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Screening of turmeric (*Curcuma longa* L.) germplasm for resistance to shoot borer (*Conogethes punctiferalis* Guen.) (Lepidoptera: Pyralidae), in Kerala, South India

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ABSTRACT: Nine hundred and fifteen accessions of turmeric (*Curcuma longa* L.) available at Indian Institute of Spices Research, Kozhikode (Kerala, India) were screened in the field against the shoot borer (*Conogethes punctiferalis* Guen.) for four consecutive years. All the accessions were susceptible to the pest infestation. Rating of accessions in relation to the level of pest infestation indicated that none of the accessions was rated as resistant, whereas, 34, 412, 456 and 13 accessions were rated as moderately resistant, moderately susceptible, susceptible and highly susceptible, respectively, to the pest. © 2011 Association for Advancement of Entomology

KEYWORDS: turmeric, *Curcuma longa*, shoot borer, *Conogethes punctiferalis*, resistance

India is the largest producer of turmeric (*Curcuma longa* L.) (Zingiberaecae), in the world producing about 792,980 tonnes annually from an area of about 180,960 hectares (NHB, 2011). There is renewed interest in production of turmeric due to various biological and medicinal properties of curcumin, the main constituent of turmeric. The shoot borer (*Conogethes punctiferalis* Guen.) (Lepidoptera: Pyralidae) is the most serious pest of the crop in India (Devasahayam and Koya, 2007). The adult moths of the shoot borer lay eggs on the tender leaf and the larvae that hatches out bore into the shoots and feed on the inner core resulting in dead hearts or withered shoots.

The present recommendation of spraying insecticides for the management of the shoot borer is undesirable due to the increasing use of turmeric in medicinal and culinary preparations and as a food colourant. Development of resistant varieties and their incorporation in IPM schedules is an eco-friendly alternative for management

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of the pest. Earlier attempts to screen turmeric lines to the shoot borer indicated that Dindigram Ca-2 (Sheila *et al.*, 1980) and Manuthy Local (Philip and Nair, 1981) were least susceptible to the pest.Velayudhan and Liji (2003) identified 22 accessions that were more tolerant to the pest.

Screening of 915 turmeric accessions including indigenous and exotic types and seedling progenies was conducted at the Experimental Farm of Indian Institute of Spices Research, at Peruvannamuzhi (11°34′ N, 75°48′ E) (Kerala, India) for four years during 2005–09. The turmeric accessions were raised in large cement pots (45 cm height, 45 cm diameter) and filled with potting mixture containing soil, sand and dried powdered cow dung in 1:1:1 ratio and maintained under open conditions, The pots were place randomly, maintaining a distance of 50 cm between the pots. Three replications were maintained for each accession. Rhizomes (20–25 g size) of each accession were planted during June in the centre of the pot which developed into a clump, containing several shoots. All standard agronomic practices, except plant protection with pesticides were followed for raising the plants. The number of damaged (dead hearts/shoots with bore hole) and healthy shoots were recorded in each clump during October–November each year when the symptoms of pest damage reached its peak. The mean per cent shoot damage in each accession was calculated pooling the years.

The data obtained was subjected to ANOVA using SPSS package after arcsine transformation. The mean and standard deviation of maximum per cent shoot damage in each accession irrespective of the year was taken for calculating pest susceptibility ratings as per the method of Bhumanavar *et al.* (1989) and adopted for screening ginger germplasm against shoot borer (Devasahayam *et al.*, 2010):

1. Highly resistant: No shoot damage
2. Moderately resistant: Less than Mean – 2 SD shoot damage
3. Moderately susceptible: Mean – 2 SD to Mean shoot damage
4. Susceptible: Mean to Mean + 2 SD shoot damage
5. Highly susceptible: More than Mean + 2 SD shoot damage

All the turmeric accessions screened were susceptible to the shoot borer infestation. The pest susceptibility ratings of different accessions of turmeric indicated that none of the accessions was resistant, whereas, 34, 412, 456 and 13 accessions were moderately resistant, moderately susceptible, susceptible and highly susceptible, respectively, to the pest (Tables 1 and 2). All the moderately resistant accessions were indigenous types and seedling progenies. Among the improved varieties released by IISR, Kozhikode, none were moderately resistant whereas, Suguna, Sudarshana, Suvarna, Prabha, Prathiba and Kedaram were moderately susceptible to the pest.

