Environment and Ecology 43 (1) : 29—33, January—March 2025
Article DOI: https://doi.org/10.60151/envec/UXQC4585
ISSN 0970-0420

Field Efficacy of Different Botanical Protectants against Spotted Pod Borer, *M. vitrata* (Geyer) on Green Gram, *Vigna radiata*

Sonu Kumari, Balbir Singh, Vikas Chauhan, Rakesh Kumar

Received 22 October 2024, Accepted 9 December 2024, Published on 14 January 2025

ABSTRACT

The current study was aimed to study the bio efficacy of botanical protectants against spotted pod borer, *M. vitrata* in green gram. The field experiments were carried out at CCSHAU, Regional Research Station, Bawal, during *kharif* 2020 and 2021. Considering the significance of eco-friendly pest management, the objective of this study was to test some botanical protectants against spotted pod borer, *M. vitrata* in green gram. The experimental results revealed that the treatment azadirachtin (0.03%) was found most effective protectants resulted in lowest per cent pod damage (12.94%) followed by neem oil @ 20 ml/l (14.07%) and neem seed kernel extract @ 50 ml/l (14.11%). The least effective treatment against pod damage was eucalyptus leaf extract (18.59%) after control followed by chilli solution (17.68%) and onion extract (17.53%) which were at par with each other. From these findings, it was concluded that among the botanical protectants azadirachtin, neem oil and neem seed kernel extract was the most effective may be incorporated in the pest management strategies against the spotted pod borer of green gram.

Keywords Green gram, Spotted pod borer, Botanical protectants, Bioefficacy, Azadirachtin.

INTRODUCTION

Pulses occupy a unique position in the agricultural economy of India and are recognized as the rich source of proteins, vitamins and minerals and play a vital role in the diet of vegetarians after cereals (Saxena *et al.* 2010). Green gram is one of the most significant pulse crops in India, a short-lived plant from the Leguminaceae family (Kundagar *et al.* 2021). At different stages of green gram's growth and under various agroclimatic conditions, several insect pests have been reported to cause severe damage (Naik *et al.* 2019). Among them, spotted pod borer (*M. vitrata*) is the most formidable and potential internal pod borer causing extensive damage to tropical grain legumes. The low economic yield of green gram is attributed to the regular outbreaks of *M. vitrata,* because of its extensive host range; it becames a persistent pest in green gram. It is reported that 20 to 30% pod damage in green gram is caused by spotted pod borer (Zahid *et al.* 2008) and third to fifth instar larvae are capable of boring into the pods and occasionally into peduncle and stem and it damages the crop right from pre flowering to pod maturing stage by feeding on flower buds, flowers and pods through webbing (Nair 1986) and

Sonu Kumari[1]*, Balbir Singh[2], Vikas Chauhan[3], Rakesh Kumar[4]

[1,3,4]Assistant Professor
Department of Agriculture, MMDU, Mullana, Ambala, Haryana 133207, India

[2]DES, Department of Entomology, CCSHAU, RRS-Bawal 125001, Haryana, India

Email: sonu.kumari@mmumullana.org
*Corresponding author

thereby causing huge losses extending upto 79.05% (Mahalle and Taggar 2018).

In order to manage insect pests, green gram growers use a variety of insecticides. Excessive indiscriminate use of pesticides resulted in a number of detrimental side effects, including the environmental degradation, the rise of resistant insect species, risk hazard to farmers and the extinction of beneficial organisms such as natural enemies and pollinators (Berani *et al.* 2018). Botanical protectants are the naturally occurring, often slow acting and secondary metabolites (phytochemicals) which are extracted from the plant sources that can manage/control and kill the insect pests thus aid in agricultural pest management (Laxmishree and Nandita 2017). Interest in pest management with botanicals protectants has been sparked by growing environmental safety concerns (Raghavendra *et al.* 2016) and a global desire for food free of pesticide residues (Ramasubramanian and Babu 1991).

