

RPF III
FINAL REPORT
Part 1: GENERAL INFORMATION

- 800 Project Code** :
- 8001 Institute Project Code No. : Ent XII (813)
- 8002 ICAR Project Code No. : Not allotted
- 801 Name of the Institute and Division** :
- 8011 Name and Address of Institute : Indian Institute of Spices Research
Post Box No. 1701, Marikunnu P.O.
Calicut-673012, Kerala.
- 8012 Name of Division/Section : Division of Crop Protection/Entomology
- 8013 Location of Project : Indian Institute of Spices Research, Calicut
- 802 Project Title** : Bioecology and integrated management
of shoot borer (*Conogethes
punctiferalis*) infesting turmeric
- 803 Priority Area** : Research
- 8031 Research Approach:

Applied Research	Basic Research	Process/Technology development	Transfer of Technology
<u>01</u>	<u>02</u>	<u>03</u>	04

- 804 Specific area** : Spices-Entomology
- 805 Duration of Project** :
- 8051 Date of start : 2005
- 8052 Date of completion : 2010
- 806 Total Cost / Expenditure Incurred** : Rs. 15,00,000/- / Rs.17,27,615/-
(Give reasons for variation, if any from original estimated cost)
The variation from the original estimated cost was due to the increase in salary of scientific, technical and supporting personnel due to the recommendations of the VI Pay Commission.

807 Executive Summary

The nature and symptoms of damage caused by shoot borer on turmeric was studied. The larvae bored into the main pseudostem at the base and also into the leaf petiole to enter into the main central shoot of turmeric plants. The crop loss caused by shoot borer on turmeric under various categories of infestation was 72 g and 79 g per clump when 25–50% and 50–75% of shoots, respectively, were damaged by the pest. The pattern of distribution of shoot borer in a turmeric field was random initially up to September-October and became more aggregated during October-December. Studies on seasonal population dynamics of shoot borer on turmeric at Peruvannamuzhi indicated that the symptoms of pest infestation were first observed during August (0.2%-1.7% shoots infested) and was high during October-December (8.6%-10.9%). *Apanteles taragamme* ? (Braconidae) was recorded to parasitize larvae of the pest for the first time but the level of parasitization was low (2.1% during December). Evaluation of four promising insecticides against shoot borer in the field indicated that lambda cyhalothrin 0.0125% and malathion 0.1% were more effective when sprayed at 21 day intervals during July-November.

Keywords: Turmeric, *Curcuma longa*, *Conogethes punctiferalis*, Bioecology, management.

PART - II: INVESTIGATOR PROFILE

(Please identify clearly changes, if any, in project personnel)

810 Principal Investigator :

8101 Name : S.Devasahayam
8102 Designation : Principal Scientist
8103 Division / Section : Crop Protection/Entomology
8104 Location : Indian Institute of Spices Research
8105 Institute Address : IISR, Marikunnu P.O., Calicut – 673 012

811 Co-Investigator

8111 Name : T.K. Jacob
8112 Designation : Principal Scientist
8113 Division/Section : Crop Protection/Entomology
8114 Location : Indian Institute of Spices Research
8115 Institute Address : IISR, Marikunnu P.O, Calicut – 673 012

813 Co-Investigator

8121 Name : K. M. Abdulla Koya
8122 Designation : Scientist SG

8123 Division/Section : Crop Protection/Entomolgy
8124 Location : Indian Institute of Spices Research
8125 Institute Address : IISR, Marikunnu P.O., Calicut – 673 012

PART - III: TECHNICAL DETAILS

820 Introduction and Objectives:

8201 Project objectives:

- a. Nature of damage caused by shoot borer infesting turmeric.
- b. Crop loss caused by shoot borer infesting turmeric
- c. Distribution of shoot borer in turmeric field.
- d. Seasonal population dynamics of shoot borer infesting turmeric.
- e. Documentation of natural enemies of shoot borer infesting turmeric.
- f. Management of shoot borer infesting turmeric.

8202 Background information and importance of the project:

The shoot borer (*Conogethes punctiferalis*) is considered as a major insect pest of turmeric in India though authentic information on the nature of damage, crop loss, seasonal population and other aspects of bio-ecology of the pest are not available. The management schedules recommended against the pest are also of ad-hoc nature. Hence it was felt necessary to propose a project on shoot borer infesting turmeric which would generate information on all basic aspects and would help to develop technologies for the management of the pest that would result in higher productivity of the crop.

821 Project Technical Profile

8211 Technical Programme

- a. Nature of damage caused by shoot borer infesting turmeric.
- b. Crop loss caused by shoot borer infesting turmeric.
- c. Distribution of shoot borer in turmeric field.
- d. Seasonal population dynamics of shoot borer infesting turmeric.
- e. Documentation of natural enemies of shoot borer infesting turmeric.
- f. Management of shoot borer infesting turmeric.

