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# Investigation of pigeon pea genotypes against pod borer complex

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**Abstract**
Field testing against pod borer and pod fly of 30 genotypes and cultivars revealed that RPS 2008-5, RPS 2008-4, and RPS 2007-109 were less infested by pod borer complexes and pod fly and produced higher grain yields. There was no significant relationship noticed between plant height, growth habit, pod length, pod breadth & days to maturity and borer complex and pod fly infestation, whereas, highly negative correlation was observed between morphological characters *viz.* pod wall thickness, calyx trichome length, calyx trichome density and pod trichome density against pod borer and pod fly infestation.

**Keywords:** Genotypes, *Helicoverpa armigera*, *Melanagromyza obtusa*, morphological characters, pigeon pea

## 1. Introduction
The pigeon pea [*Cajanus cajan* (L.) Millsp.] is an important Indian pulse crop. India has the most pigeon pea acreage (3.90 million ha) with overall output and productivity of 3.17 million tons and 1230 kilograms per hectare, respectively (DAC, 2014) [1]. It is grown widely throughout the world, but particularly in Maharashtra, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Bihar, and Gujarat. In the case of pigeonpea, damage caused by insect pests is one of the biggest contributors to low yield. From seedling to harvest, it is threatened by a variety of insect pests *viz*. *H. armigera*, *M. vitrata*, *E. atomosa*, and *Melanagromyza obtusa* which cause significant yield losses. Pesticides are costly, and multiple applications could be needed, putting them out of reach for most farmers. Insecticides and spraying machines are either unavailable in certain areas or farmers lack sufficient knowledge of how to use them. In such situations, using resistant/less vulnerable cultivars is one of the most effective ways to keep insect populations below the economic threshold level (ETL). Host plant resistance has little expense or implementation ability in pest control methods, but it is more effective when used in conjunction with other pest management elements. As a result, the susceptibility of various varieties or genotypes to major pests was investigated.

## 2. Materials and Methods
During Rabi 2017-18 and Rabi 2018-19, the screening was conducted at the Krishi vigyan kendra Sehradabari farm Dhamtari for two years in a row. During the second fortnight of November, 30 genotypes or cultivars were sown in a randomised block pattern that was repeated three times. Each cultivar was planted in two rows of 4.0 meters each, with a spacing of 60cm x 20cm. The crop was raised using all of the prescribed agronomical methods. Pest prevention practices were not used on the trial site.

### 2.1. Pod and seed damage
Five plants were randomly picked from each plot and their pods were plucked separately at the time of crop maturity to record observations on pod borer and pod fly. At harvest, pod damage caused by the lepidopteran pod borer (*Helicoverpa armigera*) was observed by randomly plucking 250 pods from 5 plants of each cultivar. The appearance of hole (s) on the pod wall indicated pod damage caused by these lepidopteran larvae. The total number of damaged pods was recorded for each treatment, and the percent infestation was determined. To record podfly (*Melanagromyza obtusa*) grain damage, 50 pods were collected separately for each of the five plants, and 250 healthy and damaged grains were counted separately for podfly damage (percent). At the time of harvesting, the yield data was recorded. Prior to statistical analysis,

the pod borer (percent) and podfly infestation (percent) were transformed using arc sin.

### 2.2. Morphological component
The present study was carried out to know the relationship of pod borer complex with different plant characters plant height, growth habit, pod length, pod breadth and days to maturity of pigeon pea cultivars were also recorded for pest preference under field conditions. Data on morphological parameters like plant height, growth habit, pod length, pod breadth and days to maturity were correlated with pod borer infesting various pigeon pea cultivars.

## 3. Results and Discussion
### 3.1. Pod borer infestation
The results presented in Table 1 showed that the pigeon pea genotypes differed significantly with respect to their reaction to pod borer, *Helicoverpa armigera*, *Maruca vitrata* and *Melanagromyza obtusa* infestation. The result on mean pod damage (%) caused by *Helicoverpa armigera* varied from 7.0 to 23.15%. Among different genotypes or cultivars RPS 2008-5 recorded the significant lowest pod damage (7.0%), followed by RPS 2008-4 (7.55%), RPS 2007-105 (7.6%) and RPS 2007-109 (7.65%) and they were at par with each other. The genotype PUSA-992 recorded significant higher pod damage (23.15%) and which was at par with AKT 501 (22.95%).