MATERIALS AND METHODS

The experiment on the effects of plant products against spotted pod borer was carried out at CCSHAU, Regional Research station, Bawal, during *kharif* 2020 and 2021. The trial was laid out in a Randomized Block Design (RBD) with eleven treatments including untreated control; each replicated thrice. The variety MH 421 was sown on July 2020 and 2021 with the spacing of 30×10 cm (row×plants). The plot size was kept 5m×3m. All the recommended cultivation practices except insect pest management were followed to raise the crop as per package of practice (Anonymous 2019b). The spray was given at pod development stage, when the larval population crossed the economic threshold level (5 webs/plant). The spray of each treatment was given using knapsack sprayer upto the point of runoff. The observations were recorded on the total number of pods and number of damaged pods on five randomly selected plants at one day before and 1, 3, 7 and 10 days after spray in order to determine the per cent pod damage. Per cent pod damage was calculated by following formula:

$$\text{Per cent pod damage} = \frac{\text{Damage pod}}{\text{Total pod}} \times 100$$

Data analysis: The data obtained in the experiments were analyzed using RBD and necessary transformations were made (wherever needed) as described by Gomez and Gomez (1984) using the statistical software package (OPSTAT).

RESULTS AND DISCUSSION

Effects of plant products on per cent pod damage due to spotted pod borer, *M.vitrata* on green gram

The result revealed that the per cent pod damage due to *M. vitrata* in green gram was significantly reduced in treated plants as compared to untreated plants after spray during *kharif* 2020 and 2021 (Table 1).

During *kharif* 2020, among the different botanical treatments, the lowest per cent pod damage due to *M. vitrata* in green gram was observed in Azadirachtin @ 0.3 ml/l i.e. 16.99, 14.18, 10.93 and 11.28% at 1, 3, 7 and 10 days after spray, respectively followed by neem oil @ 20 ml/l i.e. 18.48, 15.70, 11.78 and 12.56% and Neem Seed Kernel Extract @ 50 ml/l i.e. 18.50, 15.84, 11.80 and 12.64% at 1, 3, 7 and 10 days after spray, respectively which was at par with one another. The highest per cent pod damage was 21.41, 19.41, 17.01 and 17.36% at 1, 3, 7 and 10 DAS was recorded in treatment Eucalyptus leaf extract @ 2ml/l after control untreated plots followed by Chilli solution @ 20 ml/l i.e. 20.84, 18.87, 15.86 and 16.20% and Onion extract @ 50 ml/l i.e. 20.62, 18.62, 15.72 and 16.01% at 1, 3, 7 and 10 DAS, respectively which was also at par with one another. The overall percent pod damage was lowest in Azadirachtin @ 0.3 ml/l (13.34 %) followed by Neem Oil @ 20 ml/l (14.63 %) and Neem Seed Kernel Extract @ 50 ml/l (14.67 %).

Data presented in Table 1 revealed the almost similar results during 2021 as obtained in year 2020. In *kharif* 2021, the minimum per cent pod damage was recorded in Azadirachtin @ 0.3 ml/l i.e. 16.96, 13.36, 9.83 and 10.06% at 1, 3, 7 and 10 DAS followed by Neem Oil @ 20 ml/l (17.72, 14.68, 10.58 and 11.11% at 1, 3, 7 and 10 DAS, respectively) and Neem Seed Kernel Extract @ 50 ml/l (17.74, 14.79, 10.60 and 11.21% at 1, 3, 7 and 10 DAS, respectively) which were at par with one another. The maximum per cent

Table 1. Efficacy of plant products on per cent pod damage due to spotted pod borer *M.vitrata* on green gram, *V. radiata.*

Treatments	Dose	Before spray	Per cent pod damage (*kharif* 2020) 1 DAS*	3 DAS	7 DAS	10 DAS	Mean
Neem oil	20 ml/l	20.24 (26.71)	18.48 (25.46)**	15.70 (23.34)	11.78 (20.06)	12.56 (20.75)	14.63 (22.40)
Neem seed kernel extract	50 ml/l	19.56 (26.21)	18.50 (25.49)	15.84 (23.46)	11.80 (20.08)	12.64 (20.82)	14.67 (22.43)
Azadirachtin	0.3 ml/l	19.18 (25.90)	16.99 (24.33)	14.18 (22.11)	10.93 (19.30)	11.28 (19.61)	13.34 (21.34)
Karanj oil	20 ml/l	19.15 (25.73)	19.01 (25.84)	16.04 (23.59)	12.40 (20.61)	13.31 (21.39)	15.19 (22.85)
Chilli +garlic solution	30 ml/l	21.19 (27.34)	20.12 (26.55)	17.18 (24.48)	13.61 (21.64)	14.38 (22.27)	16.32 (23.73)
Chilli solution	20 ml/l	21.08 (27.31)	20.84 (27.78)	18.87 (25.73)	15.86 (23.66)	16.20 (23.72)	17.94 (25.22)
Garlic solution	20 ml/l	19.16 (25.78)	20.27 (26.75)	17.91 (25.03)	14.79 (22.61)	15.13 (22.88)	17.02 (24.31)
Eucalyptus leaf extract	2 ml/l	20.50 (26.89)	21.41 (28.35)	19.41 (26.13)	17.01 (24.35)	17.36 (24.61)	18.79 (25.86)
Onion extract	50 ml/l	20.74 (27.05)	20.62 (27.71)	18.62 (25.53)	15.72 (23.53)	16.01 (23.57)	17.74 (25.08)
Aak leaf extract	20ml/l	22.54 (28.31)	19.07 (25.89)	16.61 (24.04)	12.54 (20.72)	13.47 (21.52)	15.42 (23.04)
Control		21.10 (27.32)	22.93 (28.57)	24.77 (29.81)	25.24 (27.71)	28.19 (31.34)	25.28 (29.35)
CD (p=0.05)		NS	0.24	0.22	0.28	0.55	0.32
SEm ±		1.68	0.39	1.21	0.41	0.21	0.55

