



## Genetic Material as a Component of IPM for Vegetable Field Bean Pod Borer Complex

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### Abstract

Nine advanced yield trial field bean (mochai) pipeline entries along with checks CO 1 and CO2 were screened for pod borer complex in rain fed block of the farm (Latitude 12°22'36"N, Longitude 78°12'13"E and Altitude 1889 FT/490 M above MSL) with two crop year seasons viz., 2013 - 14 and 2014 - 15 in sandy loam textured soil having pH 8.1. The three entries viz., Coll-05 - 29, DPI 03 - 007 (Selection from CO 6 A) and DPI 03-004 (Selection from DL 2564) recorded a pest susceptibility index score of 3 - 4 and exhibit increasing level of resistance to field bean pod borers. The pod borer complex include *Helicoverpa armigera* and *Adisura atkinsoni* in first year while *Excelastis atomosa* in the second year.

**Keywords:** Field Bean (Mochai) Entries; Pod Borer Complex; *Helicoverpa armigera*; *Excelastis atomosa*

### Introduction

India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) pulses in the world. The output of pulses crossed 22 million tonnes (mt) last year taking self-sufficiency in the production of protein-rich food crop in India this year also with the productivity of 764 kg/ha. In Tamil Nadu. The pulses grown are Bengal gram, Pigeon pea, Green gram, Chickpea, Black gram, and Cowpea. Among the various constraints, insect pests and diseases are the major and important one affecting the production of pulses apart from ecological and biological constraints. The under-utilized food legume field bean/mochai *Lablab purpureus* (Linnaeus) Var: *Lignosus* is one of the important pulse crops in this tract which are mainly grown for its fresh pods as vegetable and dry seeds. It grows in poor, well drained, sandy loam, has a place in dietary schedule of the people of developing countries. It is being used as a vegetable and as fodder with sorghum for livestock. Field bean has high nutritive value,

the green pods contain small amount of vitamin A, C, proteins, iron, calcium and cynogenic glycosides in raw state. Schaffhausen [1] reported that the ripe seed contains 20 - 28% of protein. Field bean (mochai) is predominantly grown as inter crop in rainfed ragi in area of 65,000 ha and in groundnut with an area of 45,000 ha in Dharmapuri and Krishnagiri district. It is also grown as pure crop to a limited extent (689 ha). The crop suffers insect injury both in field and storage which results in significant crop loss. Govindan [2] reported that 56 insects have been recorded on field bean in India, among them aphids, blister beetle, pod borers viz., *Helicoverpa armigera*, *Adisura atkinsoni* and infestation of bruchids both in field and storage are the key pest. Use of tolerant or resistant varieties against these insects particularly pod borers and bruchids is considered as one of the satisfactory and safe methods for avoiding pesticide residues [3]. In this context the evaluation of diverse genetic advanced entries.

### Materials and Methods

The objective of research is to identify the field tolerant genotypes of mochai to pod borers (Host plant resistance - HPR) from advanced yield trial entries which is being simultaneously carried out in the field by plant breeders in terms of insect injury and to include further in to the components of Integrated Pest Management (IPM). Little researchon HPR has been carried out in field bean (mochai) *Lablab purpureus L.Var.Lignosus* in our North West-ern Agro Climatic Zone. The experiments on field screening of mochai germplasm and advanced genotypes/accessions against the pod borers the field were conducted in rain fed block of our Paiyur farm (Latitude: 12°22'36"N, Longitude: 78°12'13"E and Altitude: 1889 FT/490 M above MSL) with two crop year seasons viz., 2013 - 14 and 2014 - 15 respectively. The soil was sandy loam in texture with pH 8.1. The available NPK were 175, 25 and 27.5 Kg/ha with organic Carbon of 0.5%. The details of the experiments conducted are given below.

Particulars	First Experiment	Second Experiment
Crop Year	2013-2014	2014-2015
Season	Kharif 2013	Kharif 2014
Month	August	September
Date of Sowing	31.08.2013	24.09.2014
Design	RBD	RBD
Replication	Three	Three
Variety	AYT Entries/ Cultivars	AYT Entries/ Cultivars
Plot size	5×2.7 m	3 × 2.7
Spacing	90 × 60 cm	90 × 60 cm
Treatments	11	11

Table A

In the first year, nine advanced pipeline cultures generated in the plant breeding and genetics project on evolution of vegetable pea types of mochai cum current station trials along with checks Co 1 and Co 2 were screened for pod borer damage levels. Ten plants were selected at random from each genotype/entry/plot to workout percentage of pod damage, The percentage of pod damage was computed by counting both infested and total number of pods from all the genotypes/entry. The pest susceptibility rating (1 - 9 scale) was worked out by using the formula as suggested by

Lateef and Reed [4,5].

$$\text{Pest susceptibility} = \frac{\% \text{ pod damage of test entry} - \% \text{ pod damage of check entry}}{\% \text{ pod damage of check entry}} \times 100$$

\*= Increasing Resistance

Based on PSR, the genotypes were rated on 1-9 scale to classify their level of resistance.

