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## Effect of natural inputs on *Maruca vitrata* (Geyer) infesting greengram, *Vigna radiata* (L.) Wilczek

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**Abstract**

A field experiment was conducted during *khariif* 2025 at the Regional Research Station Farm, Anand Agricultural University, Anand, to evaluate the efficacy of different natural inputs against spotted pod borer, *Maruca vitrata* infesting greengram. The experiment was laid out in a Randomized Block Design with eight treatments and three replications. The treatments comprised neem seed kernel extract (NSKE) 5%, *Neemastra* 100%, *Agniastra* 4%, *Brahmastra* 4%, *Dashparni ark* 4%, *Kalmegh* leaf extract 1%, custard apple leaf extract 5% and untreated control. Three sprays were imposed at appropriate crop stages and observations on larval population were recorded at 3, 7 and 9 days after each spray. The results revealed significant differences among the treatments. NSKE 5% proved to be the most effective treatment by recording the lowest pooled larval population (0.94 larva/plant), followed by *Agniastra* 4% (0.99 larva/plant), *Neemastra* 100% (1.04 larvae/plant) and *Dashparni ark* 4% (1.09 larvae/plant), which remained statistically at par with each other in most observations. The untreated control recorded the highest larval population (4.93 larvae/plant). NSKE 5% also recorded the highest seed yield (1267 kg/ha) and haulm yield (2508 kg/ha) with 39.52 percent increase in seed yield over control. The findings indicated that NSKE 5% could be effectively utilized as an eco-friendly and sustainable option for the management of *M. vitrata* in greengram.

**Keywords:** Greengram, *Maruca vitrata*, natural inputs, NSKE, *Agniastra*, *Neemastra*, botanicals

**Introduction**

Greengram (*Vigna radiata* L. Wilczek) is an important pulse crop cultivated extensively in tropical and subtropical regions owing to its high nutritive value and short duration. It constitutes an important source of dietary protein, carbohydrates, minerals and vitamins for a large vegetarian population. India is the largest producer and consumer of greengram; however, productivity of the crop is greatly constrained by several biotic stresses, among which insect pests are of major concern (Nair and Schreinemachers, 2020) [11]. Gujarat is one of the important mung bean-growing states in India. During the normal period (2018-19 to 2022-23), greengram was cultivated on an average area of about 1.39 lakh hectares in the state, contributing nearly 3 percent of the total mung bean area in the country. The average production was 1.03 lakh tonnes, accounting for about 3 percent of national production (Anon Ymous., 2024a) [2].

Among the insect pests infesting greengram, spotted pod borer, *Maruca vitrata* (Geyer) is one of the most destructive pests causing severe damage during flowering and pod formation stages (Patel and Borad, 2016; Bhuvra and Patel, 2022) [13, 3]. The larvae web together flowers, buds and pods and feed within the webbed plant parts, resulting in substantial yield losses. Depending upon the intensity of infestation, yield losses may vary considerably under field conditions (Duraimurugan and Tyagi, 2014; Zahid *et al.*, 2008) [6, 15].

Management of *M. vitrata* has traditionally relied upon synthetic insecticides. However, indiscriminate use of chemical insecticides has led to several problems such as insecticide resistance, pest resurgence, environmental contamination and adverse effects on natural enemies (Muthomi *et al.*, 2008) [10]. Therefore, emphasis has recently shifted towards eco-friendly pest management approaches involving botanicals and natural farming inputs. Natural inputs such as NSKE, *Neemastra*, *Agniastra* and *Dashparni ark* possess antifeedant, repellent and insect growth regulatory properties and are considered safer alternatives for sustainable agriculture (Gahukar, 2013; Kumar *et al.*, 2020; Charapale *et al.*, 2021) [7, 8, 4].

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Keeping these facts in view, the present investigation was undertaken to evaluate the efficacy of different natural inputs against *M. vitrata* infesting greengram under field conditions.

### Materials and Methods

The field experiment was conducted at the Regional Research Station Farm, Anand Agricultural University, Anand, Gujarat, during *kharif* 2025. Greengram variety Gujarat Anand Mungbean-8 (Hara Moti) was sown on 21 July 2025 following all recommended agronomic practices. The experiment was laid out in a Randomized Block Design comprising eight treatments replicated thrice. The gross and net plot sizes were  $1.8 \times 5.0$  m and  $0.9 \times 4.8$  m, respectively, with spacing of  $45 \times 10$  cm. A fertilizer dose of 20:40:0 kg N:P:K ha<sup>-1</sup> was applied.

