistellata* Buckton (Psyllidae: Homoptera) is one of the important pest of mango in various part of northern India, Nepal and Bangladesh (Singh, 2000). Its distribution is restricted to districts of Punjab, Tarai regions of Uttar Pradesh and Uttarakhand, Himachal Pradesh, parts of Bihar and entire Jharkhand of India (Rahman *et al*., 2016; Raina and Srivastava, 2018). The pest directly affects the mango production through formation of inflorescences and further fruit setting. The pest forms hard conical shaped green shoot galls in place of axillary and apical buds due to sucking of nymphs at particular place. Meanwhile nymphs feed inside the fully formed galls and grow up to adults. The infested twig shows the die back symptoms in due course of time. Ultimately an infested mango tree produces only 4-5 per cent fruits when compared to healthy trees (Singh, 2000; Raina and Srivastava, 2018). Mango shoot gall psylla is considered as specific and univoltine pest of mango. Adults usually emerged from galls in month of February-March and after that start lying eggs inside the marginal side of midrib of younger leaves. Hatching of eggs observed in the month of August-September and completes the life cycle in a year (Monobrullah *et al*., 1998; Kumar *et al*., 2007).

Absence of effective biocontrol agents, use of recommended insecticides such as profenophos, thiomethoxam, dimethoate, quinalphos etc. is only viable reported control strategy against mango shoot gall psylla (Singh *et al*., 2015; Kadam, *et al*., 2017). Spray in the month of August-September at the time of egg hatching is also usually not effective due to heavy rains in a particular period. Once the insect makes the galls, spraying is not found too effective because the protective gall gives protection to gall insect against insecticidal sprays. Host Plant Resistance (HPR) is an eco-friendly and cost effective viable management strategy against such insect pest and is also recommended as a component of integrated pest management of *A. cistellata* in mango. The identified resistance sources can be used directly or indirectly in breeding programmes for development of *A. cistellata* resistant mango. Hence, in the present study, mango germplasm were screened in field conditions to find out the sources of resistance against *A. cistellata*.

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Materials and Methods

The experiment was conducted in National Germplasm Repository of Sub-tropical fruit crops at ICAR Research Complex for Eastern Region, Research Centre, Ranchi ($23^o45'$ N latitude, $85^o30'$ E longitude, elevation 620 m AMSL) Jharkhand, India. The germplasms in orchard are uniformly 25 years old. A total of 100 mango genotypes were selected for screening against mango shoot gall psylla over four consecutive years i.e. 2011-12 to 2014-15 under ICAR-National Innovations on Climate Resilient Agriculture (ICAR-NICRA) project. Each genotype has three replications at spacing of 10m x 10m. The agronomic practices for germplasm maintenance were same for all the assessed genotypes. The germplasm blocks were kept free from application of any insecticide and fungicides during the study period. Five shoots were selected randomly from each of four quadrants and therefore a total of 20 shoots were chosen from a tree. If psylla infested shoots were observed than number of galls on infested shoots were counted one shoot from each quadrant. For each genotype, three plants were selected for observations. Finally data were changed in per cent shoot infested and number of gall/s recorded per infested shoot for interpretation as a source of resistance. The data were observed at weekly intervals (NICRA team of mango pest surveillance, 2011). Genotypes were categorised in to four groups based on level of *A. cistellata* infestation and flower panicle initiation viz., genotype recorded no/less than 20 per cent shoots infestation with no/less than 3 number of galls per shoot were grouped as resistant (category I), genotype recorded 20 to 60 per cent shoots infestation with less than 3 number of galls per shoot or less than 20 per cent shoots infestation but more than 3 and up to 15 galls per shoots were grouped as moderately resistant (category II), genotype recorded 20 to 60 per cent shoots infestation with more than 3 and up to 15 galls per shoot were grouped in to susceptible (category III) and genotypes which recorded more than 60 per cent shoots infestation by shoot gall psylla along with more than 15 number of galls per shoot were grouped in to highly susceptible genotypes (category IV). The per cent shoot gall psylla infestation and number of gall per shoot were analysed through one way ANOVA and means were compared using Tukey's honestly significant difference (HSD) tests for comparison at probability level of 5%. All statistical analyses were performed using SPSS 21.0.

