

## **Preliminary screening of indigenous collections of turmeric against shoot borer (*Conogethes punctiferalis* Guen.) and scale insect (*Aspidiella hartii* Sign.)**

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### **Abstract**

The incidence of shoot borer (*Conogethes punctiferalis* Guen.) and scale insect (*Aspidiella hartii* Sign.) was scored subjectively on 0-9 scale in an indigenous collection of 489 accessions under field epiphytotic conditions at Vellanikkara, Thrissur during 2001 cropping season. The collections belonged to 21 morphotypic groups of turmeric from different agroclimatic conditions in India. Morphotypic group wise incidence of shoot borer indicated that the lowest incidence of mean score 2 was observed in morphotype 2 followed by 2.6 in morphotype 14. Lowest scale insect incidence of 0.5 was scored in morphotype 6. Eighty accessions were free of scale insect but were susceptible to shoot borer. Maximum susceptibility to the scale insect was noticed in the case of IC 137023 and IC 88895. A total of 22 accessions were tolerant to shoot borer with <3 score.

**Key words:** *Aspidiella hartii*, *Conogethes punctiferalis*, *Curcuma longa*, varietal susceptibility, varietal tolerance, turmeric

In turmeric (*Curcuma longa* L.) several insect pests have been reported from India (Koya *et al.* 1991; Premkumar *et al.* 1994; Kotikal 2000). Among these, shoot borer (*Conogethes punctiferalis* Guen. Lepodoptera: Pyralidae) infests the crop and causes 'dead heart' symptoms affecting the crop production. Scale insect (*Aspidiella hartii* Sign. Hemiptera: Diaspididae) attack mature turmeric rhizome both in the field and in storage leading to decay and damage of the planting materials in turmeric collections (Nair 1982; Koya *et al.* 1991). The National Bureau of Plant Genetic Resources (NBPGR), New Delhi in association with Central Plantation Crops Research Institute, Kasargode and Indian Institute of Spices Research, Kozhikode had collected a number of genetic resources of indigenous

turmeric. Incidence of both shoot borer and scale insect was observed in these collections planted in maintenance plots but no serious attempts were made to record the relative susceptibility of these collections to these pests. The present study was made on turmeric accessions collected before 1997 and maintained in the field and nursery by annual regeneration. Since reports are scarce on screening of such a large indigenous germplasm collection against the above pests in the field epiphytotic condition, an attempt has been made for selecting tolerant lines which could be screened later under controlled conditions. The results of the study are furnished in the present report.

A total of 675 indigenous turmeric collections belonging to 21 distinct morphotypic groups

(as per the earlier morphological classification of the Indian turmeric germplasm by Velayudhan *et al.* 1999) were planted in May 2001 on raised beds (1 m<sup>2</sup>) with three plants per line at a distance of 30 cm from plant to plant and 75cm from line to line in the farm of NBPGR Regional Station, Vellanikkara, Thrissur. Collections (three plants per collection) were maintained on soil beds in an augmented design with two controls repeated randomly. The experimental plants were sprayed with quinalphos @ 0.1% during July-August only. Observations on the incidence of shoot borer and scale insect were recorded subjectively by assessing three plants per collection and converting them into objective values or scales varying between 0-9 in 489 accessions. Observations on collections falling under morphotypic group 3 and 4 could not be made due to their loss in the field. Shoot borer incidence was recorded in the first week of October and the scale insect incidence was recorded at the time of harvest during December. Morphotype wise

range, mean, standard deviation and pest incidence based on the following formula were calculated (Misra & Chowdhury 1997).

$$\text{Infestation severity (\%)} = \frac{\text{sum of all infestation ratings}}{\text{total number of ratings} \times \text{maximum score}} \times 100$$

Frequency distribution curve was obtained with respect to shoot borer and scale insect incidence.