Pest Susceptibility Per Cent (PSP)	Relative Resistance/ Susceptibility Rating
100 %	1
75 % to 50 %	2
50 % to 25 %	3 Increasing resistance
25 % to 10 %	4
10 % to 0 %	5
-10 % to -25 %	6equal to check
-25 % to -50 %	7
-50 % to -75 %	8 Increasing susceptibility
- 75 % to less	9

Table B

### Results and Discussion

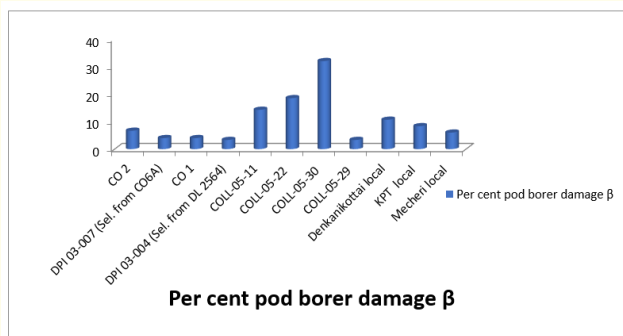
In the first year of the field trial, the pod borer damage ranges from 3.33 to 32per cent and the entries were classified based on pest susceptibility ratings. The AYT entries viz., DPI-03 - 004; CO - 11-05 - 29; DPI - 03 - 007 and CO 1 registered lowest pod damage of less than 4% with pest susceptibility per cent ranges from 10 to 50 per cent having pest susceptibility index score of 4 which exhibit increasing level of resistance, while Co11 - 05 - 30 recorded a highest pod damage of 32 per cent. Among the entries tested, DPI 03 - 007 recorded highest seed yield of 1012 kg/ha (Table 1 and Figure 1) which is 39.4% increased seed yield over CO2 (726 kg/ha).

In the second year of the trial, field level pod borer resistance entries was tested for confirmation in the second year and the results revealed that among the four field level pod borer resistance entries viz., DPI 03 - 007, DPI 03 - 004,CO 1 and COLL 05 - 29 of

S. No.	Entry	Per Cent Pod Borer Damage B	Psp	Psi	Grain Yield (Kg/ Ha)	% Increase Over Co2
1.	CO 2	6.67	Check		726	--
2.	DPI 03-007 (Sel. from CO6A)	4.00	50	4*	1012	39.4
3.	CO 1	4.00	40	4*	696	--
4.	DPI 03-004 (Sel. from DL 2564)	3.33	40	4*	877	20.8
5.	COLL-05-11	14.29	-114.2	9***	523	--
6.	COLL-05-22	18.52	-177.7	9***	857	18.0
7.	COLL-05-30	32.00	-379	9***	632	--
8.	COLL-05-29	3.33	50	4*	430	--
9.	Denkanikottai local	10.67	-609	9***	810	11.6
10.	KPT local	8.33	-24.9	7***	864	19.1
11.	Mecheri local	6.00	10	6**	790	8.8
	SED	2.27				
	CD (0.05%)	4.86				

**Table 1:** Per cent pods affected by pod borer in advanced entries, scores & their Grain yield in first year (2013-2014).

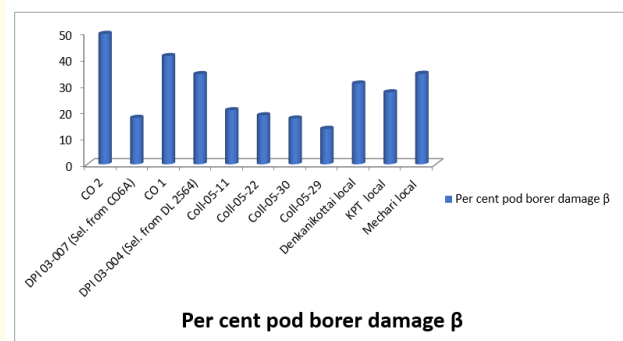
PSP-Pest Susceptibility Per cent; PSI- Pest Susceptibility Index; \*= Increasing Resistance; \*\* = Equal to check and \*\*\* = Increasing Susceptibility; Based on PSP and PSI, the genotypes were rated on 1-9 scale to classify their level of resistance;  $\beta$  *Helicoverpa armigera* and *Adisura atkinsoni*.