Results and Discussion

Germplasm of mango showed the statistically significant difference in terms of shoot gall psylla infestation (Table 1). Eleven genotypes were categorized as resistant source which have recorded less than 20 per cent shoots infested with less than three numbers of galls on infested shoots. The genotype, Himayuddin was found to consistently resistant where no galls were observed on shoots during observation period. The other three genotypes, Lal Sinduria, Mulgoa Hill and Hybrid- 11/4 also had high level of resistant against shoot gall psylla infestation (1.50, 2.92 & 0.75 per cent shoots infestation and 0.13, 0.48 & 0.06 galls per shoot, respectively). The other mango genotypes for resistant against shoot gall psylla infestation were observed as Hyder Saheb, Lucknow selection, Arka Neelkiran, Swarnajahangir, Hamlet, Hur and Benisan. These genotypes can be serving as potential resistance source for *A. cistellata* resistant breeding programmes. The genotypes, Kohitur (14.25 % shoot infested & 3.43 galls), Bhadaiya Sukul (15.00 % shoot infested & 4.23 galls), Arka Anmol (19.25 % shoot infested & 5.77 galls), and Kesar (11.83 % shoot infested & 3.11 galls) were found moderately resistant consistently during observed years (2011-12 to 2014-15). Although, Dilsad, Hybrid-51, Neelgoa, Kalipari, Sammar bahist chausa, Sahable, Surkhavarna, Khiros Patti and Amir Pasand were categorized under II (moderately resistant) based on mean of observed data but based on individual year data, some of observed year particularly 2013 data theses genotypes regularly did not fall under moderately resistant criterion. Vastara (76.83 % shoot infested & 20.63 galls) followed Mithua Bihar (69.73 % shoot infested & 19.86 galls), Hathi Jhool (60.33 % shoot infested & 16.43 galls), Jhapatta (60.42 % shoot infested & 15.64 galls), Bhatuhi (60.33 % shoot infested & 15.01 galls) and Gulabi (60.75 % shoot infested & 18.56 galls) were found to highly susceptible. Total 70 mango genotypes were categorized as susceptible against *A. cistellata*. Therefore, on the basis of susceptible/resistant group index, 11 genotypes were found resistant, 13 were categorized as moderately resistant, 70 were susceptible and remaining 6 genotypes were found to be in group of highly susceptible to *A. cistellata* in present study (Table 2). Infestation and formation of galls on shoots are very critical especially gall formation in place of apical buds, where directly interfere the initiation of inflorescence (Raina and Srivastava, 2018). The number of galls and per cent shoot infestation is also directly

Table 1. Mango genotypes evaluated in the field conditions against mango shoot gall psylla, *Apsylla cistellata* infestation during years 2011-12 to 2014-15

