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Reaction of menthol mint (*Mentha arvensis*) genotypes to sweetpotato whitefly (*Bemisia tabaci*) and bean golden mosaic virus (*Begomovirus* spp) in northern India

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ABSTRACT

The identification of potential pest resistance to plant genotypes is considered most economical and eco-friendly for integrated pest management programmes in agriculture. In this study, population of sweetpotao whitefly [*Bemisia tabaci* Genn. (Hemiptera: Aleyrodidae)] pupae, adult forms, and bean golden mosaic virus (*Begomovirus* spp) infections were sampled at different stages of growth in various menthol mint (*Mentha arvensis* Linn.) genotypes under natural field conditions at Lucknow and a variation in resistance potential was observed among genotypes. Among 26 menthol mint genotypes, MA-6, Damroo, Gomti, MAS-31, MAS-3F, MA-5, Sambhav, MAS-216V, MAB-1, MAR-45, MAS-265, Shivalik, and Kushal were found associated with low numbers of pupae while MAB-1, MAS-1-98-1, H. Putra, MAS-92-3, MA-5, MAS-92-2, Shivalik, MAS-92-1, Kushal, Gomti, Saksham, MAS-35 and Sambhav were found attacked by low number of adult of *B. tabaci* significantly (*P*=0.01). However, menthol mints genotypes; MA-6, MAB-1, MA-3 and Kalka were found infected with low number of twigs significantly (*P*=0.01) by bean golden mosaic virus. Overall, the *M. arvensis* clone of MAB-1 was found significantly less attacked by pupae and adult of *B. tabaci* and *Begomovirus* infection. These pest- and -disease resistant genotypes can be used in future hybridization programmes for developing new high-yielding menthol mint varieties.

Key words: *Begomovirus, Bemisia tabaci*, *Mentha arvensis*, Population, Resistance, Sampling

Sweetpotato whitefly (*Bemisia tabaci* Genn.) is one of the most injurious insect pests of agriculture which attacks more than 500 species of plants throughout the world. This insect has been reported as serious pest of a large number of cultivated crops in tropical and sub-tropical areas including Africa, America and West Indies etc. Whitefly damages the plants by piercing and sucking the sap from foliage resulting in early wilting of the plant, thereby reducing the plant growth rate and oil yield. Whitefly adults secrete honeydew which serves as substrate for growth of black shooty mould on leaves and thus hampering the plant photosynthesis. Whitefly transmits plant viruses that lead to about forty diseases of vegetables, fibre, and horticultural crops worldwide with yield losses ranging from 20 to 100% depending upon the crop and the season (Singh and Sachan 2004). The sweetpotato whitefly is being regularly found in commercial fields of new improved varieties of mints in northern India since 1991 (Singh *et al.* 2004). Evidently, bean golden mosaic virus (*Begomovirus* spp) disease is found to cause damage in mint crop which is usually transmitted by whitefly at growers field (Samad *et al*. 2009). Efforts have been made to manage the whitefly in various crops using synthetic pesticides and biological control etc. which have been found uneconomical in most of the crops including menthol mint (unpublished data). This pest has developed resistance towards most of the available pesticides all over the world (Prabhakar *et al*. 1992). Evaluation of plant genotypes for resistance potential to insect pests have been found more environmentally safe and economical module of pest management in various crops for integrated pest management programme. However, little contributions on evaluation of menthol mint genotypes against whitefly have been worked out in field conditions. With this aim, different menthol mint (*Mentha arvensis* Linn.) genotypes were evaluated for their resistance potential against pupae, adult of *B. tabaci,* and *Begomovirus* infection by conducting field experiments under natural conditions in northern part of India at Lucknow. The results of the field experiment are being discussed in this communication.

