

**F.No. 14-9/2008-CA.II – Contract Research Project**

**“Exploiting Host Plant Resistance for *Helicoverpa* Management  
to Increase Production and Productivity of Chickpea and Pigeonpea  
Under Rainfed Conditions in India”**

**Project Progress report: June to Dec 2009**

**Submitted to**

**The Director**

**Technology Mission on Oilseeds, Pulses and Maize (TMOP)  
Government of India, Ministry of Agriculture  
Department of Agriculture & Cooperation (DOAC)  
Krishi Bhawan, New Delhi 110 001, India**



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# Exploiting Host Plant Resistance for *Helicoverpa* Management to Increase Production and Productivity of Chickpea and Pigeonpea under Rainfed Conditions in India

## Collaborating Institutions

- ANGR Agricultural University, RRS, Tandur, Andhra Pradesh.
- University of Agricultural Sciences, RRS, Gulbarga, Karnataka.

## Objectives

- Identification of chickpea and pigeonpea genotypes with diverse mechanisms of resistance to *Helicoverpa*.
- Effect of *Helicoverpa*-resistant cultivars on ETLs, reduction in pesticide use, and their interaction with bio-control agents.
- Effectiveness of *Helicoverpa*-resistant cultivars in IPM and sustainable crop production under rainfed conditions in drought prone areas in India.
- Technology exchange and capacity building.

## Chickpea

- Evaluated the reference collection (305 lines) for resistance to *Helicoverpa*.
- Evaluated chickpea lines (95) for stability of resistance to *Helicoverpa*
- Evaluate *Helicoverpa* resistance nursery (30 lines) across locations in India and Africa.
- Test three pod borer resistant lines (ICCV 10, JG 11, KA 2, and ICCV 37) in on-farm trials in farmers' (55 quintal seed of all varieties) fields in Andhra Pradesh and Karnataka.
- Characterized mechanisms of induced resistance to *Helicoverpa*.
- Evaluate interspecific (*C. arietinum* x *C. reticulatum*) mapping population to identify interspecific derivatives with resistance to *Helicoverpa*.

## Pigeonpea

- Evaluated selected pigeonpea lines (100) for stability of resistance to *Helicoverpa*.
- Selected pigeonpea lines (20) tested for *Helicoverpa* resistance across locations.
- Test three pod borer-resistant lines (ICPL 332WR, ICPL 87119, and ICPL 83059) tested in on-farm trials in Andhra Pradesh and Karnataka.
- Studied biochemical mechanisms of resistance to *Helicoverpa* in wild relatives of pigeonpea.

**Test *Helicoverpa*-resistant varieties on farmers' fields in collaboration with ANGARU, Tandur and UAS, Gulbarga to ascertain their potential for use by the farmers**

**Pigeonpea:** Tested the pigeonpea varieties ICPL 332WR, ICPL 87119, and a local check on farmers' fields [Tandur: 40 trials (10 villages, 4 farmers in each village), and Gulbarga: 48 trials (12 villages, 4 farmers in each village)]. Ten promising selections are also being tested on limited scale. Seed multiplication of these lines for distribution in 2010/11 is in progress.

**Chickpea:** Tested chickpea varieties ICCV 10, ICCV 37, JG 11, and KAK 2 on farmers' fields [Tandur: 10 (10 villages, 1 farmer in each village), and Gulbarga: 15 (15 villages, 1 farmer in each village)]. Four selections + local check are being tested on a limited scale. Seed multiplication of these lines for distribution in 2010/11 is in progress.

**Evaluation of contribution of *Helicoverpa*-resistant cultivars of pigeonpea and chickpea in combination with insecticides for integrated pest management**

Number of insecticidal sprays needed is being assessed in chickpea and pigeonpea, based on ETLs [three levels of protection (untreated, moderate, and intensive protection)] for 10 diverse *Helicoverpa*-resistant cultivars.

**a) IPM Module for chickpea:** Genotypes: JG 11 and ICCV 10. Treatments: T1: Methomyl + spinosad + flubendiamide, T2: Methomyl + Bt/HaNPV + emmamectin benzoate, T3: Bt + NSKE + HaNPV, T4: Sunflower + sorghum (20 g of each crop per acre at sowing) (bird perches cum trap crops), T5: T4 + HaNPV/Bt, and T6: Untreated control.

**b) IPM Module for pigeonpea [Genotypes: ICPL 332WR and Maruti]. Treatments:** T1: Profenfos/methomyl (DDVP\*) + quinalphos + flubendamide + dimethoate\*\*, T2: Bt/HaNPV + Profenfos/methomyl (DDVP\*) + spinosad + dimethoate\*\*, T3: NSKE + HaNPV + Bt + Novaluron, T4: Untreated control [\*Need based application for *Maruca*. \*\* If pod fly/pod bugs are a problem, Treatments based on ETL].

