Bionature

Volume 45, Issue 1, Page 1-9, 2025; Article no.BN.1790
ISSN: 0970-9835 (P), 0974-4282 (O)

Introduction to Insect Pests of Arhar [*Cajanus cajan* (Linnaeus) Huth] Crop and their Management: A Review

Dwarka [a++], S. G. Ghugal [a++], Shobharam Thakur [b†], Sheeren Parveen [a++], Nisha Chadar [c#*] and Babli [d++]

[a] Department of Entomology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, 482004, India.
[b] PC Unit Sesame and Niger, Jawaharlal Nehru Krishi Vishwa Vidyalaya, CoA, Tikamgarh, Madhya Pradesh-472001, India.
[c] Department of Botany, Post Graduate Excellence College, Tikamgarh, Madhya Pradesh, 472001, India.
[d] Department of Plant Pathology, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, 474002, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.56557/bn/2025/v45i12052

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://prh.globalpresshub.com/review-history/1790

Review Article

Received: 01/11/2024
Accepted: 04/01/2025
Published: 09/01/2025

ABSTRACT

Arhar (*Cajanus cajan*), commonly known as pigeonpea, is an important leguminous crop widely cultivated in tropical and subtropical regions due to its high nutritional value and adaptability. However, the cultivation of arhar is significantly impacted by various insect pests, which pose

---

++ Ph.D.;
 # M.Sc.;
† Senior Technical Officer, AICRP(ICAR);
**Corresponding author: Email: chadarnisha63@gmail.com;*

***Cite as:** Dwarka, S. G. Ghugal, Shobharam Thakur, Sheeren Parveen, Nisha Chadar, and Babli. 2025. "Introduction to Insect Pests of Arhar [Cajanus Cajan (Linnaeus) Huth] Crop and Their Management: A Review". BIONATURE 45 (1):1-9. https://doi.org/10.56557/bn/2025/v45i12052.*

serious threats to its growth and yield. This paper provides an overview of the major insect pests affecting arhar, including the gram pod borer (*Helicoverpa armigera*), spotted pod borer (*Maruca vitrata*) and pod fly (*Melanagromyza obtusa*), among others. These pests contribute to substantial yield losses through their feeding habits on flowers, pods, and foliage. The interactions between these pests and the abiotic and biotic factors influencing their populations are also discussed. Effective management strategies are essential for mitigating the damage caused by these pests. Integrated pest management (IPM) approaches, including cultural, biological, and chemical control measures, are emphasized as sustainable practices to enhance crop productivity while minimizing environmental impacts. The importance of developing pest-resistant varieties and the role of monitoring and forecasting systems in pest management are highlighted to support farmers in achieving optimal arhar production.

Keywords: Insect pests of arhar; IPM, Helicoverpa armigera and effective management.

1. INTRODUCTION

Arhar (pigeon pea), *Cajanus cajan*, is a key legume crop widely grown in tropical and subtropical regions, especially in South Asia and Africa. Arhar, also known as pigeon pea, is an important legume crop cultivated for its seeds, which are rich in protein and other essential nutrients. It is highly nutritious and serves as a vital source of protein. However, the crop is severely impacted by various insect pests, leading to significant yield losses and reduced crop quality. It provides a significant amount of dietary protein (22.3%), carbohydrates (57.6%), fiber (1.5%), and minerals (3.5%) (Gupta et al., 2006). It plays a significant role in the diets of millions of people, especially in India, where it is a staple pulse crop. The pod borer complex, which includes the gram pod borer (*Helicoverpa armigera*), the spotted pod borer (*Maruca vitrata*), and the pod fly (*Malanagromyza obtusa*), can result in yield losses of up to 60% (Sreekanth et al., 2021). The crop is drought-resistant and can thrive in semi-arid regions, making it suitable for areas with variable rainfall. However, arhar is highly susceptible to insect pests that affect all stages of crop growth, from seedlings to pod maturity. Insect infestations not only reduce yields but also affect the marketability of the produce due to damaged seeds. A pigeonpea crop typically produces two to three flushes of flowers throughout the growing season, but only one of these flushes plays a significant role in the total grain yield. The other flushes are often negatively impacted by insects or other biotic and abiotic factors, leading to poor retention of flowers and pods (Pandit and Dwivedi, 2021). Effective pest management in arhar is crucial for ensuring stable yields and minimizing economic losses. This review discusses the major insect pests that attack arhar and the integrated management practices used to control them. This review provides a comprehensive overview of the major insect pests affecting arhar, their biology, damage symptoms, and current pest management strategies. Integrated pest management (IPM) approaches that incorporate biological, chemical, and cultural controls are emphasized as essential for sustainable crop protection.