8212 Total man months involvement of component project workers

- a) S. Devasahayam (PI) : 22 months
- b) T. K. Jacob (Co-PI) : 12 months
- c) K. M. Abdulla Koya : 2 months

822 Final Report on the Project

Nature of damage caused by shoot borer

The nature and symptoms of damage caused by shoot borer on turmeric was studied in the greenhouse and field. Early symptoms of pest infestation such as feeding marks on the unopened youngest leaf. Apart from boring into the main pseudostem at the base, the larvae also bored into the leaf petiole to enter into the main central shoot. The crop loss caused by shoot borer infestation on turmeric under various categories of infestation was determined to be 72 g and 79 g per clump when 25–50% of shoots and 50–75% of shoots, respectively, were damaged by the pest

Distribution

The pattern of distribution of shoot borer in a turmeric field during various studied at Peruvannamuzhi by determining various dispersion indices. During 2005-06, the pattern of distribution was random initially up to September and became more aggregated during October, November and December. During 2006-07, the pattern of distribution was random during August to October and became more aggregated during November and December.

Seasonal population

The seasonal population of shoot borer was recorded on turmeric in the field at fortnightly intervals at Peruvannamuzhi. During 2005-06 the symptoms of pest infestation were first observed during August (0.3% shoots infested) and was high during October to November (8.6%). During 2006-07 the symptoms of pest infestation were first observed during August (1.7% shoots infested) and was high during October to November (7.7% and 10.2% new shoots infested). During 2007-08 the symptoms of pest infestation were first observed during August (0.2% shoots infested) and maximum new infestations occurred during December (10.9%).

Natural enemies of shoot borer

Collections of shoot borer larvae were made at regular intervals to document the natural enemies of shoot borer on turmeric in the field. The natural enemies documented include mermithid nematode, dermapteran, *Apanteles taragamme?* (Braconidae) and an unidentified hymenopteran. The percentage of population of shoot borer larvae parasitized by the nematodes was higher during August (77.8% and 42.9%) and September (65.4% and 37.5%) during 2005-06 and 2006-07, respectively.

Evaluation of plant products and insecticides

Four plant products namely neem oil 0.5%, Neemgold 0.5%, Neemazal 0.25%, Nimbicidine 0.5% and four insecticides, malathion 0.1%, dimethoate 0.075%, carbosulfan 0.075%, imidacloprid 0.0125% and lamda cyhalothrin 0.0125% were evaluated against the pest under green house conditions. The plant products were

sprayed at 2 week intervals during July to November and the insecticides were sprayed at 3 week intervals during July to November. The trials indicated that among the plant products and insecticides, lamda cyhlothrin 0.0125%, carbosulfan 0.075% and malathion 0.1% were promising.

Evaluation of insecticides

Four insecticides namely, malathion 0.1%, carbosulfan 0.075%, imidacloprid 0.0125% and lamda cyhalothrin 0.0125% that were promising in the greenhouse were evaluated against the shoot borer in the field at Peruvannamuzhi during 2008-09 and 2009-10 for the management of shoot borer. The insecticide sprays were given at 21 day intervals during July to November and observations on the percentage of shoots infested in various treatments was recorded during December at crop maturity. Combined analysis of the trials indicted that among the insecticides, lamda cyhalothrin 0.0125% and malathion 0.1% was significantly more effective in reducing the percentage of shoots infested by the shoot borer (Table 1).

Table 1. Evaluation of insecticides against shoot borer infesting turmeric

Treatment	Shoots infested (%)*
Imidachloprid 0.0125%	12.7 (3.6)
Carbosulfan 0.075%	4.5 (2.1)
Lamda cyhalothrin 0.0125%	1.0 (1.0)
Malathion 0.01%	2.3 (1.5)
Control	21.0 (4.6)
CD (P=0.05%)	0.4

*Pooled data of 2 years

8221 Achievements in terms of targets fixed for each activity

Targets	Achievements
Nature of damage caused by shoot borer infesting turmeric.	The nature and symptoms of damage caused by shoot borer on turmeric was studied. The larvae bored into the main pseudostem at the base and also into the leaf petiole to enter into the main central shoot.
Crop loss caused by shoot borer infesting turmeric	The crop loss caused by shoot borer on turmeric under various categories of infestation was 72 g and 79 g per clump when 25–50% and 50–75% of shoots,

	respectively, were damaged by the pest.
Distribution of shoot borer in turmeric field.	The pattern of distribution of shoot borer in a turmeric field at Peruvannamuzhi was random initially up to September-October and became more aggregated during October-December.
Seasonal population dynamics of shoot borer infesting turmeric.	Studies on seasonal population dynamics of shoot borer on turmeric at Peruvannamuzhi indicated that the symptoms of pest infestation were first observed during August (0.2%-1.7% shoots infested) and was high during October-December (8.6%-10.9%).
Documentation of natural enemies of shoot borer infesting turmeric.	The natural enemies documented on shoot borer include mermithid nematode, dermapteran, <i>Apanteles taragamme?</i> (Braconidae) and an unidentified hymenopteran.
Management of shoot borer infesting turmeric.	Evaluation of four promising insecticides against shoot borer in the field indicted that lamda cyhalothrin 0.0125% and malathion 0.1% were more effective when sprayed at 21 day intervals during July-November.