The treatments consisted of NSKE 5%, *Neemastra* 100%, *Agniastra* 4%, *Brahmastra* 4%, *Dashparni ark* 4%, *Kalmegh* leaf extract 1%, custard apple leaf extract 5% and untreated control. Three sprays of the respective treatments

were applied using a high-volume knapsack sprayer fitted with a hollow cone nozzle. The first spray was imposed at the appearance of the pest and subsequent sprays were applied at suitable intervals.

Observations on larval population of *M. vitrata* were recorded on five randomly selected plants per net plot before spraying and at 3, 7 and 9 days after each spray. Seed and haulm yields were recorded on net plot basis and converted into kg ha<sup>-1</sup>. The data were subjected to statistical analysis after appropriate transformation and treatment means were compared using Duncan's New Multiple Range Test (DNMRT).

### Results and Discussion

The periodical observations on larval population of *M. vitrata* recorded after different sprays revealed significant differences among the treatments. Before spray application, larval population did not differ significantly among treatments, indicating uniform distribution of the pest in all experimental plots.

**Table 1:** Bio-efficacy of natural inputs against *M. vitrata* in greengram during *Kharif*, 2025

| Tr. No.             | Treatments                  | No. of larva(e)/plant at indicated days after spray |                          |                           |                          |                            |                          |                          |                          |                           |
|---------------------|-----------------------------|-----------------------------------------------------|--------------------------|---------------------------|--------------------------|----------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
|                     |                             | First spray                                         |                          |                           | Second spray             |                            |                          | Third spray              |                          |                           |
|                     |                             | 3 DAS                                               | 7 DAS                    | 9 DAS                     | 3 DAS                    | 7 DAS                      | 9 DAS                    | 3 DAS                    | 7 DAS                    | 9 DAS                     |
| T <sub>1</sub>      | Neem seed kernel extract    | 1.32 <sup>a</sup> (1.24)                            | 1.21 <sup>a</sup> (0.96) | 1.37 <sup>a</sup> (1.38)  | 1.22 <sup>a</sup> (0.99) | 1.20 <sup>a</sup> (0.94)   | 1.25 <sup>a</sup> (1.06) | 1.13 <sup>a</sup> (0.78) | 1.08 <sup>a</sup> (0.67) | 1.11 <sup>a</sup> (0.73)  |
| T <sub>2</sub>      | <i>Neemastra</i>            | 1.35 <sup>a</sup> (1.32)                            | 1.24 <sup>a</sup> (1.04) | 1.40 <sup>a</sup> (1.46)  | 1.28 <sup>a</sup> (1.14) | 1.22 <sup>ab</sup> (0.99)  | 1.31 <sup>a</sup> (1.22) | 1.17 <sup>a</sup> (0.87) | 1.13 <sup>a</sup> (0.78) | 1.15 <sup>a</sup> (0.82)  |
| T <sub>3</sub>      | <i>Agniastra</i>            | 1.34 <sup>a</sup> (1.30)                            | 1.23 <sup>a</sup> (1.01) | 1.38 <sup>a</sup> (1.40)  | 1.25 <sup>a</sup> (1.06) | 1.21 <sup>ab</sup> (0.96)  | 1.28 <sup>a</sup> (1.14) | 1.16 <sup>a</sup> (0.85) | 1.10 <sup>a</sup> (0.71) | 1.12 <sup>a</sup> (0.75)  |