2. INSECT PESTS

2.1 Pod Borer (*Helicoverpa armigera*)

The pod borer, particularly *Helicoverpa armigera* (also known as the cotton bollworm), is one of the most destructive pests of arhar. It primarily targets the plants reproductive parts, including flowers, buds, and pods. The larvae bore into the pods, feeding on developing seeds, leading to direct yield loss. In some cases, infestations can cause yield losses of up to 80%. The pod borer is a polyphagous pest, meaning it can feed on a variety of host plants, making its control challenging (Minja et al., 1999; Singh, 1979; Yelshetty et al., 2005; Joshi and Shrivastava, 2006; Yelshetty, 2008; Rana et al., 2008).

2.2. Pod Fly (*Melanagromyza obtusa*)

The arhar pod fly is another major pest that significantly affects pigeon pea production. The adult flies lay eggs on developing pods, and the larvae feed on the seeds inside, causing the pods to shrivel and become discolored. Infested seeds often develop into poor-quality grains, affecting both yield and market value. The pod fly is especially problematic in dry conditions, where it can proliferate rapidly and cause extensive damage to late-sown crops (Landge, 2009; Yadav et al., 2004; Rana et al., 2008; Yelshetty, 2008; Joshi and Shrivastava, 2006; Singh, 2001; Minja et al., 1999; Meena et al., 2010).

2.3 Spotted Pod Borer (*Maruca vitrata*)

This pest primarily attacks the flowers and pods of arhar. The larvae of *Maruca vitrata* bore into flowers and pods, causing them to drop prematurely, resulting in reduced seed production. Infestations can spread rapidly under favorable conditions, especially in regions with high humidity and warm temperatures. The concealed feeding habits of the larvae make control measures difficult, as they are protected within the pods and flowers (Yelshetty, 2008; Joshi and Shrivastava, 2006; Minja et al*.,* 1999).

2.4 Blister Beetles (*Mylabris spp.*)

Blister beetles are common pests of pigeon pea. The adult beetles feed on the flowers of arhar, reducing pollination and seed set. While they do not cause direct damage to the seeds, their feeding on flowers can significantly reduce yield. These beetles are more prevalent in warm and dry regions and can sometimes infest large areas of arhar fields (Singh, 2001, Yelshetty, 2008; Chitra et al*.,* 2011).

2.5 Tur Pod Bug (*Clavigralla gibbosa*)

The tur pod bug is a sucking insect that feeds on the developing pods of arhar, causing the pods to shrivel and the seeds to be poorly formed. The damage results in deformed and shriveled seeds, which negatively affect yield and market quality. The bugs are most active during the pod development stage and can cause significant losses if not controlled early (Joshi and Shrivastava, 2006; Yelshetty, 2008; Rana et al*.,* 2008, Landge, 2009; Yadav et al*.,* 2009).

2.6 Leafhoppers (*Empoasca spp.*)

Leafhoppers, or jassids, are small, sap-sucking insects that infest arhar crops during the vegetative and flowering stages. These pests cause characteristic symptoms such as yellowing of the leaf margins, leaf curling, and stunted growth, commonly referred to as "hopper burn". While not as destructive as pod borers or pod flies, severe infestations of leafhoppers can stress the plant and reduce its overall vigor (Mahalle, 2008; Landge, 2009; Kumar and Nath, 2003; Kaushik et al*.,* 2008).

2.7 Blue Butterlfly, *Lempoides boeticus*

Males typically have bright blue wings with black edges, while females are usually brown with orange spots. They have a wingspan of about 24–30 mm. The body is slender and covered in fine hairs. The larvae of *Lempides boeticus* are known to feed on the leaves of various host plants. This feeding can lead to defoliation, which may weaken the plants and reduce their overall health. The caterpillars may also consume flower buds, impacting the plant's ability to produce flowers and, consequently, seeds. This can affect the plant's reproductive success. In some cases, the larvae may feed on green pods, especially if they are present on leguminous plants, which can result in reduced yields for crops (Hadiya et al*.,* 2023; Singh et al*.,* 2013).