Table 1. Continued.

Treatments	Dose	Before spray	Per cent pod damage (*kharif* 2021) 1 DAS*	3 DAS	7 DAS	10 DAS	Mean
Neem oil	20 ml/l	18.41 (25.38)	17.72 (24.89)	14.68 (22.52)	10.58 (18.97)	11.11 (19.45)	13.52 (21.45)
Neem seed kernel extract	50 ml/l	18.34 (25.15)	17.74 (24.91)	14.79 (22.63)	10.60 (18.99)	11.21 (19.55)	13.56 (21.49)
Azadirachtin	0.3 ml/l	17.18 (24.41)	16.96 (23.31)	13.36 (21.43)	9.83 (18.26)	10.02 (18.44)	12.54 (20.36)
Karanj oil	20 ml/l	18.79 (25.57)	18.02 (25.11)	15.23 (22.96)	11.35 (19.68)	12.20 (20.43)	14.20 (22.04)
Chilli + garlic solution	30 ml/l	18.05 (25.07)	19.73 (26.37)	16.63 (24.05)	12.32 (20.54)	13.36 (21.43)	15.51 (23.09)
Chilli solution	20 ml/l	20.59 (26.92)	21.37 (27.52)	17.79 (24.93)	14.84 (22.68)	15.72 (23.34)	17.43 (24.61)
Garlic solution	20 ml/l	21.69 (27.74)	20.13 (26.74)	16.70 (24.11)	13.81 (21.13)	14.37 (22.29)	16.25 (23.56)
Eucalyptus leaf extract	2 ml/l	21.67 27.72)	21.65 (27.89)	18.38 (25.33)	16.02 (23.58)	17.56 (24.76)	18.40 (25.39)
Onion extract	50 ml/l	21.68 (27.91)	21.25 (27.46)	17.64 (24.82)	14.79 (22.61)	15.64 (23.28)	17.33 (24.54)
Aak leaf extract	20ml/l	21.74 (27.93)	18.48 (25.45)	15.67 (23.31)	11.59 (19.84)	12.36 (20.57)	14.52 (22.29)
Control		19.25 (26.00)	22.94 (28.57)	25.59 (30.37)	25.85 (30.48)	28.74 (32.93)	25.78 (30.58)
CD (p=0.05)		NS	0.36	0.39	0.44	0.85	0.51
SEm ±		1.25	0.082	0.13	1.14	0.287	0.391

*DAS: Day after spray, **Figures in the parentheses are angular transformed values.