MATERIALS AND METHODS

Twenty-six different menthol mint genotypes including collections from various sources, breeding clones and released

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varieties having variability for plant morphology and oil-yielding potential maintained at research farm of CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, India, located at 26.5°N latitude, 80.5°E longitude and at an altitude of 120 m above the mean sea level were undertaken for the study during February to June 2009 (Table 1). These clones were planted in furrows using stolons at a distance of 15 cm × 60 cm apart in plot (5.40 m × 2.70 m) replicated thrice in a randomized block Design (RBD). Ten full grown middle leaves of each menthol mint genotype were randomly collected from each plot on five different sampling dates at week interval during growth and developmental stages of the crop and the number of pupae (4th stage; last nymphal stage) of sweetpotato whitefly were counted in the laboratory using powerful hand lenses. The yellow sticky traps (YST) was used for counting the adult whitefly on each genotype on the basis of colour attraction as used earlier by Singh and Singh, Singh *et al*. (2004). The traps were placed in each plot between two rows in the morning (6 AM) and adults attached to adhesive on upper surface of the YST were counted by visual observation after three hours at 9 AM under field conditions on six different sampling dates during the growth period of mint crop. The observations on *Begomovirus* infection in each plot of menthol mint genotypes were recorded by counting the number of healthy and infected twigs/m^2 area which led to the calculation of per cent infection (Table 2).

The mean cumulative seasonal population data on number of pupae and adult of *B. tabaci,* and number of infected menthol mint twigs with *Begomovirus* spp in each

Table 1 Source of collection and oil-yielding potential of different menthol mint genotypes

Genotype	Calculated Mean fresh herb yield (kg/m^2)	Calculated Mean fresh herb yield (tonnes//ha)	Mean* oil contents (ml/100g fresh weight)	Menthol (%)
MAS 265	1.6	16	0.60	68.3
MAS 216V	1.5	15	0.70	74.2
MAS 216	2.1	21	0.62	70.1
MAS 194	1.5	15	0.55	68.6
MAS 174	1.8	18	0.70	76.2
MAS 35	1.8	18	0.63	74.7
MAS 31	1.1	11	0.50	80.2
MAS 3F	0.8	08	0.48	74.8
KUSHAL	2.4	24	0.75	76.6
DAMROO	1.0	10	0.60	75.8
SAKSHAM	2.4	24	0.65	72.1
SAMBHAV	2.4	24	0.90	77.0
HIMALAYA	1.8	18	0.75	73.7
GOMTI	1.1	11	0.60	76.9
SHIVALIK	3.1	31	0.50	78.7
KALKA	1.4	14	0.55	81.2
MAS 1-98-1	3.2	32	0.45	73.7
H. PUTRA	3.1	31	0.65	76.9
MAS 92-3	1.9	19	0.30	61.3
MAS 92-2	1.7	17	0.30	61.2
MAS 92-1	2.2	22	0.30	62.8
MAB 1	2.4	24	0.55	71.6
MAR 45	1.6	16	0.45	39.1
MA 6	0.6	06	0.38	31.4
MA 5	2.2	22	0.55	73.4
MA 3	2.0	20	0.35	56.1

*Mean of three replications

Table 2 Population dynamics of sweetpotato whitefly (*Bemisia tabaci*), pupae adult and infection intensity of bean golden mosaic virus (*Begomovirus* spp.) in menthol mint genotypes at CSIR-CIMAP Research Farm, Lucknow

Genotype	Mean* cumulative seasonal population		
	Bemisia tabaci/yellow sticky trap		*Begomovirus* spp infection/ m^2
	Pupae	Adult	
MAS 265	12.80**	299.46	35.28
MAS 216V	09.86**	264.63	34.83
MAS 216	21.60	224.70	28.88
MAS 194	15.13	278.50	33.51
MAS 174	22.46	221.56	22.78
MAS 35	19.40	205.33**	32.88
MAS 31	06.33**	249.36	47.52
MAS 3F	06.53**	280.30	21.17
KUSHAL	14.33**	189.36**	33.43
DAMROO	04.66**	342.26	25.14
SAKSHAM	18.60	195.13**	27.32
SAMBHAV	07.93**	220.66**	30.69
HIMALAYA	19.46	221.53	36.46
GOMTI	06.20**	194.53**	22.96
SHIVALIK	13.46**	186.20**	26.85
KALKA	20.60	246.96	18.44**
MAS 1-98-1	22.73	145.13**	28.82
H. PUTRA	27.33	146.93**	27.76
MAS 92-3	14.86	163.90**	24.99
MAS 92-2	15.73	197.63**	23.91
MAS 92-1	22.73	189.03**	26.25
MAB 1	10.00**	120.30**	06.54**
MAR 45	10.93**	263.06	18.46
MA 6	02.80**	337.13	02.06**
MA 5	07.53**	180.96**	25.75
MA 3	17.60	254.53	17.69**
SEM	3.052	26.540	4.308
LSD (P=0.01)	11.560	100.515	16.318
LSD (P=0.05)	08.670	075.390	12.239

