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RESEARCH ARTICLE

Induced resistance in pigeonpea, *Cajanus cajan* by organic manures against pod fly and pod bugs

■ B. BOMMESHA[1], M.I. NAIK[2], ARATI PANNURE[2], G.P. MUTTHURAJU[2]* AND SYED IMRAN[2]

[1]Department of Agricultural Entomology, College of Agriculture, SHIMOGA (KARNATAKA) INDIA
[2]Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, G.K.V.K., BENGALURU (KARNATAKA) INDIA

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***Corresponding author:**
Email: mutthuwithu@yahoo.co.in

ABSTRACT

Field experiment was conducted at College of Agriculture, Navile, Shimoga during *Kharif*, 2010, to assess the influence of various organic manures in the incidence of pod bugs and tur pod fly on pigeonpea. Application of poultry manure (@ 0.425 t/ha) + neem cake (@ 0.25 t/ha), followed by poultry manure alone (@ 0.85 t /ha) and neem cake alone (@0.5 t/ha) recorded reduced incidence of pod bugs against NPK applied plots. Similarly pod fly incidence was lowest in neem cake (@ 0.5 t/ha) treated plots, followed by vermicompost among organic treatments. The organic manures comparatively increased the total phenols in green pods and recorded lower protein, reducing and total sugars, whereas straight fertilizer received plots recorded *vice versa*. The pod flies and pod bugs incidences were significantly negative correlated with phenols, whereas significantly positive correlated with protein and non-significant positive associationship with reducing sugars and total sugars. The organic manures induced the phenol production in pods and thus induced resistance.

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INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is an important legume crop of semi-arid tropics. In India, it is mainly grown during *Kharif*. It accounts for about 11.8 per cent of total pulse area and 17 per cent of total pulse production of the country (Kunal and Anuj, 2009). Insect pests are the major constraints for low productivity in pigeonpea. Apart from lepidopteran pests, tur pod fly, *Melanagromyza obtuse* (Malloch) and pod bugs, *Riptortus pedestris* (Fab.), *Riptortus linearis* (Fab.) and *Clavigralla gibbosa* (Spinola) are also major ones causing drastic reduction in yield of pigeonpea. Several biochemical factors are known to be associated with insect resistance in pigeonpea. Biochemical constituents such as proteins, amino acids, total soluble sugars, phenolics, disease related enzymes *etc*., have been reported to contribute to the biochemical basis of resistance to insect pests (Painter, 1951; 1958 and Schoonhoven, 1968). Inducing resistance through organic means has become more viable. Induced resistance is the qualitative and quantitative enhancement of plant defence mechanism and is the non-heritable resistance where host plants are induced to impart resistance to tide over pest infestation. Hence, a study was taken up to know the impact of organic amendments on the incidence of pod fly and bugs in pigeonpea.

MATERIAL AND METHODS

For the study, field experiment was laid out in Randomized Complete Block Design with 12 treatments and three replications during *Kharif* 2010 at College of Agriculture, Shimoga, under rainfed condition. Pigeonpea variety ICPL-87 was selected for the study and sowing was taken during last week of July with a spacing of 60 cm between the rows and 30

cm within the rows in a plot size of 12.6 m^2.

Treatments details are as follows:

T_1- RDF (Recommended dose of fertilizers *i.e.*, FYM @7.5 t/ha + NPK-25:50:25 kg/ha)

T_2- VC (Vermicompost @ 2.5 t/ha)

T_3- PM (Poultry manure @ 0.85 t/ha)

T_4- NC (Neem cake @ 0.5 t/ha)

T_5- VC+PM (Vermicompost @ 1.25 t/ha + Poultry manure @ 0. 425 t/ha)

T_6- PM+NC (Poultry manure @ 0.425 t/ha+ Neem cake @ 0.25 t/ha)

T_7- NC+VC (Neem cake @ 0.25 t/ha + Vermicompost @ 1.25 t/ha)

T_8- FYM+NC (Farm yard manure @ 3.75 t/ha + Neem cake @ 0.25 t/ha)

T_9- FYM+PM (Farm yard manure @ 3.75 t/ha + Poultry manure @ 0.425 t)

T_{10}- FYM+VC (Farm yard manure @ 3.75 t + Vermicompost @ 1.25 t/ha)

T_{11}- Standard check (T_1 + Three conventional insecticidal sprays *i.e.*, endosulfan 35 EC @ 2ml /lit, chlorpyrifos 20EC @2ml/lit, phosalone 35EC @ 2ml/lit)

T_{12}- Control (Untreated check).