Genotype	2012		2013		2014		2015		Mean	
	Per cent infested shoots*	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot
Vastara	51.33^{de}	9.68^{cd}	91.67^{e}	20.92^{z}	72.67^{kl}	29.08^{p}	91.67^{l}	22.83^{jk}	76.83^{j}	20.63^{m}
Jahangir-I	30.01^{cd}	6.33^{bcd}	71.67^{de}	17.12^{xy}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	25.42^{cd}	5.86^{c}
Kala Pahar	12.33^{bc}	2.33^{ab}	86.67^{e}	17.85^{z}	51.67^{hi}	20.77^{lm}	85.67^{k}	22.77^{jk}	59.08^{hi}	15.93^{kl}
Piyara Phulo	20.00^{b}	4.58^{bc}	70.33^{de}	14.68^{v}	19.33^{cd}	9.00^{f}	94.00^{l}	22.50	50.92^{g}	12.69^{ghi}
Hathi Jhool	16.67^{bc}	3.90^{bc}	71.67^{de}	13.75^{u}	66.00^{jk}	25.75^{o}	83.00^{k}	22.32^{jk}	60.33^{hi}	16.43^{k}
Kohitur	1.33^{ab}	0.15^{a}	49.00^{c}	10.03^{op}	6.67^{ab}	2.55^{c}	0.00^{a}	0.00^{a}	14.25^{b}	3.18^{bc}
Jhapatta	37.33^{cd}	5.32^{bcd}	75.00^{de}	13.93^{u}	50.67^{hi}	21.45^{m}	78.67^{i}	21.87	60.42^{hi}	15.64^{kl}
Bhadaiya Sukul	0.00^{a}	0.00^{a}	11.67^{ab}	1.62^{ab}	20.00^{bc}	8.75^{f}	28.33^{c}	6.53^{de}	15.00^{b}	4.23^{cf}
Bag-e-bahar	11.00^{ab}	1.70^{ab}	45.00^{c}	8.43^{mn}	32.00^{ef}	14.37^{ij}	58.33^{g}	13.85^{gh}	36.58^{ef}	9.59^{fg}
Sari Khas	1.67^{ab}	0.43^{ab}	66.67^{de}	13.00^{s}	50.67^{hi}	22.75^{mn}	78.33^{i}	20.73^{jk}	49.33^{g}	14.23^{i}
Jarda	17.33^{bc}	2.58^{ab}	58.67^{d}	14.80^{v}	22.33^{de}	9.92^{g}	20.00^{b}	5.92^{cd}	29.58^{de}	8.30^{ef}
Hyder Sahab	0.00^{a}	0.00^{a}	43.33^{c}	2.80^{cd}	0.00^{a}	2.50^{c}	0.00^{a}	0.00^{a}	10.83^{b}	1.33^{b}
Mundappa Black	7.67^{ab}	0.78^{ab}	10.00^{ab}	1.33^{ab}	64.00	26.52^{o}	81.33^{k}	20.70^{jk}	40.75^{ef}	12.33^{h}
Black Andrew	0.00^{a}	0.00^{a}	74.67^{de}	6.03^{ij}	21.67	10.07^{fg}	0.00^{a}	0.00^{a}	24.08^{cd}	4.03^{c}
Anfas	3.00^{ab}	0.35^{a}	65.00^{d}	13.12^{t}	76.33	30.53^{p}	78.67^{i}	20.05^{kj}	55.75^{gh}	16.01
Kalapaddy	0.00^{a}	0.00^{a}	38.33^{bc}	8.08^{m}	60.00^{ij}	26.33^{o}	78.00^{i}	19.28^{j}	44.08^{fg}	13.43^{ik}
H/51/1	0.00^{a}	0.00^{a}	30.00^{bc}	4.67^{fg}	32.33^{ef}	14.62^{ij}	55.67^{fg}	13.92^{gh}	29.50^{d}	8.30^{ef}
Lucknow Selection	0.00^{a}	0.00^{a}	8.33^{ab}	1.25^{ab}	6.67^{ab}	3.00^{c}	0.00^{a}	0.00^{a}	3.75^{a}	1.06^{a}
