volume was enhanced by the application of miraculan 0.05 per cent at 300 ml ha^{-1} (35.3 cm^3) followed by vipul 0.1 per cent at 300 ml ha^{-1} (32.6 cm^3). The increase in fruit weight and or volume is the output of increased photosynthetic activity as result of triacontanol application, which enhanced the accumulation of carbohydrate leading to formation of larger and heavier fruits (Sharma, 1995) in tomato.

Fruit firmness

The chemical vipul 0.1 per cent at 300 ml ha^{-1} imparted in more firmness to the fruit (1.79 mm) and control treatment recorded the less firmness of 1.50 mm. Fruit firmness was improved by the application of vipul 0.1 per cent at 300 ml probably through the reduced pectinase activity (Table 2). Pectin is the partially esterified methyl ester of poly galacturonic acid, which is normally broken down, by (PGA) poly galacturonic acid during the process of ripening. The TRIA (triacontanol) application would have triggered the mechanism of slowing down the synthesis of pectinase thereby it could have protected the pectin from breaking down (Hua *et al.* 1985).

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Timing of insecticide application for the control of pigeonpea podfly

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Abstract : A field experiment was conducted at National Pulses Research Centre, Vamban, during the year 1994 to asses the critical stage for the insecticidal application to manage the pigeonpea pod fly, *Melanagromyzae obtusa* Malloch. Also a laboratory experiment was conducted to find out the preferred age for oviposition by pod fly adults which is essential for timing of insecticidal application. The results showed that the plots sprayed at the pod age of 5-10 days recorded the lowest grain damage of 12.4% and 16.8% respectively. Under laboratory condition it was found that more number of eggs *viz.*, 16.1 and 16.7 were laid in 10 and 15 day old pods than other age groups. Hence it may be concluded that the pod age of 10-15 day is the critical stage for the insecticidal application, when pod fly incidence alone is noticed. (***Key Words*** : *Pigeonpea pod fly, Pod age, Insecticidal application).*

Pulses are one of the important dietary requirements of human beings. In India, although there has been an increase in their production, the availability does not match with an increasing human

population. Among the pulses, pigeonpea stands first in the order of consumption and production. The yield of pigeonpea is reduced to a greater extent due to many constraints of which pest problem stands first. Though different insect pests are attacking in different growth stage of pigeonpea, the lepidopteran borers and dipteran borer the pod fly, *Melanagromyza obtusa* Mall are considered to be important and they cause damage to flowers and pods. The grain yield loss caused by pod fly alone was up to 72% (Lal *et al.* 1993). In Tamil Nadu also 68% of grain damage was recorded (Durairaj and Venugopal, 1996). Hence various IPM practices are being followed to reduce the damage caused by this pest and also to reduce the use of insecticides considering the various ill effects. Generally, in pigeonpea 3-4 rounds of insecticidal sprays are being used during the pod formation stage against this pest as schedule basis. The lepidopteran borers and the pod fly may occur together or individually. Hence a field experiment was conducted at National Pulses Research Centre, Vamban, during 1994 to reduce the number of insecticidal sprays and to assess the critical stage for insecticidal application, if podfly incidence alone is noticed. Also a laboratory experiment was conducted to study the pod age preference for oviposition by the adult flies, which directly reflect on its damage.

Materials and Methods

i) Timing of insecticidal application

This experiment was conducted during *kharif* 1994 with a short duration pigeonpea cultivar Vamban 1 in a factorial randomized block design with two factors and three replications in a plot size of 5 x 4 m. The recommended insecticides for the control of pigeonpea pod fly *viz.*, dimethoate (0.03%), monocrotophos (0.04%), phosphamidon (0.05%), endosulfan (0.07%) and cypermethrin (0.025%) were kept as main factors. The application of insecticides on 5, 10, 15 and 20 days after pod formation were kept as sub factors. As there was continuous pod formation, there were chances for the over - lapping of different age groups of pods. Therefore the spraying was done when more than 75% of the pods of the same age groups were found to gather. The pod fly damage on grain basis was assessed by collecting 300 pods from 10 plants selected at random leaving the border rows. The grain yield per plot was also recorded. The data were analyzed after arc sine transformation.

ii) Pod age preference for oviposition

This study was conducted under laboratory condition by providing pods of different age groups for the oviposition by the female flies. Pods of different age groups *viz.*, 5, 10, 15, 20 and 25 days were removed with pedicle intact from a susceptible cultivar Vamban 1 and place in group wise in tubular plastic containers (7.0 cm long and 2.5 cm dia.) @ 10/ container with moist sand. These containers were placed in a glass trough (15.5 to 16.0 cm dia.) in a circular manner and covered with lid with provision for ventilation. Ten pairs of freshly emerged adults were introduced into the trough for oviposition. This set up was kept for three days till all the flies were dead. The pods were removed and dissected out age wise and the number of eggs present were counted. This experiment was replicated five times. The data were analyzed after square root transformation.