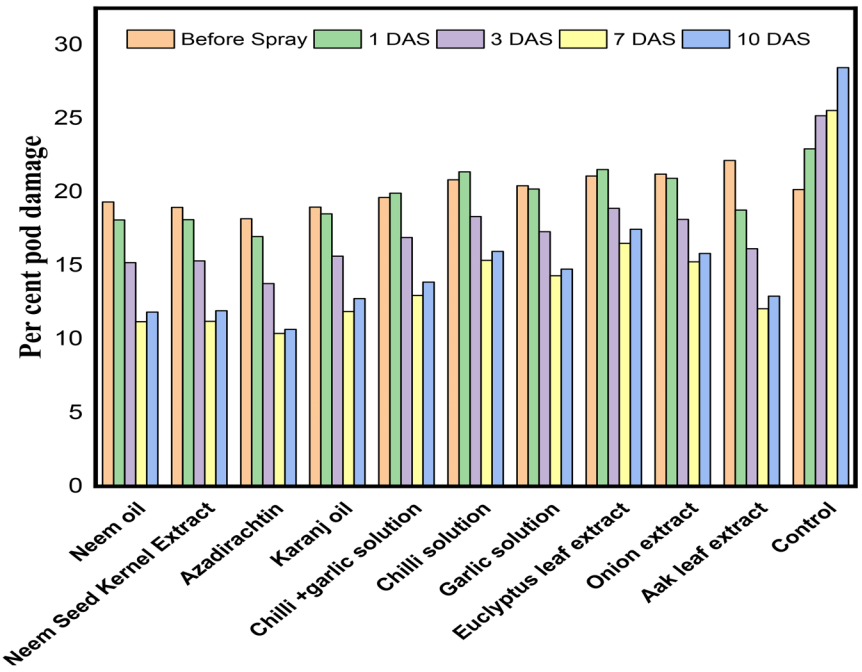

Fig. 1. Efficacy of plant products on per cent pod damage due to spotted pod borer, *M. vitrata* on green gram, *V. radiata* (Pooled of *kharif* 2020 and 2021).

pod damage of 21.65, 18.38, 16.02 and 17.56% at 1, 3, 7 and 10 DAS was recorded in treatment Eucalyptus leaf extract @ 2 ml/l after control untreated plots which was significantly differed from other treatment. The overall mean of per cent pod damage was lowest in Azadirachtin @ 0.3 ml/l (12.54 %) which was significantly superior to over other treatments followed by Neem Oil @ 20 ml/l i.e. (13.52 %) and Neem Seed Kernel Extract @ 50 ml/l (13.56 %).

The pooled result of both years showed the per cent pod damage among various treatments was ranged from 12.94 to 25.53% (Fig.1). The minimum per cent pod damage of spotted pod borer was found in azadirachtin (12.94%) which was significantly differed from other treatment followed by neem oil (14.07 %), neem seed kernel extract (14.11%) , karanj oil (14.69 %), aak leaf extract (14.97 %), chilli+garlic solution (15.91%), garlic soluion (16.63%), onion extract (17.53%), chilli solution (17.68%) and eucalyptus leaf extract (18.59%). In the present study the botanical protectants performs well to reduce the per cent pod damage due to *M. vitrata* in green gram.

The present findings are in agreement with Ganapathy (1996) the reports that neem seed kernel extract 5% and neem oil 3% recorded least pod damage (6.6 and 7.8%, respectively). It was recorded the performance of leaf extract of neem+lemongrass, neem+african curry and neem+tomato in the control of spotted pod borer was encouraging and consequently led to better pod protection with the increase in grain yields on treated plots (Oparaeke *et al.* 2005). The present findings also corroborate with the findings Selvam (2018) and found that the Azadirachtin (0.03%) was most effective against *M. vitrata* where 65.8% reduction of pod damage was recorded over untreated control. It was observed that aak leaf extract up to 10% was safest. The results of the current study are comparable with the findings Ganapathy and Durairaj (2000) who observed that the neem seed kernel extract 5% reduces pod damage. The treatment neem oil proved better than control in significantly reducing the pod damage on pigeonpea (Ramasubramanian and Babu 1991). It was investigated that among the biopesticides, NSKE 5% prevented pod damage significantly (Byrappa *et*

al. 2012). It was reported that the *Eucalyptus* spp. contain high cineol, terpinol, cumminol citronellol, piperitone and phellandrene which confer on the tree its insecticidal properties (Kelly 1969).

CONCLUSION

Azadirachtin @ 0.3 ml/l, Neem oil @ 20 ml/l and Neem Seed Kernel Extract @ 50 ml/l were found highly effective in reducing per cent pod damage due to spotted pod borer, *M. vitrata* in green gram. Considering the effectiveness of botanical protectants against *M. vitrata* botanicals karanj oil @20 ml/l, aak leaf extract @ 20 ml/l, chilli+garlic solution @ 30 ml/l, garlic solution @ 20 ml/l were emerged out as moderately effective, whereas Eucalyptus leaf extract @ 2 ml/l, Chilli solution @ 20 ml/l and Onion extract @ 50 ml/l were found to be less effective treatments. Considering the effectiveness of neem based protectants against major *M. vitrata* can well integrated as environmental friendly component of management strategy.