2.8 Plume Moth, *Exelastis atomosa* Walsingham

The eggs of the pest are typically laid individually on the pods, occasionally on flower buds, and sometimes on leaves. These eggs are light green and oval-shaped. Upon hatching, the larvae can appear green, brown, or a combination of both, closely matching the color of the pod. As they develop, the larvae remain either brownish or greenish in hue. The third instar larva can be differentiated from the second instar by its prominent, long, and slender prolegs. The duration of the fourth instar larva varies between 3 to 6 days. The fully grown caterpillar is elongated and cylindrical, displaying a greenish-brown coloration and covered in numerous setae. Pupation occurs on the surface of the pods, within the entrance of the pod, or even in the decaying pod material. The pupa is characterized by short hairs and spines, and it has a soft texture, displaying green or brown colors that closely resemble the larval stage. When disturbed, the anterior half of the pupa can be raised, indicating a response to potential threats. The larvae tend to infest the pods and flower buds, leading to considerable damage. They create holes in the pods, which can result in the loss of seeds and overall yield. While the primary damage occurs on pods and flowers, the larvae may also feed on the leaves, leading to defoliation. This reduces the plant's photosynthetic capacity and can weaken the overall health of the plant (Savde et al*.,* 2018; Chaitanya, 2012; Vijayachander and Arivudainambi, 2007; Subharani and Singh, 2007; Lal et al*.,* 2019).

2.9 Pulse Beetle: *Callosobruchus Chinensis* Linn., C. Maculatus Fab. (Coleoptera: Bruchidae)

In India, four species of bruchids within the genus *Callosobruchus* are recognized as pests of pigeonpea. These include *Callosobruchus chinensis*, *C. analis*, and *C. maculatus*, which attack pigeonpea both in the fields and during storage, while *C. theobromae* primarily affects the crop in the fields. The adult beetles are oval-shaped, reddish-brown, and measure between 3 to 4 mm in length. They are vigorous and characterized by two spots on their dorsal side, along with an ivory-colored abdomen that is notably enlarged. The larvae, or grubs, are about 3–4 mm long, white, cylindrical, meaty, and possess a light brown head. Damage often initiates in the field as the leguminous pods are collected and transported to storage facilities. However, significant harm is inflicted during storage, where these pests can cause extensive losses. Damage caused by these pests is characterized by the presence of circular exit holes in the affected pods and seeds, which reduces their market value and makes them unsuitable for planting or human consumption. Both larvae and adult beetles contribute to this damage by feeding on the internal contents of the grains, leaving only the empty shells behind (Saxena et al., 2018; Lellapalli et al., 2023).

2.10 Bihar Hairy Caterpillar, *Spilosoma obliqua* Walker, (Lepidoptera: Arctiidae)

The adult moth is reddish-brown with black patches, and both wings may display black dots on a pinkish background. Females lay clusters of eggs on the leaves. The larvae are light yellow and covered with yellow hairs. These caterpillars are polyphagous, feeding on leaves and causing significant defoliation, which can lead to substantial plant loss; in severe cases, only the stems may remain. They also feed on capsules in defoliated crops. Pupation occurs near the plants, often in the leaf litter (Lellapalli et al., 2023).

2.11 Red Hairy Caterpillar, *Amsacta moori* B, *Amsacta albistriga* W, (Lepidoptera: Arctiidae)

Amsacta moori: The head and the anterior marginal streak of the forewings both feature a red band. Several characteristics of this species are similar to those of *A. albistriga*. The fully grown caterpillars of both species are reddish-brown, with black bands at either end. Their bodies are adorned with warts that are covered in long, reddish-brown hairs (Lellapalli et al., 2023).

Amsacta albistriga: The adult moth is medium-sized, featuring white forewings adorned with brownish streaks and a yellow stripe along the anterior edge. The hindwings have black markings, and a yellowish stripe is present on the head (Lellapalli et al., 2023).

3. INTEGRATED PEST MANAGEMENT STRATEGIES

3.1 Cultural Methods

Cultural practices play a crucial role in minimizing insect pest infestations. These practices include:

1. **Timely planting**: Sowing crops early in the season helps avoid peak pest populations.
2. **Intercropping**: Growing arhar alongside other crops like sorghum or millet can reduce pest incidence by disrupting the lifecycle of key pests.
3. **Trap cropping**: Growing attractive crops such as cowpea as trap crops can lure pests like pod borers away from arhar.
4. **Field sanitation**: Regular removal of plant debris and weeds can help reduce the breeding grounds for insect pests, especially for pod flies and borers.

3.2 Mechanical Methods

Birds readily eat the caterpillars and help to check when they are numerous, 40-50 bird perches are sufficient for one hectare. Collection and destruction of egg masses of early instars of caterpillars. Install the light trap one per hectare. Clipping and collecting and burning the fallen affected parts are effective preventive measure.