### 3.2. Pod fly infestation
The data pertaining to the incidence of pod fly, *Melanagromyza obtusa* on seeds are presented in Table 1. The pod damage (%) due to pod fly range between 6.8 to 11.55% was recorded. The cultivar RPS 2008-5 recorded significantly lowest pod damage (6.8%) and it was remained at par with RPS 2015-28 (7.45%), RPS 2008-4 (7.9%) and RPS 2007-109 (8.0%). The highest percentage pod damage was recorded in GT 101 (11.55%), followed by TAT 10 (11.25%). From the overall result, it can be in inferred that out of 30 genotypes screened RPS 2008-5, RPS 2008-4, RPS 2015-28, RPS 2007-105, RPS 2015-25, RPS 2007-106 and RPS 2007-10 (CG Arhar) proved promising against pod borer and pod fly and they recorded less than 7.0% and 6.8% pod and seed infestation by pod borer and pod fly, respectively. Earlier to this Kalariya *et al*. (1998) [2] reported that GT-1 and BDN-2 observed resistant against the pod borer *viz*., *Heliothis armigera* and *Melanagromyza obtusa*. Patel *et al*. (2012) [3] observed lower pod damage due to pod borer in GT-1, which is in corroboration with the present finding.

### 3.3. Grain yield
The statically analysis of yield data (Table 1) showed that the cultivar RPS 2008-5 gave the highest grain yield (1635 kg ha-1), which was significantly higher than all other genotypes. While, genotype RPS 2008-4, RPS 2007-109, RPS 2007-105 and RPS 2007-106 remained at par with RPS 2008-5. From the overall result it can be inferred that out of 30 genotype or cultivars screened a cultivar RPS 2008-5 gave higher grain yield and lower incidence of *Helicoverpa* and pod fly, this genotype was remain at par with RPS 2008-4, RPS 2007-109 with respect to pod borer and pod fly infestation and yield. Thus this genotype can be utilize for further breeding programme.

### 3.4. Influence of morphological characters of pigeon pea on incidence of pod borer and pod fly
The different plant characters of 30 genotypes were correlated with incidence of pod borer and pod fly and result obtained are presented in Table 2. The data pertaining to simple correlation of different plant characters of pigeon pea genotypes revealed that pod borer and pod fly had non-significant correlation with plant height, growth habit, pod length, pod breadth and days to maturity, while, significant negative correlation with pod wall thickness, calyx trichome length, calyx trichome density and pod trichome density.