Ituraba	0.00^{a}	0.00^{a}	13.33^{ab}	1.33^{bc}	65.00^{jk}	27.82	82.67^{jk}	21.68^{jk}	40.25^{e}	12.71^{h}
Mulgoa hill	0.00^{a}	0.00^{a}	11.67^{ab}	1.92^{bc}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	2.92^{a}	0.48^{ab}
Swarnrekha-1	5.00^{ab}	1.15^{ab}	65.00^{d}	11.95^{qr}	41.33^{gh}	16.28^{jk}	89.33^{k}	20.13^{j}	50.17^{g}	12.38^{h}
Dilsad	20.67^{bc}	3.47^{bc}	30.00^{b}	5.58^{hi}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	12.67^{bc}	2.26^{b}
Ratna	0.00^{a}	0.00^{a}	76.00^{de}	16.35^{x}	3.33^{ab}	1.87^{c}	71.67^{i}	20.18^{jk}	37.75^{ef}	9.60^{fg}
Neelphanso	29.00^{bc}	4.65^{bc}	72.00^{de}	14.03^{u}	40.33^{fg}	19.70^{l}	84.67^{jk}	21.68^{jk}	56.50^{h}	15.02^{k}
Nileshwari	7.33^{a}	1.45^{ab}	71.67^{de}	12.58^{s}	36.00^{fg}	15.40^{j}	74.33^{i}	20.65^{jk}	47.33^{fg}	12.52^{h}
Barbelia	46.00^{de}	7.82^{cd}	71.67^{de}	14.08^{u}	54.67^{hi}	25.60^{no}	51.67^{f}	14.32^{h}	56.00^{h}	15.45^{k}
Dashehari Mahmooda	18.00^{bc}	4.05^{bc}	38.33^{bc}	7.42^{kl}	35.00^{fg}	16.28^{jk}	46.00^{e}	12.55^{g}	34.33^{e}	10.08^{fg}
Arka Neelkiran	5.67^{ab}	0.80^{ab}	33.33^{bc}	2.85^{cd}	5.00^{ab}	2.52^{c}	0.00^{a}	0.00^{a}	11.00^{b}	1.54^{b}
Hybrid/51	0.00^{a}	0.00^{a}	30.00^{bc}	4.33^{fg}	40.00^{fg}	17.73^{k}	62.33^{h}	18.97^{i}	33.08^{e}	10.26^{g}
Arka Anmol	2.00^{ab}	0.33^{a}	46.67^{cd}	11.08^{q}	28.33^{ef}	15.63^{j}	0.00^{a}	0.00^{a}	19.25^{c}	6.76^{de}
Bennet Alphanso	4.00^{ab}	0.65^{ab}	30.00^{bc}	5.75^{ij}	33.67^{fg}	16.07^{j}	21.67^{bc}	2.83^{b}	22.33^{cd}	6.33^{de}
Ratnagiri Alphanso	7.33^{ab}	1.55^{ab}	81.67^{e}	18.23^{z}	24.33^{de}	11.32^{h}	73.00^{i}	17.38^{ij}	46.58^{fg}	12.12^{h}
Amini	0.00^{a}	0.00^{a}	23.33^{b}	4.08^{ef}	0.00^{a}	0.00^{a}	75.33^{i}	18.18^{ij}	25.42^{cd}	5.57^{d}
Sabari	5.00^{ab}	0.70^{ab}	61.67^{d}	11.08^{q}	47.00^{gh}	15.77^{j}	74.67^{i}	17.67^{ij}	47.08^{fg}	11.30^{gh}
Bara Sinduria	37.00^{cd}	6.33^{bc}	78.33^{e}	16.00^{wx}	6.00^{ab}	2.43^{bc}	56.67^{g}	10.17^{fg}	44.50^{fg}	8.73^{ef}
Jawahar	24.00^{c}	3.93^{bc}	51.67^{cd}	10.42^{pq}	45.67^{g}	18.37^{k}	47.67^{ef}	8.92^{f}	42.25^{f}	10.41^{gh}
Sindhu	12.00^{bc}	1.62^{ab}	45.00^{cd}	8.50^{mn}	13.00^{abc}	4.18^{d}	45.00^{e}	10.08^{f}	28.75^{d}	6.10^{de}