**Figure 1:** Percent pods affected by pod borer in advanced entries (first year 2013-2014).

the first year trial two advanced entries Viz., DPI 03-007 and COLL 05 - 29 recorded 17.56 and 13.90 per cent pod borer damage by *Ex-cestis atomosa* respectively having pest susceptibility index score

of 3 which exhibit increasing level of resistance. The variety CO2 recorded a highest pod damage of 49.35 per cent. Out of the entries tested, DPI 03 - 007 recorded the highest seed yield of 840 kg/ha (Table 2 and Figure 2) which is 18.6% increases seed yield over CO2 (708 kg/ha).



**Figure 2:** Percent pods affected by pod borer in advanced entries (second year 2014-2015).

S. No.	Entry	Per cent pod borer damage $\beta$	PSP	PSI	Grain yield (Kg/ha)	% increase over CO2
1.	CO 2	49.35	Check		708	--
2.	DPI 03-007 (Sel. from CO6A)	17.56	50	3	840	18.6
3.	CO 1	40.94	40	5	675	--
4.	DPI 03-004 (Sel. from DL 2564)	34.11	40	4	738	4.2
5.	Coll-05-11	20.45	-114.2	3	728	2.8
6.	Coll-05-22	18.52	-177.7	3	738	
7.	Coll-05-30	17.31	-379	3	695	--
8.	Coll-05-29	13.40	50	3	737	4.1
9.	Denkanikottai local	30.55	-609	4	753	6.4
10.	KPT local	27.23	-24.9	4	695	--
11.	Mechari local	34.25	10	4	732	3.4
	SED	12.03			14.51	
	CD (0.05%)	24.56			30.48	

**Table 2:** Per cent pods affected by pod borer in advanced entries, scores & their Grain yield -Second year.

$\beta$  *Excelastis atomosa*.

Results of the pooled analysis exhibit that the entries Coll - 05 - 29, DPI 03 - 007 (Sel. from CO6A) and DPI 03 - 004 (Sel. from DL 2564) having pest susceptibility index score of 3 - 4 and exhibit increasing level of resistance apart from higher yield (Table 3). The plant breeders forwarded DPI 03 - 007 (Sel. from CO6A) and DPI 03 - 004 (Sel. from DL 2564) for testing in MLT during Kharif 2016

in five research stations in TN. Based on the MLT results, the black seeded entry DPI 03 - 004 ranked first and maturing in 130 days was promoted for evaluation in OFT during Kharif 2017 as PYR 03 - 004 instead as DPI 03 - 004 (Sel. from DL 2564) in 50 locations of five districts to find out the suitability of the genetic material as vegetable type/seed type/dual purpose entry for christening as state variety for the benefit of rainfed/irrigated farmers.

Sl.No.	Entries	Per cent pod damage			PSR/PSI		Yield Kg/ha	
		2013-14*	2014-15**	Pooled	2013-14	2014-15	2013-14	2014-15
1.	CO 2	6.67	49.35	31.06	Check		726	708
2.	DPI 03-007 (Sel. from CO6A)	4.00	17.56	11.75	4	3	1012	840
3.	CO 1	4.00	40.94	25.11	4	5	696	675
4.	DPI 03-004 (Sel. from DL 2564)	3.33	34.11	20.92	4	4	877	738
5.	Coll-05-11	14.29	20.45	17.81	9	3	523	728
6.	Coll-05-22	18.52	18.52	18.52	9	3	857	738
7.	Coll-05-30	32.00	17.31	23.60	9	3	632	695
8.	Coll-05-29	3.33	13.40	9.08	4	3	430	737

9.	Denkanikottai local	10.67	30.55	22.03	9	4	810	753
10.	KPT local	8.33	27.23	19.11	7	4	864	695
11.	Mecheri local	6.00	34.25	22.14	6	4	790	732
	SED	2.27	12.03	3.23				14.51
	CD(0.05)	4.86	24.56	6.46				30.48

**Table 3:** Per cent pods affected by pod borer in advanced entries, scores & their Grain yield (Pooled data).

\**Helicoverpa armigera* and *Adisura atkinsoni*

\*\* *Excelastis atomosa*.

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