| T <sub>4</sub>      | <i>Brahmastra</i>           | 1.62 <sup>b</sup> (2.12)                            | 1.51 <sup>b</sup> (1.78) | 1.65 <sup>bc</sup> (2.22) | 1.55 <sup>b</sup> (1.90) | 1.49 <sup>abc</sup> (1.72) | 1.61 <sup>b</sup> (2.09) | 1.42 <sup>b</sup> (1.52) | 1.42 <sup>b</sup> (1.52) | 1.45 <sup>bc</sup> (1.6)  |
| T <sub>5</sub>      | <i>Dashparni ark</i>        | 1.36 <sup>a</sup> (1.35)                            | 1.26 <sup>a</sup> (1.09) | 1.43 <sup>ab</sup> (1.54) | 1.29 <sup>a</sup> (1.16) | 1.24 <sup>abc</sup> (1.04) | 1.32 <sup>a</sup> (1.24) | 1.18 <sup>a</sup> (0.89) | 1.14 <sup>a</sup> (0.80) | 1.19 <sup>ab</sup> (0.92) |
| T <sub>6</sub>      | <i>Kalmegh</i> leaf extract | 1.64 <sup>b</sup> (2.19)                            | 1.56 <sup>b</sup> (1.93) | 1.68 <sup>c</sup> (2.32)  | 1.57 <sup>b</sup> (1.96) | 1.54 <sup>c</sup> (1.87)   | 1.64 <sup>b</sup> (2.19) | 1.50 <sup>b</sup> (1.75) | 1.44 <sup>b</sup> (1.57) | 1.47 <sup>c</sup> (1.66)  |
| T <sub>7</sub>      | Custard apple leaf extract  | 1.63 <sup>b</sup> (2.16)                            | 1.52 <sup>b</sup> (1.81) | 1.67 <sup>c</sup> (2.29)  | 1.56 <sup>b</sup> (1.93) | 1.50 <sup>bc</sup> (1.75)  | 1.62 <sup>b</sup> (2.12) | 1.44 <sup>b</sup> (1.57) | 1.43 <sup>b</sup> (1.54) | 1.46 <sup>bc</sup> (1.63) |
| T <sub>8</sub>      | Control (Water spray)       | 2.25 <sup>c</sup> (4.56)                            | 2.30 <sup>c</sup> (4.79) | 2.36 <sup>d</sup> (5.07)  | 2.36 <sup>c</sup> (5.07) | 2.36 <sup>d</sup> (5.07)   | 2.36 <sup>c</sup> (5.07) | 2.36 <sup>c</sup> (5.07) | 2.36 <sup>c</sup> (5.07) | 2.36 <sup>d</sup> (5.07)  |
| S. Em.±Treatment(T) |                             | 0.08                                                | 0.07                     | 0.07                      | 0.07                     | 0.09                       | 0.08                     | 0.07                     | 0.07                     | 0.08                      |
| Period (P)          |                             | -                                                   | -                        | -                         | -                        | -                          | -                        | -                        | -                        | -                         |
| T × P               |                             | -                                                   | -                        | -                         | -                        | -                          | -                        | -                        | -                        | -                         |
| C. D. at 5%         |                             | 0.24                                                | 0.21                     | 0.22                      | 0.22                     | 0.27                       | 0.25                     | 0.21                     | 0.23                     | 0.24                      |
| C.V. (%)            |                             | 8.74                                                | 8.19                     | 8.12                      | 8.40                     | 10.55                      | 9.32                     | 8.40                     | 9.27                     | 9.58                      |

