

**RPF III**  
**FINAL REPORT**  
**Part 1: GENERAL INFORMATION**

**800 Project Code** :

8001 Institute Project Code No. : Crop. Prot 1.2 (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** : **Screening germplasm of spice crops for reaction to insect pests**

**803 Priority Area** : Research

8031 Research Approach:

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

**804 Specific area** : Spices-Entomology

**805 Duration of Project** :

8051 Date of start : 1995

8052 Date of completion : 2006

**806 Total Cost / Expenditure Incurred:** Rs. 7,41,000/-  
(Give reasons for variation, if any from original estimated cost)

**807 Executive Summary**

Screening of 197 accessions of cultivated black pepper germplasm against pollu beetle indicated that the range of infestation was 0.3%-70.5% on the berries. Screening of 20 accessions of wild *Piper nigrum* germplasm against the pest showed that the range of infestation was 3.4%-44.0% on the berries except Acc. No. 2070 which was free of infestation. In 24 hybrids screened against the pest, the infestation ranged between 1.1%-88.3%. Screening of six high yielding varieties showed that the infestation ranged between 2.8%-14%. Two inter specific hybrids screened

against the pest were less preferred for feeding by adults. Screening of 495 accessions of ginger germplasm against shoot borer indicated that the infestation by the pest ranged from 3.3%-32.9% on the shoots.

**Keywords:** germplasm, resistance, black pepper, ginger, turmeric, pollu beetle, shoot borer.

## **PART - II: INVESTIGATOR PROFILE**

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

- 810 Principal Investigator :**
- 8101 Name : K.M. Abdulla Koya  
8102 Designation : Scientist SG  
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 : S.Devasahayam  
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
- 812 Co-Investigator**
- 8121 Name : B. Sasikumar  
8122 Designation : Senior Scientist  
8123 Division/Section : Crop Improvement  
8124 Location : Indian Institute of Spices Research  
8125 Institute Address : IISR, Marikkunnu, P.O., Calicut-673 012
- 813 Co-Investigator**
- 8121 Name : T.K. Jacob  
8122 Designation : Senior Scientist  
8123 Division/Section : Crop Protection/Entomolgy  
8124 Location : KVK, Peruvannamuzhi  
8125 Institute Address : IISR, Marikunnu P.O., Calicut – 673 012
- 814 Co-Investigator**
- 8131 Name : Johnson K. George  
8132 Designation : Senior Scientist  
8133 Division/Section : Crop Improvement  
8135 Location : Indian Institute of Spices Research  
8135 Institute Address : IISR, Marikkunnu, P.O., Calicut-673 012

**815 Co-Investigator**

8141 Name : K.V. Saji  
8142 Designation : Senior Scientist  
8143 Division/Section : Crop Improvement  
8144 Location : Indian Institute of Spices Research  
8145 Institute Address : IISR, Marikunnu P.O., Calicut – 673 012

**PART - III: TECHNICAL DETAILS****820 Introduction and Objectives:**

8201 Project objectives:

The project was proposed to study the reaction of spice crops such as black pepper, ginger and turmeric for their reaction to major insect pests and to isolate sources of resistance in the germplasm.

8202 Background information and importance of the project:

The pollu beetle *Longitarus nigripennis* is the most serious insect pest of black pepper damaging tender leaves, spikes and berries. The pest infestation causes up to 40% crop loss in Kerala (Devasahayam et al. 1988). In the case of ginger and turmeric, the shoot borer *Conogethes punctiferalis* is the most serious pest and the larvae bore into the pseudostems. A reduction of 38 g of green ginger per plant has been reported when more than 50% of pseudostems are damaged by the pest (Koya et al 1986).

Most of the insect pests of spice crops are currently managed by application of insecticides. Hence locating resistant sources would help in developing varieties resistant against insect pests which would enhance the productivity of black pepper, ginger and turmeric and would also help in obtaining a produce free of pesticide residues.

**References**

Devasahayam, S., Premkumar, T. and Koya, K. M. A. 1988. Insect pests of black pepper (*Piper nigrum*) in India -a review. J. Plantn. Crops 16 : 1-11.