8222-Questions Answered

- a. What is the nature of damage caused by shoot borer infesting turmeric?
The early symptoms of pest infestation included minute feeding marks on the unopened youngest leaf. Apart from boring into the main pseudostem at the base, the larvae also bored into the leaf petiole to enter into the main central shoot.
- b. What is the crop loss caused by shoot borer infesting turmeric?
The crop loss caused by shoot borer on turmeric under various categories of infestation was determined as 72 g and 79 g per clump when 25–50% and 50–75% of shoots, respectively, were damaged by the pest.
- c. What is the nature of distribution of shoot borer in turmeric field?
The pattern of distribution of shoot borer in a turmeric field at Peruvannamuzhi was

random initially up to September-October and became more aggregated during October-December.

- d. What is the trend in seasonal population dynamics of shoot borer infesting turmeric?
Studies on seasonal population dynamics of shoot borer on turmeric at Peruvannamuzhi indicated that the symptoms of pest infestation were first observed during August (0.2%-1.7% shoots infested) and was high during October-December (8.6%-10.9%).
- e. What are the natural enemies of shoot borer infesting turmeric?
The natural enemies recorded on shoot borer on turmeric in the field include mermithid nematode, dermapteran, *Apanteles taragamme?* (Braconidae) and an unidentified hymenopteran.
- f. How can the shoot borer infesting turmeric be managed in the field?
The shoot borer infesting turmeric can be managed by spraying lamda cyhalothrin 0.0125% or malathion 0.1% at 21 day intervals during July-November.

8223-Process/ Product/ Technology/Developed

Technology for the management of shoot borer infesting turmeric in the field by spraying lamda cyhalothrin 0.0125% or malathion 0.1% at 21 day intervals during July-November was developed

8224 Practical Utility

The technology developed for the management of shoot borer infesting turmeric would lead to higher productivity of the crop and returns to the farmer.

8225 Constraints, if any:

Nil.

823 Publications

8231 Research papers:

- a. Devasahayam, S. 2006. Biodiversity of natural enemies of insect pests of spice crops. In: Abstracts, National Conference on Agrobiodiversity, 12-15 February 2006, Chennai, pp. 226-227.

8232 Popular articles

Nil

8233 Reports

- a. IISR Annual Reports 2005-10. Indian Institute of Spices Research, Calicut.
- b. Devasahayam, S. and Koya, K. M. A. 2007. Insect pests of turmeric. In : Ravindran, P. N., Babu, K. N. and Sivaraman, K. (Eds.) Turmeric. The Genus *Curcuma*. CRC Press, Boca Raton. pp. 169–192.

8233 Seminars, conferences and workshops (relevant to the project) in which the scientists have participated

- a. National Conference on Agrobiodiversity, 12-15 February 2006, Chennai (S. Devasahayam)
- b. Workshop on Production and Post-harvest Technology of Ginger and Turmeric for Uttaranchal, 5-7 March 2009, Dehradun (S. Devasahayam)
- c. XX Workshop of All India Coordinated Research Project on Spices, 6-8 June 2009, Coimbatore (S. Devasahayam)
- d. Interaction Meeting of Entomologists of ICAR institutes of Horticulture Division, 10-11 June 2009, Lucknow (S. Devasahayam, T. K. Jacob)

824 Infrastructural facilities developed

Nil

825 Comments/suggestions of Project Leader regarding possible future line of work that may be taken up arising out of this Project.

The technology for the management of shoot borer on turmeric can be validated through on-farm trials by the Krishi Vigyan Kendra.

**PART- IV PROJECT EXPENDITURE
(Summary) 2005-10**

830 Total Recurring Expenditure

8301 Salaries: (Designation with pay scale)

- | | | |
|------|------------|-----------------|
| i) | Scientific | : Rs. 12,17,500 |
| ii) | Technical | : Rs. 2,04,525 |
| iii) | Supporting | : Rs. 1,48,090 |
| | Wages | : Nil |

	Sub Total	: Rs. 15,70,115
8302	Consumables	
	i) Chemicals	: Rs. 22,500
	ii) Glassware	: Rs. 25,000
	iii) Others	: Nil
	Sub Total	: Rs. 47, 500
8303	Travel	: Rs. 55,000
8304	Miscellaneous	: Rs. 55,000
8305	Sub-Total	: Rs. 1,57,000
831	Total Non- Recurring Expenditure.	: Nil
832	Total (830 & 831)	: Rs. 17,27,615

PART-V: DECLARATION

This is to certify that the final report of the project has been submitted in full consultation with the project workers as per the approved objectives and technical programme and the relevant records, note-books, materials are available for the same.

Signature of the Project Investigator : S. Devasahayam

Co-investigators : T. K. Jacob

: K. M. Abdulla Koya

Signature & Comments of the Head of Division/Section

Signature & Comments of the Director