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# Web-forming lepidopteran, *Maruca vitrata* (Geyer): an emerging and destructive pest in pigeonpea

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**Abstract:** In recent years the legume pod borer, *Maruca vitrata* (Geyer) is a major limitation in pigeonpea production. Keeping this point in view, the field experiments were undertaken on "web-forming Lepidopteran, *Maruca virtata* (Geyer): An emerging and destructive pest in pigeonpea" during 2005 and 2009 at Agricultural Research Station, Gulbarga, Karnataka, India. Results indicated that incidence of spotted pod borer was high in early (140-150 days) and late maturing (190-200 days) varieties, moderate in medium duration (170-180 days). It is noteworthy to mention that the incidence was high in late sown conditions and also in varieties having clustering type of branching habit. The management strategies revealed cultural practices such as intercropping with sorghum, time of sowing (first fortnight of June) and removing of weeds belonging to Leguminaceous family reduces the pod borer damage. Among the insecticides, one application of profenphos 50EC @ 2.0 ml/ liter of water in combination with DDVP @ 0.5 ml/liter of water at the time of flowering was found most effective in combating the pest and registered lowest pod damage (6.23 %), highest grain yield (10.20 q/ha) with highest cost benefit ration (1: 5.30) as compared to individual insecticides. This treatment is followed by monocrotophos 36SL @ 2.0 ml + DDVP @ 0.5 ml/liter and methomyl 40SP @ 1.0 g DDVP @ 0.5 ml/liter. Biorationals such as Neem Seed Kernel Extract (5%) + DDVP @ 0.5 ml/liter of water was found next best treatment for the management of spotted pod borer

**Key words:** *Maruca vitrata,* insecticides, pigeon pea

## Introduction

More than 250 species of insects have been found feeding on pigeonpea, although only a few of these cause significant and consistent damage to crop *viz.,* web forming or spotted pod borer, *M. vitrata,* the gram pod borer, *Helicoverpa armigera* (Hubner) and the pod fly, *Malanagromyza obtusa* Malloch are the major pest species inflicting damage to pods. Spotted pod borer, *M. vitrata* is becoming predominant insect pest in recent years in all pigeonpea growing areas of India. This pest is a single major factor responsible for heavy loss in early and medium late maturing pigeonpea genotypes (Sahoo, 1995; Shanower *et al.,* 1999). Larvae feed by remaining inside the webbed mass of leaves, flowers and pods. This concealed feeding complicates the management of this pest as pesticides and natural enemies have difficulty in penetrating the shelter to reach the larvae (Sharma, 1998). Pigeonpea genotypes with determinate growth habit, where pods are bunched together at the top of the plant are more prone to damage than in the indeterminate ones (Sharma *et al.,* 1999). With the introduction of short duration genotypes for cultivation, Maruca has emerged as one of the major constraint because of the coincidence of high humidity and moderate temperature in September – October coinciding with the flowering of the crop in India. In these circumstances the investigation on spotted pod borer needs to be strengthened as the pest is new to this crop and the research studies in Karnataka is very meager. Hence the detailed investigations were undertaken to manage the insect during 2005-2009 at Agriculture Research Station, Gulbarga, Karnataka.

## Material and methods

Seven pigeonpea different genotypes were evaluated for the incidence of spotted pod borer with three replications (Table 1). Similarly, six different intercropping systems were evaluated to know the incidence of spotted pod borer in pigeonpea with three replications (Table 2). For the management of spotted pod borer, a field experiment was laid out in randomized block design to assess the efficacy of insecticides and botanicals during 2005-09. The experiment consisted of eleven treatments (Table 3) including control replicated thrice, with a plot size of 5.4 x 4.5 meters. The variety employed for the study was ICPL – 87119 (Asha), a late maturing variety with a spacing of 90 cm x 30 cm between rows and plants, respectively. All the package of practices were followed except management practice for spotted pod borer. The treatments were imposed once at 50 per cent flowering. Observations were recorded at harvest for both pod damage and grain yield from five randomly selected plants from each plot. For pod damage, all the pods of five selected plants were assessed for recoding grain damage for which 100 pods were selected randomly among the pods of five plants. The per cent pod damage and grain yield was computed and the data were subjected to statistical analysis.