3.3 Biological Control

Biological control involves the use of natural enemies such as predators, parasitoids, and pathogens to control pest populations. Some effective biological control agents for arhar pests include:

Puntambekar et al. (1997) found that *Bacillus thuringiensis* subsp. *kurstaki*, at concentrations of 10^{10} and 10^{8} spores/ml, was effective in controlling the major lepidopteran pests, which are part of the pod borer complex in pigeonpea (*Cajanus cajan*). Sadawarte and Sarode (1997) investigated the effectiveness of NSKE, cow dung, cow urine, and their combinations, both with and without insecticides, in managing *Helicoverpa armigera*, *Exelastis atomosa*, and *Melanagromyza obtusa* on pigeonpea. Prabhakara and Srinivasa (1998) found that various *Bacillus thuringiensis* (Bt) formulations, including Biobit, Centari, and Dipel, resulted in a 58.72% mortality rate among third-instar larvae of *Helicoverpa armigera* within one day of application. Mandal and Mishra (2003) focused on controlling the pod borers, including *Helicoverpa armigera*, *Maruca testulalis* [*M. vitrata*], and the pod fly *Melanagromyza obtusa*, in pigeonpea. Prabhakara and Srinivasa (1998) reported that *Bacillus thuringiensis* (Bt) formulations such as Biobit, Centari, and Dipel led to a 58.72% mortality rate in third-instar larvae of *Helicoverpa armigera* within one day of their application. Kumar and Nath (2004) examined the effectiveness of various pest control methods, including indigenous botanical insecticides, commercial plant products, animal products, microbial insecticides, and synthetic insecticides, in managing the pod borer complex (*Melanagromyza obtusa*, *Maruca testulalis* [*M. vitrata*], *A. clavipes*, and *Helicoverpa armigera*) on the pigeonpea variety Sharad. Thilagam and Kennedy (2007) assessed the biopesticide *Bacillus thuringiensis* var. *kurstaki* product Spic-BioReg for its effectiveness against pod borers in pigeonpea. Their findings indicated that applying Spic-BioReg at a rate of 2.5 l/ha was the most effective treatment, resulting in the lowest larval populations of *Helicoverpa armigera* and *Exelastis atomosa*. Mohapatra and Srivastava (2008) investigated the effectiveness of the biorational insecticide Biobit (*Bacillus thuringiensis* subsp. *kurstaki*) against the spotted pod borer, *Maruca vitrata*, in the short-duration pigeonpea variety ICPL 87. They reported that among the biorational insecticides tested, *B. thuringiensis* subsp. *kurstaki* was notably effective. Khanpara et al. (2011) examined the dose response of *Bacillus thuringiensis* var. *kurstaki* on the feeding and oviposition behavior of *Helicoverpa armigera* on pigeonpea. Sreekanth and Seshamahalakshmi (2012) found that the lowest percentage of inflorescence damage caused by the legume pod borer was observed with spinosad 45% SC at 73 g *a.i.*/ha (4.74%). This was followed by *Bacillus thuringiensis*-1 at 1.5 kg/ha (10.52%) and *Beauveria bassiana* SC formulation at 300 mg/l (14.15%), which resulted in reductions of 80.9%, 57.6%, and 42.9% over the control, respectively, which had a damage level of 24.7%. Additionally, pod damage from *Maruca* was also lowest with spinosad, recording 17.38%.