The treatments included the application of vermicompost, neem cake, poultry manure and their combinations with FYM and recommended dose of fertilizer (RDF) on the basis of N_2 requirement of soil (25:50:25 kg/ ha). The organic manures were applied in respective plots as basal applications by mixing in soil manually, a week before. Required quantity of NPK fertilizer as per the recommendation (Anonymous, 2006) was applied into soil while sowing. The recommended plant protection was followed with an interval of 14 days in standard check (T_{11}).

The nymphs and adults of pod bugs (*Riptortus pedestris*, *Riptortus linearis* and *Clavigralla gibbosa*) were counted on five randomly selected tagged plants in each plot and population was averaged per plant. The observations were made at weekly interval starting from flower initiation till the harvest of crop. The observation on population of tur pod fly larvae was recorded on ten pods in each plot commencing from pod formation stage till harvest. The changes in the biochemical components like total chlorophyll, phenol, protein, reducing sugars and total sugars due to application of organic manures were analyzed by collecting immature pods from five randomly selected plants at 90 days after sowing (DAS). Phenol and protein were estimated as suggested by Mallik and Singh (1980) and Lowry *et al.* (1951), respectively. Reducing sugar was estimated by Nelson (1944) method and total soluble sugars were estimated by Dubois *et al*. (1956) method.

The population data of pests were transformed to vx+0.5 values. These transferred values were analyzed using ANOVA and the mean values were subjected to Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The results of Table 1 revealed that an average population of pod bug incidence was significantly highest in

Table 1 : Effect of various organic manures on the incidence of pod bugs and tur pod fly in pigeonpea during *Kharif* 2010 at Navile, Shimoga

Treatments	Pod bugs Nos. of nymph and adults/plant *	Tur pod fly Nos. of larvae/10 pods**
T_1 RDF	0.88 (1.16)^{a}	1.43 (1.36)^{a}
T_2 VC	0.45 (0.97)^{bc}	0.87 (1.14)^{abc}
T_3 PM	0.32 (0.90)^{b}	0.97 (1.18) ^{abc}
T_4 NC	0.37 (0.92) ^{bc}	0.50 (0.97)^{c}
T_5 VC+PM	0.49 (0.99) ^{bc}	1.08 (1.23)^{abc}
T_6 PM+NC	0.29 (0.88)^{b}	0.77 (1.09) ^{abc}
T_7 NC+VC	0.52 (1.00) ^{bc}	1.03 (1.21)^{abc}
T_8 FYM+NC	0.53 (1.01) ^{bc}	0.90 (1.15) ^{abc}
T_9 FYM+PM	0.47 (0.97) ^{bc}	1.05 (1.22))^{abc}
T_{10} FYM+VC	0.59 (1.03) ^{bc}	1.13 (1.25)^{ab}
T_{11} Standard check	0.35 (0.91)^{b}	0.73 (1.08)^{bc}
T_{12} Untreated check	0.84 (1.15)^{a}	1.30 (1.31)^{ab}
S.Em.±	0.06	0.08
CD (P=0.05)	0.18	0.23
CV (%)	11.00	11.38

DAS- Day after sowing; RDF- Recommended dose of fertilizer; VC-Vermicompost ; PM-Poultry manure; NC - Neem cake; FYM- Farm yard manure; Figures within parenthesis are ?x+0.5 transformed values and those outside are original mean value; In a column means followed by same letter(s) are not significantly different at P=0.05 as per DMRT.

* Average of five observations

** Average of four observations

RDF (0.88 / plant) followed by the untreated control (0.84) compared to organic treatments (T_2 to T_{10}) and the lowest incidence was recorded in PM+NC (0.29), followed by PM (0.32) which were at par with the standard check (0.35/plant) and also with rest of the organic treatments *viz.*, T_4 (NC) (0.37), T_2 (VC) (0.45), T_9 (FYM+PM) (0.47), T_5 (VC+PM) (0.49), T_7 (NC+VC) (0.52), T_8 (FYM+NC) (0.53) and T_{10} (FYM+VC) (0.59). This might be attributed to the fact that poultry manure and neem cake may induce the resistance in plant. Similar results were obtained by Rajaram and Siddeswaran (2006), that poultry manure controls the pests of cotton as it has insecticidal properties and potential to check the pests incidence on cotton. It is also in agreement with the findings of Prasanna (2009) who reported that the incidence of dusky cotton bug, *Oxycarenus hyalinipennis* was lower in combination of FYM+PM (9/boll) followed by PM (9.27) and NC (9.8) compared to RDF (12.33/boll).