ACKNOWLEDGMENT

Authors thank the Regional Director (Regional Research Station, Bawal), and Professor & Head (Department of Entomology, CCS HAU, Hisar) for providing the necessary facilities.

REFERENCES

Anonymous (2019b) Package of Practices for *kharif crops* Directorate of Extension Education, CCS HAU, Hisar.

Berani NK, Godhani PH, Bhatt NA (2018) Bio-efficacy of botanical insecticides against lepidopteran insect pest infesting black gram. *Journal of Entomological and Zoological Studies* 6(4): 642-646. https://dx.doi.org/10.22271/j.ento

Byrappa A, Kumar N, Divya M (2012) Impact of biopesticides application on pod borer complex borer, *Maruca vitrata* (Fabricius) in green gram. *Legume Research- An International Journal,* pp 1-4. https://dx.doi 10.18805/LR-5169

Ganapathy N (1996) Bio-ecology and management of spotted pod borer, *Maruca testulalis* Geyer, (Lepidoptera:Pyrallidae) in pigeonpea. PhD thesis. Tamilnadu Agricultural University, Coimbtore, India, pp 17.

Ganapathy N, Durairaj C (2000) Bioefficacy of some newer insecticides against pod borers of blackgram. *Pestology* 26: 43-44. https://scopus.com/sourceid/88997

Gomez KA, Gomez AA (1984) Statistical Procedures for Agricultural Research. 2nd edn, John Wiley and Sons, New York, pp 680.

Kelly S (1969) The Eucalypts. In: Chippendale GM, Johnston RD Thomas Nelson Publication, Australia, pp 482.

Kundagar D, Singh NB, Jeberson MS, Sinha B, Singh NG (2021) Genetic diversity analysis in blackgram (*Vigna mungo* L. Hepper). *International Journal of Current Microbiology and Applied Science* 10(01): 1321-1328. 10.20546/ijcmas

Laxmishree C, Nandita S (2017) Botanical pesticides –A major alternative to chemical pesticides: A review. *International Journal of Life Science* 5(4): 722-729. DOI : 10.53730/ijls.v8n2.15075

Mahalle RM, Taggar GK (2018) Yield loss assessment and establishment of economic threshold level of *Maruca vitrata* in pigeonpea. *Journal of Food Legumes* 31(1): 36-44. https://doi.org/10.59797/jfl.v37i3.1100

Naik MG, Mallapur CP, Naik AK (2019) Field efficacy of newer insecticide molecules against spotted pod borer, *Maruca vitrata* (Geyer) on blackgram. *Journal of Entomological and Zoological Studies* 7(3): 635-637. https://dx.doi.org/10.22271/j.ento

Nair MRGK (1986) Insects and mites of crops in India. ICAR, New Delhi, pp 48-69.

Oparaeke AM, Dike MC, Amatobi CI (2005) Botanical pesticide mixtures for insect pest management on cowpea, *Vigna unguiculata* (L.) walp plants – 2.The pod borer, *Maruca vitrata* Fab. (Lepidoptera:Pyralidae) and pod sucking bug, *Clavigralla tomentosicollis* (Heteroptera: Coreidae). *Agricultural Tropical et Subtropical* 38 (2): 33-38. https://doi.org/10.1177/003072706100300311

Raghavendra KV, Gowthami R, Lepakshi NM, Dhananivetha M, Shashank R (2016) Use of botanicals by farmers for integrated pest management of crops in Karnataka. *Asian Agri-History* 20(3): 173-180. doi: 10.1371/journal.pone.0158365

Ramasubramanian G, Babu PS (1991) Field evaluation of insecticides and botanicals against the spotted pod borer, *Maruca testulalis* (Geyer) on lablab. *Madras Agricultural Journal* 78: 17-19. DOI:10.29321/MAJ.2018.000118

Saxena KB, Vijayakumar R, Sultana R (2010) Quality nutrition through pigeonpea - A review. *Health* 2: 1335. DOI: 10.4236/health.2024.1610062

Selvam K (2018) Efficacy of botanicals and entomogenous fungi against major pod borers of black gram. *Biological International* 14(2):109-122. doi:10.7150/ijbs.98107

Zahid MA, Islam MM, Begum MR (2008) Determination of economic injury levels of *Maruca vitrata* in green gram. *Journal of Agricultural Rural Development* 6 (1-2): 91-97. DOI:10.5897/JARD