*Means of pooled analysis of five samplings at a week interval genotypes were statistically analyzed by calculating critical difference through NE version 0.5. The least significance variance (LSD) at *P*=0.01 and *P*=0.05 probability was used to test the significance of difference among treatment means. Correlation co-efficient was analyzed by mean values of cumulative seasonal outbreak of whitefly population and bean golden mosaic virus infection in menthol mint.

RESULTS AND DISCUSSION

Among 26 menthol mint genotypes evaluated for their resistance potential to sweetpotato whitefly pupae, 13 mint genotypes; MA 6, Damroo, Gomti, MAS 31, MAS 3F, MA 5, Sambhav, MAS 216V, MAB 1, MAR 45, MAS 265, Shivalik, and Kushal were found associated with average low numbers of pupae 02.80, 04.66, 06.20, 06.33, 06.53, 07.53, 07.93, 09.86, 10.00, 10.93, 12.80, 13.46 and 14.33 per ten leaves, respectively. However, the menthol mint genotypes MAB 1, MAS 1-98-1, H. Putra, MAS 92-3, MA 5, MAS 92-2, Shivalik, MAS 92-1, Kushal, Gomti, Saksham, MAS 35 and Sambhav were found attacked by low number of adult of *B. tabaci*; 120.30, 145.13, 146.93, 163.90, 180.96, 197.63, 186.20, 189.03, 189.36, 194.53, 195.13, 205.33 and 220.66 per YST, respectively significantly (*P*=0.01). However, menthol mint genotypes; MA-6, MAB-1, MA-3 and Kalka were found infected by bean golden mosaic virus significantly (*P*=0.01) with average low number of twigs; 02.06, 06.54, 17.69 and 18.44/m^2 area, respectively. Overall, the *M. arvensis* clone of MAB 1 was found significantly (*P*=0.01) less attacked by pupae, adult of *B. tabaci* and *Begomovirus* infection (Table 1). The negative correlation co-efficient was found among cumulative seasonal outbreak of whitefly population and bean golden mosaic virus infection in menthol mint.

Evidently, the genetic differences and behaviour characteristics of whitefly (biotypes) may play role in host plant resistance (Perring *et al.* 1993). Similarly, Singh *et al.* (2010) have found highly resistant genetically diverse tomato genotypes (H 88-78-1) to bean golden mosaic virus transmitted through *B. tabaci* in both natural and artificial conditions. Among 16 exotic collections of gerbera grown under polyhouse conditions, two varieties Eva and Carocci have shown significantly high resistance potential to whitefly (Reddy and Aswath 2008). Under the screening 25 cotton genotypes to determine the role of morphological character in imparting resistance against sweetpotato whitefly, the genotypes having smooth leaf surface with short hair length and less number of leaf hairs had recorded lower population of whitefly nymphs and adults (Acharya and Bhargava 2008). However, no such work has been reported on reaction of menthol mint in field and/or polyhouse conditions to whitefly and bean golden mosaic virus till our reports (DS). Although, the detail studies on status of trichomes number, size and shape along with number of globules on leaf surface of menthol mint in relation to population of whitefly and transmission of virus may be further intriguing factor. Menthol mint genotype (MAB 1) resistant to whitefly and bean golden mosaic virus possibly be opted by growers for reduction in cost of production and environmental pollution in whitefly prone area of agriculture ecosystems, and be used in future hybridization programmes for developing new high-yielding pest- and disease-resistant varieties.

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