Genotype	2012		2013		2014		2015		Mean	
	Per cent infested shoots*	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot
Lal Sinduria	0.00^{a}	0.00^{a}	5.00^{b}	0.50^{b}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	1.25^{a}	0.13^{a}
Hybrid/27	4.33^{ab}	0.62^{ab}	30.00^{bc}	0.65^{b}	13.33^{abc}	6.53^{e}	40.00^{d}	7.08^{e}	21.92^{cd}	3.72^{c}
Sabari-1	0.00^{a}	0.00^{a}	94.00^{e}	7.72^{l}	0.00^{a}	0.00^{a}	81.67^{j}	18.17^{ij}	43.92^{fg}	6.47^{de}
Chinnarasam	0.00^{a}	0.00^{a}	80.33^{e}	15.82^{vw}	2.67^{ab}	1.05^{ab}	68.33^{h}	16.98^{hi}	37.83^{ef}	8.46^{e}
Swarnajahangir	3.33^{ab}	0.28^{a}	12.67^{a}	3.00^{de}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	4.00^{b}	0.82^{b}
Swarnaguddi	27.67^{c}	5.98	63.33^{d}	13.10st	0.00^{a}	0.00^{a}	23.00^{bc}	5.32^{c}	28.50^{d}	6.10^{de}
Pedarasam	1.67^{ab}	0.18^{a}	49.33^{cd}	10.17^{op}	0.00^{a}	0.00^{a}	50.00^{f}	10.88^{f}	25.25^{c}	5.31^{c}
Totapuri	21.67^{b}	3.30^{bc}	71.33^{d}	14.98^{v}	28.33^{ef}	10.60^{g}	29.67^{cd}	6.17^{d}	37.75^{f}	8.76^{ef}
Nileshan	5.33^{ab}	0.80^{ab}	21.67^{b}	4.97^{gh}	38.33^{f}	14.78^{j}	25.67^{b}	5.98^{c}	22.75^{cd}	6.63^{de}
Hamlet	0.00^{a}	0.00^{a}	33.00^{bc}	2.50^{cd}	0.00^{a}	1.80^{bc}	0.00^{a}	0.00^{a}	8.25^{b}	1.08^{ab}
Neelam	38.67^{cd}	5.95^{cd}	27.33^{bc}	6.33^{jk}	42.33^{gh}	17.15^{k}	50.00^{f}	12.00^{g}	39.58^{e}	10.36^{gh}
Chandrakiran	16.67^{bc}	1.67^{ab}	79.33^{e}	17.48^{z}	0.00^{a}	0.00^{a}	73.33^{i}	15.57^{h}	42.33^{f}	8.68^{ef}
Alampur Benisan	22.67^{cd}	7.65^{cd}	78.00^{e}	17.27^{yz}	79.00^{kl}	19.47	28.33^{cd}	6.65^{de}	52.00^{gh}	12.76^{hi}
Dudhia Malgoa	14.33^{bc}	2.87^{bc}	81.33^{e}	15.93^{w}	78.00^{kl}	18.82^{kl}	67.33^{h}	16.08^{i}	60.25^{i}	13.43^{hi}
Jahangir-II	48.33^{de}	12.25	69.67^{de}	13.43^{tu}	28.67^{ef}	11.62^{h}	61.00^{g}	12.27^{g}	51.92^{gh}	12.39^{hi}
Kesar	4.67^{ab}	0.78^{ab}	21.67^{b}	6.62^{k}	0.00^{a}	0.00^{a}	21.00^{b}	4.03^{c}	11.83^{b}	2.86^{bc}
Champa	52.91^{de}	15.39	53.67^{cd}	11.25^{qr}	26.67^{de}	11.20^{h}	45.33^{e}	12.15^{g}	44.64^{fg}	12.50^{hi}
Kesington	11.67^{bc}	2.95^{bc}	47.33^{cd}	9.62^{no}	6.67^{ab}	2.55^{c}	0.00^{a}	0.00^{a}	16.42^{c}	3.78^{c}
Intemax	11.33^{b}	2.08^{ab}	43.33^{cd}	7.98^{m}	21.67^{de}	8.88^{f}	44.33^{e}	13.08^{gh}	30.17^{de}	8.01^{ef}