## Results and discussion

The incidence of web forming or spotted pod borer was high in early (130-140 days) and late maturing (190-220 days) varieties and moderate in medium duration (170-180 days) varieties. The mean number of webs varied from 1.20 to 8.31 per plant among the test genotypes (Table 1). Short duration genotype, i.e. GC-11-39 was susceptible to *Maruca;* whereas medium duration genotypes i.e. Gullayl local, TS3-R, WRP-1 and Maruti were resistant to *M. vitrata* registering 1.20 to 3.75 webs per plant. Genotype (GC-11-39) with determinate growth habit, where pods are bunched together at the top of the plant are more prone to damage than in the indeterminate type which agrees with the findings of Sharma *et al.,* (1999) ; Mohapatra and Srivastava, (2003). Short duration genotype had higher infestation of *M. vitrata* than medium duration and long duration pigeonpea which was in agreement with the findings of Rao *et*

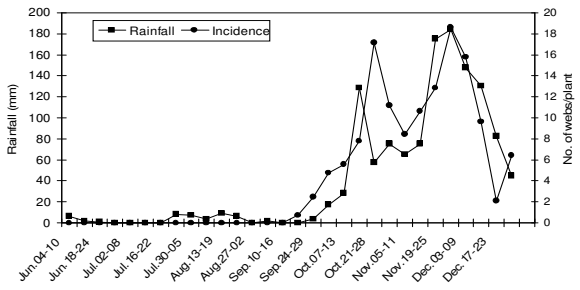


Figure 1. Correlation between rainfall and incidence of M. vitrata in pigeonpea ecosystem.

*al.,* (2004); Mandal (2005). The incidence of *M. vitrata* increased with the initiation of flowering, having the highest population at full podding stage (Imosanen and singh, 2005). It is noteworthy to mention that the incidence was high in late sown conditions and also in varieties having clustering type of branching habit.

Among the six intercrops evaluated *viz.,* sorghum, green gram, black gram, soybean, bajra and sunflower, both sorghum and bajra recorded lowest webs per plant (0.62 to 0.75)(Table 2). Whereas severe attack by *M. vitrata* was observed in sole pigeonpea crop (3.32 webs/plant). The incidence of *M. vitrata* is bimodal where early infestation starts from September reaching its first peak during middle October and second peak during December (Figure 1). The positive correlation (r=0.86) between rainfall and incidence of the pest has been reported by Sharma et al., (2000).

The untreated check recorded higher number of webs per plant (5.21 to 7.07) as compared to rest of the treatments (Table 3). The flower bud stage is most preferred for ovipositon and it is at this stage, the young larvae cause substantial damage and reduce the crop potential for flowering and pod setting. The young larvae bore into the flower buds and cause flower shedding by destroying the enclosed parts of young flower like the sepals. At this stage the damage is largely internal and there is little or no sign of damage externally. The third to fifth instar larvae are capable of boring into the pods and can also consume the developing grains. When insecticides are sprayed individually, the pest escaped coming in contact with insecticides. Interestingly, when the contact insecticides are mixed with fumigants especially DDVP, the larva come out of the web due