Notes: (1) Figures outside the parentheses are  $\sqrt{x + 0.5}$  transformed values and those inside the parentheses are retransformed values

(2) Treatment means followed by the same letter are not significantly different by DNMRT at 5% level of significance

(3) Significance parameters and interaction: P

### First spray

Three days after the first spray, NSKE 5% recorded the lowest larval population (1.24 larvae/plant), which remained statistically at par with *Agniastra* 4% (1.30 larvae/plant), *Neemastra* 100% (1.32 larvae/plant) and *Dashparni ark* 4% (1.35 larvae/plant). *Kalmegh* leaf extract 1%, custard apple

leaf extract 5% and *Brahmastra* 4% were comparatively less effective, whereas untreated control recorded the highest larval population (4.56 larvae/plant). Similar trends were observed at 7 and 9 days after spraying, wherein NSKE 5% consistently recorded the minimum larval population.

**Table 2:** Bio-efficacy of natural inputs against *M. vitrata* in greengram (Pooled over sprays)

| Tr. No.              | Treatments                  | No. of larva(e)/plant at indicated days after spray |                             |                             |                             |
|----------------------|-----------------------------|-----------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|
|                      |                             | First spray                                         | Second spray                | Third spray                 | Pooled over sprays          |
| T <sub>1</sub>       | Neem seed kernel extract    | 1.29 <sup>a</sup><br>(1.16)                         | 1.22 <sup>a</sup><br>(0.99) | 1.10 <sup>a</sup><br>(0.71) | 1.20 <sup>a</sup><br>(0.94) |
| T <sub>2</sub>       | <i>Neemastra</i>            | 1.33 <sup>a</sup><br>(1.27)                         | 1.26 <sup>a</sup><br>(1.09) | 1.14 <sup>a</sup><br>(0.80) | 1.24 <sup>a</sup><br>(1.04) |
| T <sub>3</sub>       | <i>Agniastra</i>            | 1.31 <sup>a</sup><br>(1.22)                         | 1.24 <sup>a</sup><br>(1.04) | 1.12 <sup>a</sup><br>(0.75) | 1.22 <sup>a</sup><br>(0.99) |
| T <sub>4</sub>       | <i>Brahmastra</i>           | 1.59 <sup>b</sup><br>(2.03)                         | 1.54 <sup>b</sup><br>(1.87) | 1.42 <sup>b</sup><br>(1.52) | 1.52 <sup>b</sup><br>(1.81) |
| T <sub>5</sub>       | <i>Dashparni ark</i>        | 1.35 <sup>a</sup><br>(1.32)                         | 1.28 <sup>a</sup><br>(1.14) | 1.17 <sup>a</sup><br>(0.87) | 1.26 <sup>a</sup><br>(1.09) |
| T <sub>6</sub>       | <i>Kalmegh</i> leaf extract | 1.62 <sup>b</sup><br>(2.12)                         | 1.58 <sup>b</sup><br>(2.00) | 1.47 <sup>b</sup><br>(1.66) | 1.56 <sup>b</sup><br>(1.93) |
| T <sub>7</sub>       | Custard apple leaf extract  | 1.60 <sup>b</sup><br>(2.06)                         | 1.56 <sup>b</sup><br>(1.93) | 1.44 <sup>b</sup><br>(1.57) | 1.53 <sup>b</sup><br>(1.84) |
| T <sub>8</sub>       | Control (Water spray)       | 2.30 <sup>c</sup><br>(4.79)                         | 2.35 <sup>c</sup><br>(5.02) | 2.35 <sup>c</sup><br>(5.02) | 2.33 <sup>c</sup><br>(4.93) |
| S. Em.±Treatment (T) |                             | 0.03                                                | 0.04                        | 0.03                        | 0.02                        |
| Period (P)           |                             | 0.02                                                | 0.02                        | 0.02                        | 0.01                        |
| Spray (S)            |                             | 0.07                                                | 0.08                        | 0.07                        | 0.01                        |
| T × P                |                             | -                                                   | -                           | -                           | 0.04                        |
| T × S                |                             | -                                                   | -                           | -                           | 0.04                        |
| P × S                |                             | -                                                   | -                           | -                           | 0.02                        |
| T × P × S            |                             | -                                                   | -                           | -                           | 0.07                        |
| C. D. at 5% T        |                             | 0.11                                                | 0.12                        | 0.11                        | 0.07                        |
| P                    |                             | -                                                   | -                           | -                           | 0.04                        |
| S                    |                             | -                                                   | -                           | -                           | 0.04                        |
| T × P                |                             | -                                                   | -                           | -                           | NS                          |
| T × S                |                             | -                                                   | -                           | -                           | NS                          |
| P × S                |                             | -                                                   | -                           | -                           | NS                          |
| T × P × S            |                             | -                                                   | -                           | -                           | NS                          |
| C.V. (%)             |                             | 8.22                                                | 9.46                        | 9.09                        | 8.95                        |

**Notes:** (1) Figures outside the parentheses are  $\sqrt{x} + 0.5$  transformed values and those inside the parentheses are retransformed values

(2) Treatment means followed by the same letter are not significantly different by DNMRT at 5% level of significance

(3) Significance parameters and interaction: S, P, P × S and T × S

### Second and third sprays

The efficacy pattern observed during the second and third sprays was similar to that recorded after the first spray. NSKE 5% remained the most effective treatment throughout the crop period. *Agniastra* 4%, *Neemastra* 100% and *Dashparni ark* 4% also exhibited appreciable suppression of larval population and remained statistically comparable with NSKE in several observations. *Brahmastra* 4% recorded moderate effectiveness, while *Kalmegh* leaf extract 1% and custard apple leaf extract 5% were comparatively less effective. The untreated control plots consistently harboured significantly higher larval populations than all treated plots.

### Pooled analysis

The pooled analysis over all sprays clearly indicated that NSKE 5% was the most effective treatment against *M. vitrata*, recording the lowest larval population (0.94 larva/plant). This treatment was closely followed by *Agniastra* 4% (0.99 larva/plant), *Neemastra* 100% (1.04 larva/plant) and *Dashparni ark* 4% (1.09 larvae/plant). *Brahmastra* 4% recorded moderate efficacy with 1.81 larvae/plant. *Kalmegh* leaf extract 1% (1.93 larvae/plant) and custard apple leaf extract 5% (1.84 larvae/plant) were comparatively less effective and remained statistically at par. The untreated control recorded significantly highest larval population (4.93 larvae/plant).