Illaichi	0.00^{a}	0.00^{a}	26.67^{bc}	5.93^{ij}	0.00^{a}	0.00^{a}	26.67^{cd}	5.08^{c}	13.33^{bc}	2.75^{c}
Lahutia	45.25^{d}	10.47^{ef}	45.00^{cd}	10.08^{op}	24.33^{de}	10.18^{g}	22.67^{cd}	6.37^{d}	34.31^{e}	9.28^{f}
Neeluddin	22.00^{bc}	3.07^{bc}	58.33^{cd}	12.87st	13.33^{abc}	6.35^{e}	0.00	0.00^{a}	23.42^{c}	5.57^{d}
Bhatuhi	60.67^{ef}	10.32^{e}	72.67^{de}	17.27^{xy}	3.33^{ab}	13.10^{i}	95.67	17.55^{ij}	60.33^{i}	15.01^{k}
Hybrid-51	7.00^{ab}	1.42^{ab}	35.33^{bc}	6.67^{k}	22.33^{de}	8.27^{f}	0.00^{a}	0.00^{a}	16.17^{bc}	4.09^{c}
Neelgoa	5.00^{ab}	0.48^{ab}	29.33^{bc}	4.45^{fg}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	8.58^{b}	1.23^{ab}
Jarda II	8.00^{ab}	1.05^{ab}	31.33^{bc}	4.80^{gh}	14.33^{abc}	6.20^{e}	27.67^{cd}	5.95^{cd}	20.33^{cd}	4.50^{c}
Mohan Thakur	9.67^{ab}	1.43^{ab}	26.33^{bc}	5.03^{gh}	3.33^{ab}	1.42^{b}	26.67^{c}	5.98^{cd}	36.50^{ef}	3.47^{c}
Swarnarekha - 2	5.00^{ab}	0.58^{ab}	42.33^{c}	8.17^{mn}	38.00^{fg}	17.15^{k}	75.67^{i}	15.45^{h}	40.25^{ef}	10.34^{gh}
Hybrid-13	26.33^{c}	3.75^{bc}	35.00^{bc}	7.57^{lm}	56.67^{ij}	23.10^{n}	0.00^{a}	0.00^{a}	29.50^{de}	8.60^{ef}
Hybrid-14	18.67^{bc}	4.30^{bc}	71.33^{de}	12.67st	25.00^{de}	9.30^{f}	53.33^{f}	12.12^{g}	42.08^{f}	9.60^{fg}
Hybrid-165	17.33^{bc}	4.08^{bc}	61.67^{d}	15.33	15.33^{abc}	0.28^{a}	51.00^{f}	11.92^{g}	36.33^{f}	7.90^{ef}
Hybrid-20	1.67^{a}	0.28^{a}	20.00^{b}	4.90^{gh}	17.00^{abc}	8.38^{f}	24.00^{bc}	5.43^{c}	15.67^{b}	4.75^{c}
Pulihara	38.67^{cd}	5.43^{bc}	53.33^{cd}	10.95^{q}	62.67^{ij}	27.23^{op}	66.67^{h}	17.27^{ij}	55.33^{gh}	15.22^{k}
Peter	20.33^{bc}	4.02^{bc}	62.00^{d}	12.52st	48.00^{gh}	24.65^{no}	78.33^{ij}	19.83^{j}	52.17^{gh}	15.25^{k}
Mithua Bihar	53.91^{de}	13.07^{f}	86.67^{e}	18.08	59.00^{ij}	28.95^{p}	79.33^{ij}	19.32^{j}	69.73^{i}	19.86^{m}
Hybrid-11/4	3.00^{ab}	0.00^{a}	0.00^{a}	0.25^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.75^{a}	0.06^{a}
Himayuddin	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}
Gulabi	31.00^{bc}	8.12^{cd}	55.00^{cd}	14.78^{v}	76.67^{kl}	30.80^{pq}	76.33	20.55^{jk}	60.75^{hi}	18.56^{lm}
Rajapuri	19.00^{bc}	3.25^{bc}	20.00^{b}	4.00^{ef}	26.67^{de}	11.78^{h}	27.00^{c}	6.92^{de}	23.17^{cd}	6.49^{de}
Kalipari	20.33^{bc}	3.95^{bc}	49.67^{cd}	11.83^{qr}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	17.50^{c}	3.95^{c}