Table 1. Evaluation of pigeonpea varieties against *Maruca vitra* during 2008-09

| Inflorescence type | Duration | Genotype | Duration (days) | Plant type | Number of webs per plant | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | September | October | November | December | Mean |
| Non cluster | LD | BSMR-736 | 190-220 | Indeterminate | 10.70 | 5.20 | 1.33 | 0.00 | 4.31 |
| Cluster | ED | GC-11-39 | 130-140 | Determinate | 11.80 | 16.40 | 2.94 | 2.10 | 8.31 |
| Non cluster | MD | Gullyal local | 150-160 | Indeterminate | 9.40 | 4.50 | 1.08 | 0.00 | 3.75 |
| Non cluster | MD | TS3-R | 150-160 | Indeterminate | 5.20 | 3.40 | 0.88 | 0.00 | 2.37 |
| Non cluster | MD | WRP-1 | 150-160 | Indeterminate | 3.80 | 2.60 | 0.58 | 0.50 | 1.87 |
| Non cluster | MD | Maruti | 170-180 | Indeterminate | 2.50 | 1.80 | 0.48 | 0.00 | 1.20 |
| Cluster | LD | Asha | 190-220 | Indeterminate | 8.50 | 6.75 | 1.37 | 1.40 | 4.51 |
| | SEm ± | | | | 0.83 | 0.41 | 0.15 | 0.11 | |
| | CD at 5% | | | | 2.52 | 1.23 | 0.45 | 0.34 | |

LD = Late duration, ED = Early duration, MD = Medium duration

Table 2. Effect of intercropping system on the incidence of *Maruca vitrata* in pigeonpea during 2008-09

| Sl. No | Intercropping system | Number of webs per plant | | | | | Natural enemies/plant | |
|---|---|---|---|---|---|---|---|---|
| | | September | October | November | December | Mean | Coccinellids | Spider |
| 1. | Pigeonpea + Sorghum | 1.00 | 0.72 | 0.19 | 0.56 | 0.62 | 0.72 | 1.25 |
| 2. | Pigeonpea + greengram | 4.28 | 2.08 | 0.53 | 0.00 | 1.72 | 0.54 | 0.82 |
| 3. | Pigeonpea + blackgram | 3.40 | 2.70 | 0.55 | 0.00 | 1.66 | 0.41 | 0.54 |
| 4. | Pigeonpea + bajra | 1.52 | 1.04 | 0.23 | 0.20 | 0.75 | 0.69 | 1.05 |
| 5. | Pigeonpea + soybean | 3.76 | 1.44 | 0.43 | 0.00 | 1.41 | 0.40 | 0.60 |
| 6. | Pigeonpea + sunflower | 2.08 | 1.80 | 0.35 | 0.00 | 1.06 | 0.63 | 1.14 |
| 7. | Pigeonpea sole | 4.72 | 6.56 | 1.18 | 0.84 | 3.32 | 0.21 | 0.34 |
| | SEm ± | 0.23 | 0.15 | 0.03 | 0.02 | | 0.03 | 0.04 |
| | CD at 5% | 0.72 | 0.46 | 0.11 | 0.05 | | 0.09 | 0.12 |

Table 3. Evaluation of insecticides and botanicals on larval population of *M. vitrata* in pigeonpea during 2005-09