Results and Discussion

The experimental results showed that all the insecticides proved their effectiveness in reducing the pod fly damage with yield increase and were better than control. With regard to time of application of insecticides, the plot sprayed at the pod age of 10 days recorded the lowest grain damage of 12.4% followed by 5 day old pods (16.8%). Insecticides applied on 15 day and 20 day old pods recorded the grain damage of 18.2% and 22.9% respectively (Table 1). It was also observed that at the time of insecticide application the lepidopteran borers damage was less than 10% invariably in all the treatments. A maximum grain yield of 856.1 kg ha^{-1} was recorded in plots sprayed at the pod age of 15 days followed by plots sprayed in 10 days old pods (822.5 kg ha^{-1}). The plot sprayed at the age of 5 days and 20 days recorded the grain yield of 723.9 and 299.4 kg ha^{-1} respectively (Table 2). The reduction in pod fly damage might have increased the grain yield and the reduction in damage might be due to the mortality of the adult flies, which is the only stage that could come in contact with insecticides directly.

The effectiveness of cypermethrin against pod fly adult was earlier reported by ICRISAT, 1993. It was also confirmed that the mortality of the pod fly adult was quicker when exposed to the insecticides *viz.*, endosulfan and cypermethrin (Durairaj and Venugopal, 1995). Hence there may be reduction in egg laying. The other possible reason might be the ovicidal action of the insecticides. The

Table 1. Pod fly grain damage (%) on pods of different age groups treated with insecticides*

Treatment	Conc. (%)	Pod age (Days) 5	10	15	20	Mean
Dimethoate	0.03	14.7 (22.1)	9.3 (17.1)	14.3 (22.0)	20.0 (26.2)	14.6 (22.0)
Monocrotophos	0.04	13.7 (21.7)	9.0 (17.4)	16.7 (24.1)	23.7 (29.1)	15.8 (23.2)
Phosphamidon	0.05	16.0 (23.6)	9.0 (17.4)	17.7 (24.8)	20.3 (26.8)	15.8 (23.2)
Endosulfan	0.07	15.7 (23.3)	9.3 (17.7)	17.3 (24.5)	22.3 (28.2)	16.2 (23.5)
Cypermethrin	0.025	13.0 (21.1)	8.7 (17.0)	15.7 (23.2)	24.7 (29.8)	15.5 (22.8)
Untreated check	-	28.0 (32.0)	29.0 (32.6)	27.3 (31.5)	26.3 (30.9)	27.7 (31.7)
Mean		16.8 (24.0)	12.4 (20.0)	18.2 (25.1)	22.9 (28.6)	

* Mean of three replications

Figures in parentheses are sine tranformed values

Factors	Level of significance	CD
Insecticides (I)	P=0.05	1.21
Pod age (P)	P=0.05	1.00
I Vs P	P=0.05	2.91

Table 2. Grain yield (kg ha^{-1}) in different age group of pods treated with insecticides*

Treatment	Conc. (%)	Pod age (Days) 5	10	15	20	Mean
Dimethoate	0.03	791.7	900.0	965.0	295.0	737.9
Monocrotophos	0.04	786.7	950.0	1053.3	276.7	766.7
Phosphamidon	0.05	830.0	938.3	1023.3	295.0	771.7
Endosulfan	0.07	815.0	881.7	1041.7	318.3	764.2
Cypermethrin	0.025	808.3	901.7	918.3	303.3	732.9
Untreated check	-	311.7	363.3	315.0	308.3	324.6
Mean		723.9	822.5	856.1	299.4	

* Mean of three replications

Figures in parentheses are sine tranformed values

Factors	Level of significance	CD
Insecticides (I)	P=0.05	38.15
Pod age (P)	P=0.05	31.10
I Vs P	P=0.05	76.19

Table 3. Response of pod age to oviposition by pod fly adults.

Sl. No.	Age of the pods in days	Mean no. of eggs laid by 5 females
1	5	8.7 (2.93)
2	10	16.1 (4.00)
3	15	16.7 (4.07)
4	20	5.1 (2.23)
5	25	0.0 (0.07)
CD (P=0.05)	0.21	

Mean of three replications

Figures in parentheses are sine tranformed values

antiovipositional effect of monocrotophos and endosulfan was also confirmed earlier by Durairaj, (1995). Under laboratory condition it was found that the pod age of 10-15 days was conducive for the oviposition, where more number of eggs were laid than other age group of pods (Table 3).

This finding is in accordance with Sithanatham *et al.* (1981) who observed more number of eggs in pods of up to 10 days old followed by partially matured pods. However, Lal *et al.* (1988) found the seasonal variation on pod age preference by pod fly adults. The most preferred pod age for oviposition was 30-35 days in January, while it was 10-20 days in April. Hence it may be concluded that the pod age of 10-15 days was the critical stage for insecticidal application there by the insecticide usage will be minimized.

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