**Table 1:** Screening of different genotype against *H. armigera* and *Melanagromyza obtuse*

| S. No. | Genotype | % Pod borer infestation *H. armigera* | % Pod fly infestation *Melanagromyza obtusa* | Grain yield (kg ha-1) |
|---|---|---|---|---|
| 1. | RPS2007-10 (CG Arhar-1) | 8.35 (16.8) | 8.45 (16.9) | 14.45 |
| 2. | Rajeevlochan (Check) | 8.1 (16.5) | 8.35 (16.8) | 14.7 |
| 3. | JKM-189 | 8.95 (17.4) | 8.3 (16.7) | 14.2 |
| 4. | BDN 2 | 9.6 (18.0) | 8.45 (16.9) | 14.9 |
| 5. | TJT 501 | 9.45 (17.9) | 8.8 (17.3) | 14.6 |
| 6. | UPAS 120 | 17.2 (24.5) | 11.3 (19.6) | 14.15 |
| 7. | Laxmi (ICPL 85063) | 11.95 (20.2) | 10.45 (18.9) | 14.05 |
| 8. | VLA 1 (ICPL 88039) | 13 (21.1) | 10.55 (19.0) | 13.6 |
| 9. | Asha (ICPL 87119) | 12.1 (20.4) | 10.45 (18.9) | 13.5 |
| 10. | RPS 2008-5 | 7 (15.3) | 6.8 (15.1) | 16.35 |
| 11. | RPS 2008-4 | 7.55 (15.9) | 7.9 (16.3) | 15.4 |
| 12. | RPS 2007-109 | 7.65 (16.1) | 8 (16.4) | 15.2 |
| 13. | RPS 2007-106 | 7.65 (16.1) | 8.25 (16.7) | 15 |
| 14. | RPS 2007-105 | 7.6 (16.0) | 8.35 (16.8) | 15.2 |
| 15. | RPS 2015-25 | 7.65 (16.1) | 8.3 (16.7) | 14.95 |
| 16. | RPS 2015-22 | 9.6 (18.0) | 8.6 (17.1) | 15.05 |
| 17. | RPS 2015-13 | 8.4 (16.8) | 9.75 (18.2) | 14.35 |
| 18 | RPS 2015-28 | 8.55 (17.0) | 7.45 (15.8) | 14.25 |
| 19. | RPS 2015-29 | 10.05 (18.5) | 7.6 (16.0) | 13.75 |
| 20. | Rajeshwari (PT 0012) | 12.7 (20.9) | 9.1 (17.6) | 12.75 |
| 21. | PUSA 33 | 17.8 (25.0) | 9.15 (17.6) | 12.58 |
| 22. | Pragati (ICPL 87) | 16.55 (24.0) | 9.15 (17.6) | 14.25 |
| 23. | AL 15 | 15.45 (23.1) | 12.9 (21.0) | 13.92 |
| 24. | PUSA 84 | 11.75 (20.0) | 10 (18.4) | 11.83 |

| | | | | |
|---|---|---|---|---|
| 25. | PUSA 85 | 13.85 (21.8) | 10.85 (19.2) | 11.66 |
| 26. | GT 100 | 21.8 (27.8) | 10.95 (19.3) | 10.99 |
| 27. | AKT 501 | 22.95 (28.6) | 10.95 (19.3) | 11.33 |
| 28. | PUSA 992 | 23.15 (28.8) | 10.95 (19.3) | 10.66 |
| 29. | TAT 10 | 17.95 (25.1) | 11.25 (19.6) | 10.74 |
| 30. | GT 101 | 16.6 (24.0) | 11.55 (19.9) | 10.8 |
| SEm± | | 1.65 | 0.73 | 0.42 |
| CV (%) | | 23.11% | 13.40% | 18.64 |
| CD (5%) | | 4.69 | 2.07 | 1.26 |

**Table 2:** Correlation coefficient between morphological characters of pigeon pea genotypes and percent pod damage by pod borer complex *viz. Helicoverpa armigera*, and *Melangromyza obtusa* (Mean of Rabi 2017-18 and Rabi 2018-19)

| S. No. | Morphological characters | % Pod damage by | |
|---|---|---|---|
| | | ***Helicoverpa armigera*** | ***Melangromyza obtusa*** |
| 1 | Plant height | -0.05 | -0.06 |
| 2 | Pod length | 0.26 | 0.27 |
| 3 | Pod breadth | -0.29 | -0.24 |
| 4 | Pod wall thickness | -0.91** | -0.31** |
| 5 | Days to maturity | 0.21 | 0.23 |
| 6 | Seed yield | -0.71** | -0.82** |
| 7 | Trichomes length of flower calyx | -0.71** | -0.84** |
| 8 | Trichomes length of pod | -0.76** | -*0.63* |
| 9 | Trichome density of flower calyx | -0.85** | -0.64** |
| 10 | Trichome density of pod | -0.85** | -0.86** |

* Significant at 0.05%, ** Highly significant at 0.01%

## 4. Conclusion

Field screening of 30 genotypes or cultivars against pod borer and pod fly showed that among 30 genotypes or cultivars, RPS 2008-5, RPS 2008-4 and RPS 2007-109 were less infested by pod borer and pod fly and gave higher yield. No correlation was observed between morphological plant characters *viz*. plant height, growth habit, pod length, pod breadth and days to maturity while, significant negative correlation recorded with pod wall thickness, calyx trichome length, calyx trichome density and pod trichome density.

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