| | Treatment | Dosage/ lit Water | Number of larvae / plant | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2005-06 | | 2006-07 | | 2007-08 | | 2008-09 | | Pooled over years | |
| | | | 1 DBA | 10 DAA | 1 DBA | 10 DAA | 1 DBA | 10 DAA | 1 DBA | 10 DAA | 1 DBA | 10 DAA |
| T1 | Monocrotophos 36 SL | 1.0 ml | 5.11 | 2.29 | 8.75 | 3.98 | 3.17 | 1.28 | 2.89 | 1.29 | 4.97 | 2.21 |
| T2 | Methomyl 40SP | 0.6 g | 4.69 | 2.05 | 7.64 | 3.60 | 3.93 | 1.02 | 2.71 | 1.14 | 4.74 | 1.95 |
| T3 | Profenophos 50EC | 2.0 ml | 4.52 | 1.96 | 7.72 | 3.38 | 2.87 | 1.16 | 2.56 | 1.10 | 4.41 | 1.90 |
| T4 | NSKE 5% | 50 g | 4.86 | 2.49 | 8.26 | 4.25 | 3.21 | 1.60 | 2.76 | 1.41 | 4.77 | 2.44 |
| T5 | DDVP 76EC | 0.5 ml | 4.65 | 2.4 | 7.94 | 4.14 | 2.99 | 1.41 | 2.63 | 1.35 | 4.55 | 2.32 |
| T6 | Monocrotophos+DDVP | 1.0+0.5 | 4.86 | 0.83 | 8.34 | 1.75 | 2.97 | 0.95 | 2.74 | 0.58 | 4.73 | 1.03 |
| T7 | Methomyl 40 SP +DDVP 76 EC | 0.6+0.5 | 5.37 | 0.79 | 9.26 | 1.02 | 3.19 | 0.63 | 3.03 | 0.66 | 5.21 | 0.78 |
| T8 | Profenphos+DDVP | 2.0+0.5 | 5.06 | 0.10 | 8.68 | 0.17 | 3.12 | 0.08 | 2.86 | 0.06 | 4.93 | 0.10 |
| T9 | NSKE 5%+ DDVP | 50 + 0.5 | 5.08 | 0.80 | 8.62 | 2.84 | 3.35 | 1.83 | 2.88 | 0.89 | 4.98 | 1.59 |
| T10 | IPM | -- | 5.18 | 6.44 | 8.86 | 10.7 | 3.25 | 4.83 | 3.33 | 4.19 | 5.15 | 6.54 |
| T11 | UTC | -- | 5.32 | 7.22 | 9.07 | 12.3 | 3.43 | 4.68 | 3.02 | 4.09 | 5.21 | 7.07 |
| | CD at 5% | | NS | 0.38 | NS | 1.20 | 1.02 | 0.59 | 0.47 | 0.45 | 0.87 | |
| | SEm ± | | 0.35 | 0.13 | 0.55 | 0.40 | 0.34 | 0.2 | 0.15 | 0.15 | 0.29 | |
| | CV (%) | | 14.35 | 13.6 | 17.24 | 21.60 | 12.9 | 19.28 | 11.72 | 9.48 | 10.84 | |

DBA : Day Before Application, DAA : Days After Application

Table 4. Evaluation of insecticides and botanicals on pod damage, grain yield and cost returns due to *M. vitrata* in pigeonpea during 2005-09

