Table 2. Frequency distribution for recovery from *Maruca testulalis* of determinate and indeterminate pigeonpea lines damage, Maha Illuppallama, Sri Lanka, rainy season 1990/91.

	Determinate lines		Indeterminate lines		Total	
Score	No.	%	No.	%	No.	%
1	-	-	3	2.52	3	1.10
2	-	-	4	3.36	4	1.48
3	3	1.97	27	22.69	30	11.07
4	13	8.55	38	31.93	51	18.82
5	136	89.47	47	39.50	183	67.53
Total	152	100.00	119	100.00	271	100.00

The present study provides preliminary but useful information about the extent of *M. testulalis* damage in DT and IDT pigeonpea lines. Since DT types have clustered inflorescences, they appear to be more prone to *M. testulalis* damage than the IDT types which have long fruiting branches and loose inflorescences. Lateef and Reed (1981) also suggested that the DT types suffer more flower and/or young pod damage by *M. testulalis*. The variations observed within each plant type indicates that there is a scope for selecting promising genotypes.

However, more experiments are needed to confirm these results. The ability of plants to recover from the pest damage is important from the point of view of yield stability. The expression of this trait is complex and could be influenced by soil moisture content, plant age, and the inherent physiological capacity of the plant to produce flower buds in the second flush. No relationship was observed between the *M. testulalis* damage and recovery scores. This suggests that in breeding programs aimed at developing resistant lines, the two traits should be handled very carefully and attempts should be made to combine these characters.

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A Survey of Pigeonpea Pests in Sri Lanka

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Biotic constraints, particularly insect pests, are of great concern to pigeonpea farmers in Sri Lanka. There are reports of insect damage in farmers' fields. Therefore during the rainy, or maha season, 1995, insect pests and damage were surveyed in six districts of Sri Lanka. Except for Ratnapura, the locations covered in the survey are in the dry or intermediate rainfall zones of Sri Lanka, where pigeonpea production is concentrated. The survey was conducted between Jan–Mar 1995 and included pigeonpea growing in farmers' fields and on research stations. The pigeonpea varieties grown in these areas included ICPL 2, ICPL 87, ICPL 89008, and MPG 537.

A total of 44 fields were visited. At each location insect counts were taken on 20 plants, and the crop was visually scored for flower and pod damage. Pod damage assessment was undertaken at crop maturity by collecting all pods from three randomly selected plants in three districts. The insects observed in this survey were *Maruca testulalis*, *Helicoverpa armigera*, *Exelastis* sp *Lampides* sp, *Melanagromyza obtusa*, and *Mylabris* sp Jewel beetles (*Sphenoptera* sp) were also found damaging pigeonpea stems at few locations.

In Polonnaruwa district, *Maruca* populations were high in both ICPL 87 (3.1 larvae plant^{-1}) and MPG 537 (3.6 larvae plant^{-1}). The larval populations were similar in farmer- and researcher-managed plots. At the Seed Production Farm at Aluttarama in Polonnaruwa district, slightly lower *Maruca* infestation (2.15 larvae plant^{-1})

Table 1. Pigeonpea fields surveyed for pest incidence, Sri Lanka rainy season 1994/95.

District	Field surveyed	Larvae plant^{-1} (20 plants mean)			
		Maruca	*Helicoverpa*	*Lampides*	*Exelastis*
Anuradhapura	10	0.27 (0.10-0.60)[1]	0.12 (0.0-0.30)	0.12 (0.0-1.35)	0.05 (0.0-0.30)
Polonnaruwa	11	1.57 (0.25-3.60)	0.005 (0.0-0.10)	0.02 (0.0-0.45)	0.009 (0.0-0.20)
Hambantata	3	0.31 (0.12-0.55)	0.02 (0.0-0.15)	0.10 (0.0-0.75)	0.09 (0.0-0.45)
Badulla	7	0.37 (0.10-1.00)	0.0 (0.00)	0.0 (0.00)	0.007 (0.0-0.50)
Monaragala	8	0.05[2] (0.05)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Ratnapura	5	0.63 (0.40-0.80)	0.0 (0.00)	0.16 (0.0-0.60)	0.05 (0.00-1.50)

1. Figures in parentheses are range of larvae plant^{-1}.
2. Counts on 3 flowering pigeonpea fields only.

Table 2. Performance of pigeonpea/maize intercropping against *Maruca testulalis* in Bandiweva, Polonnaruwa, Sri Lanka, rainy season 1994/95.