The range, mean, standard deviation and percentage infestation for shoot borer and scale insect morphotype wise are furnished in table 1 and 2, respectively. The data on shoot borer incidence indicated that morphotypic group 2 had the lowest mean incidence of 2 followed by 2.6 in morphotypic group 14. With respect to incidence of scale insect morphotype wise mean varied from 0.50 in morphotype 6 to 4.28 in morphotype 5. Percentage scale insect infestation severity varied from 0 in morphotype 2, 16, 18, 19 and 20 to 47.35 in morphotype 5. With respect to

**Table 1.** Incidence of shoot borer in 19 morphotypes of turmeric

Morphotype	No. of collections	Incidence*	Incidence**				Severity (%)***
			No.	Min.	Max.	Mean	
1	228	228	1	7	4.16	1.02	46.35
2	1	1	1	1	2.00	—	22.22
5	43	43	2	6	3.76	1.22	49.74
6	2	2	4	5	4.50	0.70	50.00
7	11	11	4	9	7.63	1.28	74.74
8	39	39	2	9	4.38	2.19	47.37
9	19	19	3	5	4.37	0.76	48.54
10	25	25	3	8	5.76	1.13	64.35
11	11	11	3	8	4.73	1.62	29.29
12	18	18	1	9	7.50	1.69	80.86
13	22	22	2	7	4.64	1.00	51.52
14	5	5	2	3	2.60	0.55	24.07
15	57	57	3	8	5.72	1.01	63.49
16	1	1	1	1	5.00	—	55.55
17	1	1	1	1	7.00	—	77.70
18	1	1	1	1	7.00	—	77.70
19	3	3	4	6	5.00	1.00	55.56
20	1	1	5	5	5.00	—	55.56
21	1	1	1	1	8.00	—	88.89
Total	489	489	1	9			

\* Number of accessions with shoot borer attack

\*\* Based on 0-9 scale

\*\*\* Based on the formula of Misra & Choudhary (1997)

**Table 2.** Incidence of scale insect in 19 morphotypes of turmeric

Morphotype	Number of collections	Incidence*	Incidence**				Severity(%)***
			Min.	Max.	Mean	SD	
1	228	180	0	8	3.04	2.43	33.87
2	1	-	0	0	0.00	0.00	0
5	43	41	0	8	4.28	2.41	47.35
6	2	1	0	1	0.50	0.71	5.56
7	11	10	0	8	3.82	3.32	37.78
8	39	36	0	9	3.10	2.04	35.38
9	19	18	0	5	2.95	1.84	32.75
10	25	22	0	6	3.00	1.85	33.33
11	11	9	0	3	1.55	1.13	17.17
12	18	16	0	6	3.44	2.18	32.29
13	22	19	0	8	2.09	1.97	24.34
14	5	5	1	3	1.40	0.89	15.56
15	57	48	0	8	3.30	2.24	36.11
16	1	-	-	-	-	-	0
17	1	1	2	2	2.00	0.00	22.22
18	1	-	0	0	0.00	0.00	0
19	3	-	0	0	0.00	0.00	0
20	1	-	0	0	0.00	0.00	0
21	1	1	2	2	2.00	0.00	22.22
Total	489	407	0	8			

\* Number of accessions with shoot borer attack

\*\* Based on 0-9 scale

\*\*\* Based on the formula of Misra &amp; Choudhary (1997)

**Table 3.** Turmeric accessions tolerant to shoot borer

TCR No.	IC No.	State of origin
551	70080	Kerala
1370	6171	Meghalaya
003	136859	Kerala
060	136890	Kerala
061	136891	Kerala
066	136894	Andhra Pradesh
073	136897	Kerala
405	88681	Kerala
952	136970	Unknown
418	88766	Andhra Pradesh
422	88768	Kerala
424	88769	Kerala
430	88772	Kerala
833	88890	Kerala
861	88906	Tamilnadu
1205	136993	Himachal Pradesh
1207	137060	Himachal Pradesh
1211	136994	Himachal Pradesh
1050	137027	Andhra Pradesh
1255	137093	Himachal Pradesh
123	137097	Unknown
801	88755	Kerala