The superior performance of NSKE may be attributed to the presence of azadirachtin and other limonoids, which possess antifeedant, repellent and insect growth regulatory activities against lepidopteran larvae. Similar findings were reported by Oparaek *et al.* (2005) [12] and Kumari *et al.* (2025) [9], who observed effective suppression of *M. vitrata* through botanical and plant-derived pest management approaches.

### Impact of Natural Inputs on Yield

Significant differences in seed and haulm yield were observed among the treatments. NSKE 5% recorded the highest seed yield (1267 kg/ha) and haulm yield (2508 kg/ha), followed by *Agniastra* 4% (1226 and 2471 kg/ha, respectively) and *Neemastra* 100% (1181 and 2458 kg/ha, respectively). The untreated control recorded the lowest seed yield (908 kg/ha) and haulm yield (1851 kg/ha). The increase in seed yield over control ranged from 14.20 to 39.52 percent. The maximum increase in seed yield over control was obtained with NSKE 5% (39.52%), followed by *Agniastra* 4% (35.10%) and *Neemastra* 100% (30.05%). The lowest increase was observed with *Kalmegh* leaf extract 1% (14.20%). Avoidable losses were also minimum in NSKE-treated plots. Similar findings were reported by Ahmed *et al.* (2020) [1], Tanzum *et al.* (2023) [14] and Darji *et al.* (2025) [5], who observed reduced infestation of *M. vitrata* and increased yield following application of eco-friendly pest management inputs.

**Table 3:** Impact of natural inputs on seed and haulm yield of greengram

| Tr. No.        | Treatment                   | Conc. (%) | Yield(kg/ha)       |                    | Increase in seed yield over control (%) | Avoidable loss (%) |
|----------------|-----------------------------|-----------|--------------------|--------------------|-----------------------------------------|--------------------|
|                |                             |           | Seed               | Haulm              |                                         |                    |
| T <sub>1</sub> | Neem seed kernel extract    | 5         | 1267 <sup>a</sup>  | 2508 <sup>a</sup>  | 39.52                                   | 28.32              |
| T <sub>2</sub> | <i>Neemastra</i>            | 100       | 1181 <sup>ab</sup> | 2458 <sup>a</sup>  | 30.05                                   | 23.11              |
| T <sub>3</sub> | <i>Agniastra</i>            | 4         | 1227 <sup>ab</sup> | 2470 <sup>a</sup>  | 35.10                                   | 25.98              |
| T <sub>4</sub> | <i>Brahmastra</i>           | 4         | 1071 <sup>ab</sup> | 2266 <sup>ab</sup> | 17.88                                   | 14.45              |
| T <sub>5</sub> | <i>Dashparni ark</i>        | 4         | 1164 <sup>ab</sup> | 2304 <sup>ab</sup> | 28.12                                   | 21.95              |
| T <sub>6</sub> | <i>Kalmegh</i> leaf extract | 1         | 1037 <sup>b</sup>  | 2211 <sup>ab</sup> | 14.20                                   | 11.89              |
| T <sub>7</sub> | Custard apple leaf extract  | 5         | 1069 <sup>ab</sup> | 2108 <sup>bc</sup> | 17.79                                   | 14.38              |
| T <sub>8</sub> | Control                     | --        | 908 <sup>c</sup>   | 1851 <sup>c</sup>  | -                                       | -                  |
|                | S. Em.±                     | -         | 39.57              | 59.74              | -                                       | -                  |
|                | C. D. at 5%                 | -         | NS                 | NS                 | -                                       | -                  |
|                | C.V. (%)                    | -         | 11.98              | 8.87               | -                                       | -                  |

**Note:** Treatment means followed by the same letter are not significantly different by DNMRT at 5% level of significance

### Conclusion

The present investigation demonstrated that among the various natural inputs evaluated against *Maruca vitrata* infesting greengram, NSKE 5% proved to be the most effective treatment by recording minimum larval population and maximum seed yield. *Agniastra* 4%, *Neemastra* 100% and *Dashparni ark* 4% were the next promising treatments. Therefore, NSKE 5% can be recommended as an eco-friendly, economical and sustainable component of integrated pest management (IPM) for the management of *M. vitrata* in greengram under middle Gujarat conditions.

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