Koya, K. M. A., Balakrishnan, R., Devasahayam, S., and Banerjee, S. K. 1986. A sequential sampling strategy for the control of shoot borer (*Dichocrocis punctiferalis* Guen.) in ginger (*Zingiber officinale* Rosc.) in India. Trop. Pest Manage. 32 : 343-346.

## 821 Project Technical Profile

### 8211 Technical Programme

1. Screening of black pepper cultivars against pollu beetle.
2. Screening of black pepper hybrids against pollu beetle.
3. Screening of wild *Piper nigrum* against pollu beetle.
4. Screening of ginger germplasm against shoot borer.
5. Screening of turmeric germplasm against soot borer.

### 8212 Total man months involvement of component project workers

- a) Scientific : 60
- b) Technical : 4
- c) Supporting : 4

## 822 Final Report on the Project

### Black Pepper

Screening of black pepper germplasm was done by counting the number of berries infested by the pollu beetle on 10 spikes selected at random on each vine. Observations were recorded from four vines from each accession and the mean percentage of berries infested was calculated. All the observations were carried out for 3 years.

Screening of 35 black pepper accessions during 1995-97 showed that the infestation by pollu beetle ranged from 11.9%-70.5% on the berries. The range of pest infestation on the berries was 0.3%–38.5% in 162 cultivars screened during 2000-05. During 2005-06, preliminary screening conducted on 98 accessions of black pepper cultivars showed that the infestation on berries ranged from 8.8%-35.8% (Table 1).

Screening of 20 accessions of wild *Piper nigrum* during 1994-97 revealed that the infestation ranged between 3.4%-44% on the berries except on Acc. No. 2070 which was free of infestation (Table. 1).

In 24 hybrids of black pepper screened during 2000-05, the infestation on the berries ranged from 1.1%–88.3%. Out of 110 hybrids preliminarily screened during 2005-06, Acc. No. 612 was free of infestation while the range of infestation was between 0.4%-37.0% in the susceptible ones (Table 1).

Screening high yielding varieties such as Panniyur-2, 3, 4, Panchami, Sreekara and Subhakara during 1998-2000 indicated that pest infestation on the berries ranged between 2.8%-14% (Table. 1).

Two inter specific hybrids namely, *P. nigrum* x *P. attenuatum* and *P. nigrum* x *P. barberi*, screened during 1999-2000 were less preferred for feeding (leaf) by pollu beetle (Table 2).

**Table 1. Screening of black pepper accessions against pollu beetle**

Period	No. of accessions screened				% berries infested (range)
	Cultivars	Wild <i>Piper</i> spp.	Hybrids	High yielding varieties	
1995-97	35	-	-	-	11.9-70.5
1994-97	-	20	-	-	3.4-44.0
1998-2000	-	-	-	6	2.8-14.0
2000-05	162	-	-	-	0.3-38.5
2000-05	-	-	24	-	1.1-88.3
2005-06	98	-	-	-	8.8-35.8
2005-06	-	-	110	-	0.4-37.0

**Table 2. Reaction of *Piper* spp. and inter-specific hybrids to pollu beetle**

Species/Hybrid	Leaf area fed by beetle per 24 h (mm <sup>2</sup> )
<i>P. nigrum</i> (cv. Aimpiriyam)	4.05
<i>P. attenuatum</i>	0.11
<i>P. nigrum</i> x <i>P. attenuatum</i>	0.80
<i>P. nigrum</i> (cv. Karimunda)	3.74
<i>P. barberi</i>	0.03
<i>P. nigrum</i> x <i>P. barberi</i>	0.46

**Ginger**

In ginger, the total number of pseudostems and the number infested by the shoot borer were recorded on various accessions and the percentage of pseudostems infested was calculated. All the observations were carried out for 3 years. The mean percentage of pseudostems infested by the shoot borer ranged from 3.3-32.9 in 495 accessions of ginger germplasm screened during 2001-04 (Table 3).