Genotype	2012		2013		2014		2015		Mean	
	Per cent infested shoots*	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot	Per cent infested shoots	No. of galls/ infested shoot
Sammar Bahist Chausa	5.33^{ab}	1.07^{ab}	0.00^{a}	0.00^{a}	17.67^{abc}	8.65^{f}	0.00^{a}	0.00^{a}	5.75^{a}	2.43^{b}
Fazri Zafrani	35.67^{cd}	7.58^{d}	52.67^{cd}	11.55^{qr}	71.00^{jk}	16.25^{j}	77.33^{ij}	16.93^{i}	59.17^{h}	13.08^{hk}
Hybrid-115	12.67^{ab}	1.43^{ab}	41.00^{cd}	8.17^{mn}	0.00^{a}	0.00^{a}	23.00^{bc}	5.90^{cd}	19.17^{c}	3.88^{c}
Sahabale	0.00^{a}	0.00^{a}	79.33^{e}	15.92^{w}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	19.83^{c}	3.98^{c}
Sesar	21.33^{ab}	2.95^{bc}	81.67^{e}	17.28^{xy}	0.00^{a}	0.00^{a}	73.00^{i}	20.38^{j}	44.00^{f}	10.15^{g}
Surkhavarn	9.00^{ab}	1.58^{ab}	43.33^{cd}	9.48^{o}	1.00^{ab}	0.50^{a}	26.00^{c}	5.20^{c}	19.83^{c}	4.19^{c}
Jalal	0.00^{a}	0.00^{a}	61.67^{d}	16.00^{x}	0.00^{a}	0.00^{a}	33.67^{d}	8.43^{f}	23.83^{cd}	6.11^{de}
Pairi	6.00^{ab}	0.65^{ab}	53.33^{cd}	12.48^{s}	28.33^{ef}	10.53^{gh}	65.00	16.68^{i}	38.17^{ef}	10.09^{fgh}
Fernandin	8.00^{ab}	2.10^{ab}	71.67^{de}	12.90^{st}	28.00^{ef}	9.42^{fg}	24.00^{bc}	5.62^{c}	32.92^{de}	7.51^{e}
Papaya Khas- I	6.00^{ab}	0.85^{ab}	70.00^{de}	17.55^{z}	15.67^{abc}	4.85^{d}	0.00^{a}	0.00^{a}	22.92^{c}	5.81^{c}
Khiros Patti	1.00^{ab}	0.20^{a}	45.00^{cd}	8.82^{n}	0.00^{a}	0.00^{a}	25.67^{bc}	5.53^{c}	17.92^{c}	3.64^{c}
HARP Selection	23.00^{bc}	2.90^{bc}	69.00^{de}	18.23^{xy}	35.00^{fg}	10.95^{g}	29.67^{cd}	5.27^{c}	39.17^{ef}	9.34^{fg}
Asduith	22.00^{bc}	4.35^{bc}	58.00^{cd}	11.73^{rs}	0.00^{a}	0.00^{a}	44.67^{e}	11.50^{g}	31.17^{d}	6.90^{d}
Vanraj	9.00^{ab}	1.55^{ab}	86.67^{e}	20.22^{xy}	28.00^{ef}	8.68^{f}	0.00^{a}	0.00^{a}	30.92^{de}	7.61^{e}
Hur	7.00^{ab}	0.45^{ab}	34.67^{bc}	2.50^{cd}	0.00^{a}	2.00^{bc}	0.00^{a}	0.00^{a}	10.42^{b}	1.24^{ab}
Benisan	1.00^{ab}	0.25^{a}	27.33^{bc}	2.33^{cd}	0.00^{a}	1.50^{bc}	0.00^{a}	0.00^{a}	7.08^{b}	1.02^{ab}
Bombay Selection	7.00^{ab}	2.00^{ab}	73.33^{de}	18.98^{xy}	16.67^{abc}	4.15^{d}	70.00^{hi}	18.07	41.75^{f}	10.80^{gh}
Indonesia	42.00^{cd}	8.85^{cd}	75.00^{de}	19.65	45.33^{gh}	13.77^{i}	24.00^{bc}	5.82^{cd}	46.58^{f}	12.02
Amir Pasand	0.00^{a}	0.00^{a}	48.67^{c}	11.45^{qr}	24.67^{de}	6.93^{e}	0.00^{a}	0.00^{a}	18.33^{c}	4.60^{c}
Buponix	20.00^{bc}	2.75^{b}	86.67^{e}	19.52	28.33^{ef}	10.25^{g}	71.67^{hi}	16.13^{i}	51.67^{g}	12.16^{hi}
Alif Laila	47.60^{de}	9.50^{cd}	60.00^{cd}	11.07^{q}	21.67^{de}	6.37^{e}	70.33^{h}	17.67	49.90^{g}	11.15^{gh}
Baramasia Yogada	33.80^{cd}	4.61^{bc}	66.33^{de}	14.78^{v}	23.00^{de}	7.95^{ef}	47.33^{ef}	9.98^{f}	42.62^{f}	9.33^{fg}
Papaya Khas- II	45.45^{de}	8.50^{cd}	71.00^{de}	16.75^{y}	1.33^{ab}	0.60^{ab}	0.00^{a}	0.00^{a}	29.45^{de}	6.46^{de}
SE(m)	3.75	0.85	6.20	0.15	2.25	0.36	2.12	0.42	2.24	0.45
LSD ($P = 0.05$)	10.42	2.36	17.26	0.45	6.27	1.05	5.90	1.17	6.24	1.25
F calculated	17.63	15.62	11.79	1238.21	106.67	660.02	262.72	360.22	303.90	568.51
Error degree of freedom	396	396	396	396	396	396	396	396	396	396