A 10-day training course on screening for resistance to *Helicoverpa* was organized during 3 to 11 Dec 2009. The program schedule is given in appendix I.

**Appendix I. Training Program**  
**Techniques to Screen for Resistance to *Helicoverpa***  
**03-11 December 2009**  
**New Sahel Conference Center, ICRISAT, Patancheru, AP, India**

**03 Dec 2009**

1000	Registration/tea	SR Venkateswarulu
1030	Welcome	CLL Gowda/Mike Butterfield
1040	Remarks on behalf of TPOM	Anil Pratap Singh
1050	Inauguration of the training program	DA Hoisington
1105	Objectives of the project/training program	HC Sharma
1115	Photograph in the <i>Helicoverpa</i> nursery – BP 3C	SR Venkateswarulu
1300	Host plant resistance to <i>Helicoverpa</i> – Potentials and limitations	HC Sharma
1400	Practical: No-choice cage technique to screen for resistance to <i>Helicoverpa</i> under greenhouse conditions	MK Dhillon

**04 Dec 2009**

0900	Application of molecular markers for resistance to <i>Helicoverpa</i>	Rajeev Varshney /PM Gaur / HC Sharma
1000	Tea break	
1030	Techniques to screen for resistance to <i>Helicoverpa</i>	HC Sharma/Ram Ujagir/CP Srivastava
1300	Practical: Detached leaf assay to screen for resistance to <i>Helicoverpa</i> in chickpea and pigeonpea	MK Dhillon

**05 Dec 2009**

0900	Breeding for resistance to <i>Helicoverpa</i> in pigeonpea	KB Saxena/Rakesh Srivastava
1000	Tea break	
1030	Practical: Techniques to breed for resistance to <i>Helicoverpa</i> in pigeonpea	R Vijay Kumar/ HP Thanki
1300	Visit to city	SR Venkateswarulu/Vithal Reddy

**06 Dec 09 Sunday - Holiday**

**07 Dec 2009**

0900	Breeding for resistance to <i>Helicoverpa</i> in chickpea	CLL Gowda / PM Gaur/ S Tripathi
1000	Tea break	
1030	Practical: Techniques to breed for resistance to <i>Helicoverpa</i> in chickpea	VV Rao / MA Ghaffar
1300	Disease resistance in chickpea and pigeonpea	S Pande/M Sharma
1600	Visit to Genebank	HD Upadhyaya

**08 Dec 2009**

0900	Screening for <i>Helicoverpa</i> resistance in chickpea under field conditions	HC Sharma
1000	Tea break	
1030	Practical: Data recording on screening for <i>Helicoverpa</i> resistance in chickpea under field conditions	Pravin Siddhabhatti/Madhusudan Reddy
1300	Visit to biopesticide lab	S Gopalkrishnan
1500	Visit to NPV lab	GV Ranga Rao

**09 Dec 2009**

0900	Practical: DNA extraction and genotyping	Rajeev Varshney/ Shiv Kumar
1000	Tea break	
1030	Screening for <i>Helicoverpa</i> resistance in pigeonpea under field conditions	HC Sharma
1330	Practical: Data recording on screening for <i>Helicoverpa</i> resistance in pigeonpea under field conditions	Pravin Siddhabhatti/Madhududan Reddy
1330	Data recording in experiments on detached leaf assay	MK Dhillon
<b>10 Dec 2009</b>		
0900	Exploitation of wild relatives of crops for <i>Helicoverpa</i> resistance	N Mallikarjuna/ HD Upadhayay / HC Sharma
1000	Tea break	
1030	Practical: Wide hybridization for <i>Helicoverpa</i> resistance	Deepak Jadhav
1330	Data recording in no-choice screening experiments in the greenhouse	MK Dhillon
<b>1800</b>	<b>Dinner – 204 Banquet Hall Area</b>	
<b>11 Dec 2009</b>		
0900	Development of transgenic plants for resistance to <i>Helicoverpa</i>	KK Sharma / Pooja Bhatnagar / HC Sharma / Mukesh Dhillon
1000	Tea break	
1030	Practical: Tissue culture and transformation protocols for <i>Helicoverpa</i> resistance	Pooja Bhatnagar Mathur
1330	Visits to genetic engineering lab	
<b>Plenary Session</b>		
1500	Remarks by the Chair	<b>Chair: DA Hoisington</b> DA Hoisington
1510	Remarks by the GTL	CLL Gowda
1520	Distribution of certificates	DA Hoisington
1530	Vote of thanks	HC Sharma
1600	Tea break	
1630	Departure	