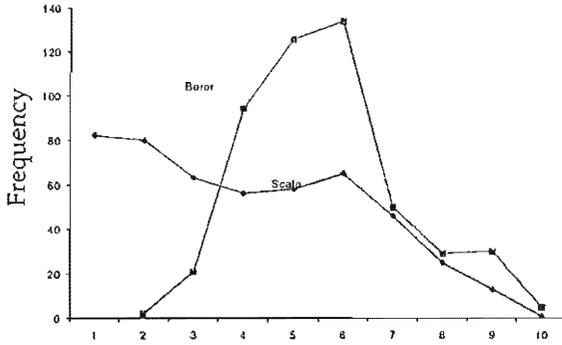
borer incidence 22 accessions had the incidence of 1 to 2 score indicating their probable tolerance to the borer (Table 3). These accessions belonged to Kerala (11), Meghalaya (1), Andhra Pradesh (3), Himachal Pradesh (4) and Tamilnadu (1) and two accessions are of unknown origin. Percentage of borer infestation severity varied from 22.22 in morphotype 2 to 88.89 in morphotype 21. With respect to scale insect incidence, 80 accessions were free. These were from Kerala (54), Tamilnadu (2), Arunachal Pradesh (4), Himachal Pradesh (4) Andhra Pradesh (1), Madhya Pradesh (1), Uttar Pradesh (1), Karnataka (1), Meghalaya (2) and Northeastern region (1). The origin of nine accessions was unknown. The result indicates the possibility of occurrence of resistant lines in some of them (Table 4), which is to be verified by further screening studies under controlled conditions. None of the accessions was found completely free from shoot borer incidence while the scale insect incidence was 83%.

**Table 4.** Turmeric accessions free from scale insect attack origin (geographical distribution)

TCR No.	IC No.	State of origin	TCR No.	IC No.	State of origin
003	136859	Kerala	751	136913	Kerala
018	136866	Kerala	782	88745	Kerala
025	266520	Unknown	849	88884	Tamilnadu
044	136880	Kerala	914	136919	Arunachal
053	136885	Kerala	922	136923	Arunachal
063	136893	Kerala	1075	136938	Kerala
271	88608	Kerala	1090	136940	Kerala
288	88620	Kerala	1139	136977	Tamilnadu
326	88640	Kerala	952	136970	Unknown
328	88641	Kerala	200	136907	North East
352	88651	Kerala	424	88769	Madhya Pradesh
384	88669	Kerala	199	137010	Arunachal
388	88671	Kerala	190	137023	Unknown
393	88674	Kerala	172	137019	Unknown
395	88676	Kerala	1339	313130	Kerala
405	88681	Kerala	141	137063	Unknown
460	69978	Kerala	167	137049	Unknown
467	69983	Kerala	875	88866	Meghalaya
471	69990	Kerala	660	88776	Kerala
484	70003	Kerala	1202	137066	Uttar Pradesh
496	70017	Kerala	910A	13710A	Arunachal
516	70042	Kerala	1370	6171	Meghalaya
520	70046	Kerala	893	137073	Himachal Pradesh
539	70067	Kerala	1222	137083	Himachal Pradesh
540	70068	Kerala	1224	137085	Himachal Pradesh
544	70073	Kerala	346	88781	Kerala
548	70077	Kerala	588	70113	Kerala
591	70117	Kerala	686	88877	Karnataka
593	70119	Kerala	729	88784	Kerala
595	70121	Kerala	772	88792	Kerala
598	70125	Kerala	799	88798	Kerala
599	70126	Kerala	816	88800	Kerala
614	88689	Kerala	906	88923	Karnataka
622	88694	Kerala	941	137106	Kerala
623	88695	Kerala	197B	137110B	Unknown
624	88696	Kerala	739	88779	Kerala
643	88708	Kerala	184	137017	Andhra Pradesh
644	88900	Kerala	194A	137112	Unknown
645	88709	Kerala	194B	137113	Unknown
667	88720	Kerala	898	137114	Himachal Pradesh

Fig. 1 depicts the frequency distribution of shoot borer and scale insect incidence, which indicates that the borer incidence has a near normal frequency curve and the scale insect incidence an abnormal distribution.

The results of the investigation are unique as the materials screened represented all the geographical and agro-ecological situations including wild or run wild populations of turmeric from Western Ghats. As such it clearly suggests that there is a chance of detecting



Scale insect and shoot borer incidence (0-9 scale)

**Fig. 1.** Shoot borer and scale incidence in turmeric germplasm

either resistant and tolerant lines against scale insect and shoot borer by conducting further screening studies under controlled conditions. This will also lead to clear cut understanding of the geographical distribution of resistant and tolerant genes in the indigenous germplasm of the crop..

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