Since the variation in the per cent shoot damage between various accessions was wide, it was not possible to fix the upper and lower limits of each group as constant values. Hence, the mean and standard deviation of the maximum shoot damage irrespective of the year was used for calculating various categories of resistance/susceptibility. The categorization based on the extent of variation from

TABLE 1. Reaction of turmeric accessions to shoot borer (*Conogethes punctiferalis*)

Category of resistance	Range of shoot damage (%) (Criteria for classification)	No. of accessions
Resistant	0	0
Moderately resistant	< 13.57 (less than mean – 2 SD)	34
Moderately susceptible	13.58 – 28.95 (mean – 2 SD to mean)	412
Susceptible	28.96 – 44.33 (mean to mean + 2 SD)	456
Highly susceptible	>44.34 (more than mean + 2 SD)	13

Mean = 28.95; SD = 7.69.

TABLE 2. List of turmeric accessions exhibiting a moderately resistant reaction to shoot borer (*Conogethes punctiferalis*)

Category of resistance	Accession
Moderately resistant	954, 619, 1026, 422, 435, 589, 687, 579, 964, 1028, 751, 693, 592, 1036, 1039, 483, 749, 438, 931, 972, 684, 413, 433, 419, 615, 930, 580, 381, 594, 1010, 911, 985, 1034, 932

The accessions are arranged in ascending order of shoot damage.

the mean (positive or negative) reduced the probabilities of inclusion of pseudo-resistant/susceptible accessions (Bhumanavar *et al.*, 1989).

Wide variations in pest susceptibility was also reported while screening brinjal germpalsm for resistance against shoot and fruit borer (*Leucinodes orbonalis* Guen.) (Lal *et al.*, 1976) and ginger germplasm for resistance against shoot borer (*C. punctiferalis*) (Devasahayam *et al.*, 2010). Earlier screening studies by Sheila *et al.* (1980) and Philip and Nair (1981) were conducted for a single year and with a limited number of accessions (13 and 9 accessions, respectively) only. Though Velayudhan and Liji (2003) screened 489 accessions, their study was limited to a single year only. The present study was conducted for four years, and the methodology adopted for rating the accessions also overcomes the variations in pest susceptibility during years. The 34 accessions which exhibited a moderately resistant reaction to the shoot borer in the present study provides a wide choice of breeding lines for developing turmeric varieties resistant to the shoot borer.

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REFERENCES

Bhumanavar B. S., Singh S. P. and Sulladmath V. V. (1989) Evaluation of citrus germplasm for resistance to the black aphid, *Toxoptera aurantii* (Boy) under tropical humid South Indian conditions. Insect Science and its Application 10: 81–88.

Devasahayam S. and Koya K. M. A. (2007) Insect pests of turmeric. In: *Turmeric. The Genus* Curcuma. Ravindran P. N., Babu K. N. and Sivaraman K. (Eds) CRC Press, Boca Raton, pp. 169–192.

Devasahayam S., Jacob T. K., Abdulla Koya K. M. and Sasikumar B. (2010) Screening of ginger (*Zingiber officinale* Rosc.) germplasm for resistance to shoot borer (*Conogethes punctiferalis* Guen.) (Lepidoptera: Pyralidae) in Kerala, South India. Journal of Medicinal and Aromatic Crops 32: 137–138.

Lal O. P., Sharma R. K., Verma T. S., Bhagchandani P. M. and Chandra J. (1976) Resistance in brinjal to shoot and fruit borer, *Leucinodes orbonalis* Guen. Vegetable Science 3: 111–115.

National Horticulture Board (NHB) (2011) *Indian Horticulture Database-2010.* National Horticulture Board, Gurgaon.

Velayudhan K. C. and Liji R. S. (2003) Preliminary screening of indigenous collections of turmeric against shoot borer (*Conogethes punctiferalis* Guen.) and scale insect (*Aspidiella hartii* Sign.). Journal of Spices and Aromatic Crops 12: 72–76.

Philip J., and Nair P. C. S. (1981) Field reaction of turmeric types to important pests and diseases. Indian Cocoa, Arecanut and Spices Journal 4: 107–109.

Sheila M. K., Abraham C. C. and Sivaraman Nair P. C. (1980) Incidence of the shoot borer (*Conogethes punctiferalis*) (Lepidoptera: Pyraustidae) on different types of turmeric. Indian, Cocoa, Arecanut and Spices Journal 3: 59–60.

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