**Table 3. Screening of ginger accessions against shoot borer**

Period	% pseudostems infested (range)	No. of accessions
2001-04	0-5	4
	5.1-10	151
	10.1-20	334
	20.1-30	5
	>30 (32.9)	1

**Turmeric**

In turmeric, the total number of pseudostems and the number infested by the shoot borer were recorded on various accessions and the percentage of pseudostems infested was calculated. Screening of 895 accessions of turmeric during 2005-06 against the pest revealed that two accessions (845 and 846) were free of infestation. The percentage infestation by the pest was between 5-75 in the susceptible accessions (Table 4).

**Table 4. Screening of turmeric accessions against shoot borer**

Period	% pseudostems infested (range)	No. of accessions
2005-06	0	2
	1-5	4
	5.1-10	38
	10.1-20	368
	20.1-30	318
	30.1-40	118
	40.1-50	43
	50.1-60	1
	60.1-70	1
	>70 (75)	2

8221 Achievements in terms of targets fixed for each activity

Targets	Achievements
Screening of black pepper germplasm against pollu beetle.	295 cultivated germplasm accessions, 134 hybrid accessions, 6 high yielding varieties, 20 wild <i>Piper nigrum</i> accessions and 2 inter specific hybrids were screened against pollu beetle among which one wild <i>P. nigrum</i> (Acc. No. 2070) was resistant.

Screening of ginger germplasm against shoot borer.	Screening of 495 accessions against shoot borer indicated that the average infestation on pseudostems ranged from 3.3%–32.9%.
Screening turmeric germplasm against shoot borer.	Screening of 895 accessions against shoot borer indicated that two accessions (845 and 846) were free of infestation in the preliminary screening.

#### 8222-Questions Answered

Are there any sources of resistance in black pepper, ginger and turmeric against major insect pests?

#### 8223-Process/ Product/ Technology/Developed

One wild *Piper nigrum* accession (Acc. No. 2070) was identified to be resistant to pollu beetle.

#### 8224 Practical Utility

The resistant lines identified can be utilized in hybridization programmes to develop improved varieties resistant to insect pests, which would increase the productivity of the crop and would also help in obtaining a produce free of pesticide residues.

8225 Constraints, if any: Nil.

### 823 Publications

#### 8231 Research papers:

1. B. Sasikumar, B. Chempakam, Johnson K. George, A. B. Remashree, S. Devasahayam, K.P.M Dhamayanthi, P.N. Ravindran and K.V. Peter. 1999 Characterization of two inter specific hybrids of *Piper*. Journal of Horticultural Science and Biotechnology 74: 125-131.

#### 8232 Popular articles

Nil

#### 8233 Reports

1. IISR Annual Reports 1995-2005.

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

1. International Conference on Pest and Pesticide Management for Sustainable Agriculture, 11-13 December 1998, Kanpur (S.Devasahayam)
2. National Symposium on Pest Management Strategies: Current Trends and Future Prospects, 1-2 February 2001, Chennai (S.Devasahayam).
3. Discussion Meeting on Applied Chemical Ecology: Implication of Induced Resistance and Transgenics in Insect Plants Interactions, 30 November 2002, Chennai, (S.Devasahayam)

**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 sources of resistance identified can be utilized in crop improvement programmes for developing improved varieties resistant to the pest. The basis of resistant in these lines are also to be studied to understand the mechanism of resistance.

**PART- IV PROJECT EXPENDITURE  
(Summary) 1995-2005**

**830 Total Recurring Expenditure**

8301 Salaries: (Designation with pay scale)

i)	Scientific	: Rs. 7,00,000
ii)	Technical	: Rs. 16,000
iii)	Supporting	: Rs. 10,000
	Wages	: Nil
	Sub Total	: Rs. 7,26,000

8302 Consumables

i)	Chemicals	: Nil
ii)	Glassware	: Nil
iii)	Others	: Rs. 5,000
	Sub Total	: Rs. 5,000

8303 Travel : Rs. 5,000

8304 Miscellaneous : Rs. 5,000

8305 Sub-Total : Rs. 10,000

**831 Total Non- Recurring Expenditure. : Nil**

**832 Total (830&831) : Rs. 7, 41,000**



## **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 : K. M. Abdulla Koya

Co-investigators : S. Devasahayam

: B. Sasikumar

: T. K. Jacob

: Johnson K. George

: K. V. Saji

Signature & Comments of the Head of Division/Section

Signature & Comments of the Director