

Screening of ginger (*Zingiber officinale*) germplasm for resistance to shoot borer (*Conogethes punctiferalis*)

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ABSTRACT

Four hundred and ninety two accessions of ginger *Zingiber officinale* Rosc. including popular cultivars and high yielding varieties were screened in the field against the shoot borer *Conogethes punctiferalis* Guen. for four consecutive years during 2001-04 at the experimental farm of Indian Institute of Spices Research (IISR), Peruvannamuzhi, Kerala, India. All the accessions were susceptible to the pest attack. None of the accessions was rated as resistant, whereas, 49, 251, 130 and 62 accessions were rated as moderately resistant, moderately susceptible, susceptible and highly susceptible, respectively, to the pest.

Key words: Ginger, *Zingiber officinale*, shoot borer, *Conogethes punctiferalis*, accessions.

INTRODUCTION

Ginger (*Zingiber officinale* Rosc.), an important spice and medicinal crop, is mainly grown in Nigeria, India, China, Indonesia, Thailand and Nepal. India with an area of about 113,550 hectares under the crop is the largest producer of ginger, contributing to about 31% of the world's production [3]. More than 30 species of insects have been reported to damage the crop in India including under storage, among which, shoot borer (*Conogethes punctiferalis* Guen.) (Pyralidae: Lepidoptera) is the most serious pest [5]. Adult moth lays eggs on the tender unopened leaf and the larvae on hatching scrape and feed on the green contents of the leaf; later they bore into the shoots and feed on the inner core, resulting in withered shoots. The yield of the crop is significantly affected when more than 45% of the shoots in a clump are damaged by the pest [6].

The shoot borer is managed by monthly spraying of malathion (0.1%) during July-October [7] or by integrating mechanical pruning and destruction of freshly damaged shoots during July-August and monthly spraying of malathion (0.1%) during September-October [1]. However, intensive use of

pesticides in the field for the management of the pest could result in pesticide residues in the produce, and may also cause harm to the ecosystem. Hence, development of resistant varieties and their incorporation in IPM schedules is a viable alternative for management of this pest. Twenty five ginger types were screened against the shoot borer at Vellanikkara (Kerala) and no significant differences among them were found in their reaction to the pest [9]. IISR, Calicut, Kerala maintains a large collection of ginger from Nepal, China, Taiwan, Japan, Fiji, Jamaica, Brazil, USA and Canada apart from indigenous collections, in the germplasm conservatory, offering great scope for identification of resistant sources. Keeping the above in view, the available ginger accessions (492) were evaluated for their resistance/susceptibility to the shoot borer.

MATERIALS AND METHODS

Screening of 492 ginger accessions including 26 popular cultivars and 3 high yielding varieties against the shoot borer was carried out for four consecutive years during 2001-04 at the experimental farm of IISR at Peruvannamuzhi (Kerala, India) (11°34'N, 75°48'E, 60 m MSL, mean annual rainfall 4461 mm). The ginger accessions raised in cement pots (45 cm height, 45 cm diameter) were filled with potting mixture and replicated twice. The pots were kept randomly in blocks of two rows, each row containing six pots, maintaining a distance of 50 cm between the pots in a row and rows in a block; a distance of 1 m separated each block. The pots were maintained under a green shade net (50% transparency) in the field.

Three rhizomes (20-25 g size) of each accession were planted during June/July in the centre of the pots at equal distances in a triangular lay out. All agronomic practices recommended by IISR, Calicut were followed for raising the plants except plant protection with pesticides [2]. The number of damaged (dead hearts/shoots with the characteristic bore hole) and healthy shoots were recorded in each pot once during November each year when the symptoms of pest damage reached its peak. The mean per cent shoot damage in each accession was calculated.

The data thus obtained was subjected to ANOVA using SPSS package after arcsine transformation. The mean and

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standard deviation of maximum per cent shoot damage in each accession irrespective of the year was taken for calculating pest susceptibility ratings [4].

RESULTS AND DISCUSSION

All the ginger accessions screened were susceptible to the shoot borer infestation. The rating of different accessions of ginger to the shoot borer indicated that none of the accessions was highly resistant, whereas, 49, 251, 130 and 62 accessions were moderately resistant, moderately susceptible, susceptible and highly susceptible, respectively, to the pest (Table 1). Among the popular cultivars, Jorhat, Rio-de-Janerio, Thingpui and Burdwan were rated as moderately resistant, and among the high yielding varieties released by IISR, Calicut, only Rejatha was moderately susceptible to the pest; Mahima and Varada were susceptible to the pest.

Table 1. Reaction of different accessions of ginger to shoot borer (*Conogethes punctiferalis*)

Category of resistance	Range of shoot damage (%)	No. of accessions
Highly resistant	0	Nil
Moderately resistant	0.1 – 12.5	49
Moderately susceptible	12.6 – 17.1	251
Susceptible	17.2 – 21.8	130
Highly susceptible	>21.8	62

The study indicated that none of the ginger accessions screened were highly resistant to the shoot borer; however, 49 accessions were moderately resistant 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 fixing various categories of resistance/susceptibility. The categorization based on the extent of variation from the mean (positive or negative) reduced the probabilities of inclusion of pseudo resistant/susceptible accessions [4].

Screening of 675 collections of turmeric (*Curcuma longa* L.) against the shoot borer at Vellanikara indicated that none of the collections were free of the pest infestation but 22 accessions were relatively tolerant to the pest [10]. Screening of 25 ginger types to the shoot borer also indicated that none was significantly different in their reaction to the pest; however, maximum shoot damage was observed in Valluvanad (43.4%) and minimum in Rio-de-Janeiro (21.3 %) [9]. Rio-de-Janeiro was found moderately resistant to the shoot borer in the present study also. The earlier studies quoted above were conducted for a single year only. During our study which

was conducted for four years, we could observe 50% shoot infestation in two accessions (Accs. 43 and 70) during 2001 which remained below 29% during the subsequent years. Such variation under natural infestation was also reported while screening brinjal germplasm for resistance against the shoot and fruit borer (*Leucinodes orbonalis* Guen.) [8]. The 49 accessions which exhibited a moderately resistant reaction in the present study provides the breeders with a wide choice of breeding lines for developing ginger varieties resistant to the shoot borer.

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