*Value following different letter down the column are significantly different using Tukey's HSD test

proportional to initiation of inflorescence in shoot gall psylla infested mango trees (Raina and Srivastava, 2018). Therefore in the present study, 100 mango genotypes in four years were screened on the basis of per cent shoot infested and number of galls formed on infested shoot to understand the relative preference of *A. cistellata* to various mango genotypes. Earlier some preliminary work on varietal screening against *A. cistellata* has been done in Himachal Pradesh and Uttarakhand (Gupta *et al*., 1994; Singh, 2000). Singh (2000) studied the varietal preference based on two years data and screen out the 113 mango varieties against *A. cistellata* infestation and reported that 20 varieties viz., Annanas, Awain, Baramalda, Chinnaswaranrekaha, Delicious, Gulabkhas, K.O.7, K.O.-11, Makaram, Maharaja of Mysore, Mohamddi, Mundappa, Nowneetum, N x Panchadharakalsa, Panchadhara Kalsa, Police, Sonakullu, Salem Banglora and Vellakachi were categorized as resistant in field conditions.

Table 2. Categorizations of evaluated mango germplasms based on shoot gall psylla, *Apsylla cistellata* infestation during 2011-12 to 2014-15

Resistant category	Genotype/s	Number of genotypes
Category I (Resistant)	Hyder Sahab, Lucknow Selection, Mulgoa Hill, Arka Neelkiran, Lal Sinduria, Swarnajahangir, Hamlet, Hybrid- 11/4, Himayuddin, Hur, Benisan	11
Category II (Moderately resistant)	Kohitur, Bhadaiya Sukul, Arka Anmol, Kesar, Dilsad, Hybrid-51, Neelgoa, Kalipari, Sammar bahist chausa, Sahable, Surkhavarn, Khiros Patti, Amir Pasand	13
Category III (Susceptible)	Jahangir-I, Kala Pahar, Piyara Phulo, Bag-e-bahar, Sari Khas, Jarda, Mundappa Black, Black Andrew, Anfas, Kalapaddy, H/51/1, Iturba, Swarnrekha-1, Ratna, Neelphanso, Nileshwari, Barbelia, Dashehari Mahmooda, Bennet Alphanso, Ratnagiri Alphanso, Amini, Sabari, Bara Sinduria, Jawahar, Sindhu, Hybrid/27, Sabari-1, Chinnarasam, Swarnaguddi, Pedarasam, Totapuri, Nileshan, Neelam, Chandrakiran, Alampur Benisan, Dudhia Malgoa, Jahangir-II, Champa, Kesington, Intemax, Illaichi, Lahutia, Neeluddin, Hybrid-51, Jarda-II, Mohan Thakur, Swarnarekha-2, Hybrid-13, Hybrid-14, Hybrid-165, Hybrid-20, Pulihara, Peter, Rajapuri, Fazri Zafrani, Hybrid-115, Sesar, Jalal, Pairi, Fernandin, Papaya Khas-I, HARP selection, Asduith, Vanraj, Bombay Selection, Indonesia, Buponix, Alif Laila, Baramasia Yogada, Papaya Khas-II	70
Category IV (Susceptible)	Vastara, Hathi Jhool, Jhapatta, Mithua Bihar, Bhatuhi, Gulabi	6

We conclude that mango genotype, Himayuddin, Lal Sinduria, Mulgoa Hill and Hybrid- 11/4 grouped as resistant sources against *A. cistellata* in field condition based on four years continuous data observations.

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