| | Treatment | Dosage/ lit Water | Pod damage (%) | | | | | Grain Yield (q/ha) | | | | | Cost returns (Rs.) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2005-06 | 2006-07 | 2007-08 | 2008-09 | Pooled over years | 2005-06 | 2006-07 | 2007-08 | 2008-09 | Pooled over years | Cost of insect-icide | Other cost | Total cost | Gross returns | Net returns | B:C ratio |
| T1 | Monocrotophos 36SL | 1.0 ml | 18.29 | 28.30 | 19.40 | 15.20 | 20.30 | 8.46 | 7.17 | 7.96 | 7.53 | 7.78 | 290 | 5500 | 5790 | 26452 | 20662 | 4.57 |
| T2 | Methomyl 40SP | 0.6 g | 15.77 | 25.20 | 13.20 | 15.12 | 17.32 | 9.24 | 7.52 | 9.25 | 8.34 | 8.59 | 600 | 5500 | 6100 | 29206 | 23106 | 4.79 |
| T3 | Profenphos 50EC | 2.0 ml | 16.80 | 27.40 | 13.12 | 15.00 | 18.08 | 9.05 | 7.28 | 9.12 | 8.15 | 8.40 | 750 | 5500 | 6250 | 28560 | 22310 | 4.57 |
| T4 | NSKE 5% | 50 g | 18.62 | 24.60 | 22.40 | 20.14 | 21.44 | 8.64 | 7.04 | 8.50 | 7.73 | 7.98 | 350 | 5500 | 5850 | 27132 | 21282 | 4.64 |
| T5 | DDVP 76EC | 0.5 ml | 15.28 | 21.36 | 16.36 | 19.40 | 18.10 | 8.83 | 7.16 | 8.77 | 7.92 | 8.17 | 310 | 5500 | 5810 | 27778 | 21968 | 4.78 |
| T6 | Monocrotophos + DDVP | 1.0+0.5 | 11.35 | 13.20 | 9.80 | 12.50 | 11.71 | 9.14 | 9.24 | 9.27 | 9.15 | 9.20 | 600 | 5500 | 6100 | 29750 | 23650 | 5.13 |
| T7 | Methomyl + DDVP | 0.6+0.5 | 8.48 | 14.80 | 7.53 | 12.40 | 10.80 | 9.38 | 8.78 | 9.34 | 9.47 | 9.24 | 910 | 5500 | 6410 | 31416 | 25006 | 4.90 |
| T8 | Profenphos+ DDVP | 2.0+0.5 | 5.41 | 7.60 | 4.80 | 7.10 | 6.23 | 10.00 | 9.18 | 11.40 | 10.22 | 10.20 | 1060 | 5500 | 6560 | 34782 | 28222 | 5.30 |
| T9 | NSKE 5%+ DDVP | 50 + 0.5 | 14.40 | 15.50 | 12.80 | 16.50 | 14.80 | 9.08 | 8.33 | 9.50 | 8.87 | 8.95 | 660 | 5500 | 6160 | 30430 | 24270 | 4.94 |
| T10 | IPM | -- | 17.48 | 29.66 | 15.43 | 29.12 | 22.92 | 7.92 | 6.94 | 8.64 | 7.50 | 7.75 | 0 | 5500 | 5500 | 26350 | 20850 | 4.79 |
| T11 | UTC | -- | 40.12 | 57.20 | 37.20 | 50.40 | 46.23 | 4.14 | 3.12 | 5.05 | 4.54 | 4.21 | 0 | 3150 | 3150 | 14314 | 11164 | 4.54 |
| | CD at 5% | | 5.14 | 2.29 | 3.32 | 3.84 | 2.36 | 0.92 | 0.76 | 1.28 | 0.87 | 0.51 | ---- | ---- | ---- | ---- | ---- | ---- |
| | SEm ± | | 1.71 | 0.76 | 1.11 | 1.28 | 0.79 | 0.30 | 0.24 | 0.42 | 0.29 | 0.24 | ---- | ---- | ---- | ---- | ---- | ---- |
| | CV (%) | | 9.60 | 11.86 | 10.64 | 13.6 | 6.37 | 11.20 | 8.50 | 15.50 | 10.40 | 3.88 | ---- | ---- | ---- | ---- | ---- | |

IPM: Profenophos 50 EC @ 2 ml/l – HaNPV 250 LE/ha – NSKE 5% - Spinosad 45 SC @ 0.1 ml/l.

to suffocation and contacted sprayed particles of insecticides leading to the death of the larva (Table 3).

The management strategies revealed that among the insecticides, one application of profenophos 50EC @ 2.0 ml/l of water in combination with DDVP @ 0.5 ml/l of water at the time of flowering was found most effective in combating the pest and registered lowest pod damage (6.23 %), highest grain yield (10.20 q/ha) with highest cost benefit ratio (1: 5.30) as compared to individual insecticides. This was followed by monocrotophos 36SL @ 2.0 ml + DDVP @ 0.5 ml/l and methomyl 40SP @ 1.0 g DDVP @ 0.5 ml/l. Neem Seed Kernel Extract (5%)+ DDVP @ 0.5 ml/l of water was next best treatment for the management of spotted pod borer (Table 4). The information on combined use of insecticides and fumigants against *M. vitrata* is scanty but lot of work has been done on efficacy of individual insecticides which corroborates with the findings of Sharma *et al.* (1999 and 2000); Mohapatra and Srivastava (2003) ; Suhas *et al.* (2007) and Mandal (2005).

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