It was clearly evident from the study (Table 1) that among the organic treatments, significantly lowest mean number of tur pod fly was found in (NC (0.50 / 10 pods) which was at par with the standard check (0.73) and also other organics but superior to RDF (1.43) and untreated check (1.30) which recorded the highest incidence of pod fly. This might due to the application of organic amendments. The organics increased the total phenol in pods and also activities of enzyme *viz*., polyphenol oxidase and peroxidase, which might be responsible for oviposition deterrence to pod fly and hence considerably the incidence reduced compared to NPK applied plots.

Relationship between biochemical constituents of green pods and the population of pod bugs and pod fly :

In the present study, the total phenol content was high and protein, reducing sugar and total sugar content was low in green pods sample collected from organic treated plots as against green pods that received synthetic fertilizers (Table 2). The present findings are in close agreement with Lyashenko *et al*. (1982), who reported that increased level of leucoanthocinins, catachins, flavanolglycocides and phenol-carboxilic acids in plants that received organics. Also, Shilpa (2005) reported that total proteins, total reducing sugars were comparatively lower in flower buds, pods and seeds in the tolerant varieties than in the susceptible varieties.

The results of Table 3 indicated that tur pod fly incidence had positive non-significant relationship with protein, reducing and total sugar (r=0.49, 0.50 and 0.32, respectively), but significant negative relationship with phenol (r= 0.68*) in green pods of pigeonpea. Dass and Odak (1987) reported that

Table 2 : Influence of various organic manures on biochemical parameters in immature pods (green pods) of pigeonpea

Treatments	Protein (%)	Phenol (mg /g)	Reducing sugars (%)	Total sugars (%)
T_1 RDF	24.39^{a}	6.94^{cd}	2.69^{a}	4.03^{ab}
T_2 VC	22.24^{bc}	7.43^{abc}	2.34^{bcd}	3.61^{bc}
T_3 PM	21.61^{c}	7.77^{ab}	1.94^{d}	3.42^{c}
T_4 NC	21.60^{bc}	7.97^{a}	1.92^{d}	3.44^{c}
T_5 VC+PM	21.86^{c}	7.46^{abc}	2.27^{bcd}	3.50^{c}
T_6 PM+NC	21.85^{c}	7.89^{a}	2.18^{cd}	3.56^{bc}
T_7 NC+VC	21.71^{c}	7.43^{abc}	2.40^{abc}	3.62^{bc}
T_8 FYM+NC	21.82^{c}	7.64^{abc}	2.25^{cd}	3.56^{bc}
T_9 FYM+PM	21.84^{c}	7.48^{abc}	2.32^{bcd}	3.52^{bc}
T_{10} FYM+VC	22.25^{bc}	7.42^{abc}	2.41^{abc}	3.60^{bc}
T_{11} Standard check	23.99^{ab}	7.04^{bcd}	2.79^{a}	4.11^{a}
T_{12} Untreated check	23.93^{ab}	6.57^{d}	2.56^{abc}	3.75^{abc}
S.Em.±	0.65	0.22	0.13	0.16
CD (P=0.05)	1.90	0.65	0.39	0.45
CV (%)	5.01	5.16	9.95	7.38

RDF- Recommended dose of fertilizer; VC-Vermicompost ; PM-Poultry manure; NC - Neem cake; FYM- Farm yard manure; In a column means followed by same letter(s) are not significantly different at p=0.05 as per DMRT.

Table 3 : Correlation co-efficient of the pod borers incidence with biochemical constituents of immature pods (green pods) in pigeonpea

Pests	Correlation co-efficient			
	Protein	Phenol content	Reducing sugars	Total sugars
Pod bugs (*Riptortus pedestris, Riptortus linearis* and *Clavigralla gibbosa*)	0.64*	-0.76*	0.55	0.44
Tur pod fly (*Mealanagromyza obtusa*)	0.49	-0.68*	0.50	0.32

*Indicates significant at 5%; Table "r" value =0.576

reducing and non-reducing sugars content had a positive relationship with pod infestation (r = +0.99 and r= +0.94, respectively). It showed that there was increase of one per cent pod infestation with increase of 0.6 mg of reducing and 0.32 mg of non-reducing sugar g^{-1} sample and also negative correlation was found between pod infestation and the phenol content (r= -0.81**).

With respect to pod bugs, significant positive correlation was seen with protein (r=0.64*), negative significant associationship with phenol (r= -0.76*) and positive correlation with reducing sugars (r=0.55) and total sugars (r=0.44). Baruah and Dutta (1994) reported that crude protein content and reducing sugars in seeds of green gram varieties were positively correlated with the frequency of *Riptortus linearis*.

Thus, the organic manures applied to the crop not only provided nutrition to the plants but also it offers induced resistance to plants against different insect pests.

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