Ratio of pigeonpea:maize population	*Maruca* larvae plant^{-1}			Pod damage rating (1–9)		
	Trial 1	Trial 2	Mean	Trial 1	Trial 2	Mean
2:4	1.25	1.20	1.23	2.80	2.50	2.65
3:4	1.38	1.35	1.37	4.50	4.50	4.50
Sole pigeonpea	1.65	1.60	1.63	5.00	5.50	5.25

Damage rating: 1 = no damage; 9 = severe damage (80–100%).

were observed in ICPL 87. In Bibile (Polonnaruwa district) no pest was found on seedlings of crop sown in mid-Dec. However, *Maruca* larvae were observed (2 larvae flower^{-1}) on *Sesbania grandiflora*, sown as a hedge in the seed farm. A summary of pest densities in different districts is given in Table 1. In the demonstration plots sown in Bandiweva village of Polonnaruwa district, pigeonpea intercropped with maize (2:4) had lower infestation than pigeonpea/maize (3:4), and sole pigeonpea (Table 2). Insect damage was greatest in Monaragala district: borer damage 22.6%, and podfly damage 48.5%. Whereas in Anuradhapura, least pod damage (25.7%) and highest yield (17.13g plant^{-1}) were recorded (Table 3).

M. testulalis was the most important insect pest and was found at almost all locations. *Maruca* larval populations were higher in plots sown during mid-Sep. Plots sown after mid-Nov had lower infestations. The high humidity and moderate temperatures which occur from mid-Nov to mid-Jan probably favor higher populations of *Maruca* (Dharamsena et al. 1992) and crops which reach maturity during this time suffer higher damage due to *M. testulalis*.

Table 3. Pigeonpea pod damage by insect pests in three districts of Sri Lanka, rainy season 1994/95.

District	Samples	Percent pod damage (Mean)			Yield plant^{-1} (g)
		Borer	Podfly	Total	
Anuradhapura	10	19.5	06.0	25.7	17.13
Polonnaruwa	06	17.0	08.7	29.4	10.06
Monaragala	05	22.6	48.5	71.9	13.27
Mean	07	19.7	21.1	42.3	13.21

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Seasonal Incidence of Pigeonpea Podfly in Tamil Nadu, India

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Poor yield of pigeonpea in India is mainly because of the attack of both lepidopteran and dipteran borer complex which occur during the reproductive phase. The podfly *Melanagromyza obtusa* causes as much or greater damage in the central and northern parts of India as the complex of lepidopteran borers (Reddy et al. 1981). *M. obtusa* is an internal feeder, whose maggots remain inside the pod, and feed on the developing grains. The damage to grains is as high as 87% (Gangrade 1963) and the affected seeds do not germinate (Singh and Singh 1986). In recent years podfly damage in pigeonpea is on the increase in Tamil Nadu (Durairaj 1995). Hence a seasonal incidence study was made at National Pulses Research Centre, Vamban (Tamil Nadu Agricultural University) during 1993.

This study was conducted with Vamban-1 pigeonpea cultivar 105–110 days duration, photoperiod insensitive, and determinate type) sown in 4-m^2 plots at monthly intervals, Jan–Dec 1993. This crop was raised under unprotected conditions. Samples of 200 pods were collected 90 days after each sowing from ten randomly chosen plants, and percent podfly damage was assessed from 300 grains. Damage occurring throughout the year at varying levels indicated that *M. obtusa* is active throughout the year. Crops sown during Apr and May recorded very low damage (5.5%), while the Feb-sown crop had a very high damage of 68% (Table 1). Sowings in Oct, Jul, and Aug recorded a moderate level of damage (10–20%). In the remaining monthly sowings, the damage was 20.5–38%.

Table 1. Podfly damage to pigeonpea pods, Vamban, Tamil Nadu, India, 1992/93.

Date	Month of observation	Grain damage (%)[1] at 90 DAS[2]
1992		
Nov	Jan	28.5 (32.3)[3]
Dec	Feb	34.0 (35.7)
1993		
Jan	Mar	33.0 (35.1)
Feb	Apr	68.0 (55.6)
Mar	May	38.0 (38.1)
Apr	Jun	5.5 (13.6)
May	Jul	5.5 (13.6)
Jun	Aug	20.5 (27.0)
Jul	Sep	18.0 (25.1)
Aug	Oct	20.0 (26.6)
Sep	Nov	28.0 (32.0)
Oct	Dec	10.0 (18.4)
CD ($P = 0.05$)		

1. Mean of three replications.
2. DAS = days after sowing.
3. Figures in parentheses are arcsine transformed values.

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