3.4 Chemical Control

Sanap et al. (1994) investigated the comparative effectiveness of synthetic pyrethroids, organophosphates, and chlorinated hydrocarbon insecticides in controlling *Helicoverpa armigera*, *Exelastis atomosa*, and *Melanagromyza obtusa* on pigeonpea. Patel et al. (1997) assessed the effectiveness of synthetic and botanical insecticides against *Helicoverpa armigera* and *Melanagromyza obtusa* infesting pigeonpea. They found that chlorpyrifos 20 EC at 0.02% most effective. Rajshekhar et al. (1998) examined the effectiveness of chlorpyrifos and cypermethrin against *Helicoverpa armigera* on pigeonpea, finding that all the insecticides significantly reduced pod and grain damage compared to untreated controls. Ujagir (1999) reported that fenvalerate at concentrations of 0.005% and 0.006% was effective in mitigating pod borer damage and minimizing grain yield losses. Singh et al. (2001) identified methomyl 12.5 L at 0.1% as the most effective insecticide, resulting in minimal pod damage. Baruah et al. (2002) evaluated the efficacy of four insecticides: cypermethrin (0.006%), fenvalerate (0.008%), deltamethrin (0.002%), and endosulfan (0.07%) against *H. armigera* infesting pigeonpea. Meena et al. (2006) studied the bioefficacy of newer insecticides against the gram pod borer and reported that flubendiamide 20 WDG at 50 g *a.i.*/ha was the most effective, resulting in minimal grain damage. Suganthi et al. (2006) assessed the bioefficacy of pyridalyl against *H. armigera* and found that pyridalyl at 75 and 100 g *a.i.*/ha was comparable in effectiveness to indoxacarb at 75 g *a.i.*/ha, both showing better results. Srinivasan and Durairaj (2007) noted that the lowest larval population of *Helicoverpa* was found in plots treated with spinosad 45 SC at 73 g *a.i.*/ha, followed by indoxacarb 14.5 SC, while the untreated control had the highest population. Ambulker (2008) reported that two applications of emamectin benzoate 5% SG at 9 g *a.i.*/ha effectively reduced the larval population of *H. armigera* and pod damage. Singh et al. (2008) evaluated several newer and commonly used insecticides against the insect pest complex of short-duration pigeonpea, finding the lowest pod and grain damage in coragen 20% SC at 40 g *a.i.*/ha, and the highest grain yield (615.2 kg/ha) from spinosad 45% SC at 73 g *a.i.*/ha. Ughade et al. (2008) reported that spinosad 45 SC (Tracer at 0.005%) and indoxacarb 14.5 SC (Avaunt at

0.01%) resulted in the lowest pod and grain damage caused by *H. armigera* and *E. atomosa* on pigeonpea. Chavan et al. (2009) found that flubendiamide 480 SC at 48 g *a.i.*/ha yielded the highest grain yield in pigeonpea. Das et al. (2009) noted that two applications of rynaxypyr (coragen) 20 SC at 30-40 g *a.i.*/ha, initiated at 50% flowering and repeated at 10-day intervals, effectively controlled the pigeonpea pod borer complex. Pawar (2010) indicated that spinosad 45 SC at 73 g *a.i.*/ha and rynaxypyr 20 SC at 40 g *a.i.*/ha were the most effective treatments, reducing grain damage and enhancing yield against the pod borer complex. Mahendra et al. (2011) evaluated seven newer insecticides alongside untreated controls against *H. armigera* on pigeonpea, finding that spinosad (0.006%) and indoxacarb (0.007%) were the most effective, followed by emamectin benzoate (0.001%), flubendiamide (0.004%), and novaluron (0.0075%), all of which reduced larval populations. Pandey et al. (2011) reported that emamectin benzoate 5% SG at 11 g *a.i.*/ha resulted in minimal pod (17.00%) and grain (12.2%) damage caused by the pod fly, with spinosad 45% SC at 37 g *a.i.*/ha also effective. Joshi and Sharma (2012) found that pod damage and larval populations were lowest in plots treated with endosulfan, which was comparable to a higher dose of HaNPV at 600 ml/ha.

5. CONCLUSION

Insect pests pose a significant threat to the productivity and profitability of arhar cultivation. While chemical control remains the dominant strategy for managing these pests, sustainable solutions require a shift toward integrated pest management (IPM) practices. Combining biological control, cultural practices, and judicious use of chemical pesticides can help reduce pest pressure while minimizing the environmental impact.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

ACKNOWLEDGEMENT

All this above information was fetched from the following sources which included authentic books, several research papers and other official websites of the government, several universities. Conveying information to as many agricultural producers as possible is the main objective.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Ambulker, V. K. (2008). *Studies on efficacy of newer insecticides on gram pod borer, Helicoverpa armigera (Hub.) infesting pigeonpea and their impact on potent parasites* (M.Sc. thesis). JNKVV, Jabalpur.

Baruah, A. A. L. H., Deka, S. C., & Barman, N. (2002). Efficacy of synthetic pyrethroids against pod borer, Helicoverpa armigera (Hubner) in pigeonpea. *Journal of Agricultural Science Society of North East India, 15*(2), 141–145.

Chavan, A. P., Patil, S. K., Deshmukh, G. P., Pawar, K. B., Brahmane, R. O., & Harer, P. N. (2009). Sources of resistance to pigeonpea pod borer. Presented at the *International Conference on Grain Legume* held at Indian Institute of Pulses Research, Kanpur, 256–257.

Chitanya, T. (2012). *Biology and management of pod borer in redgram* (M.Sc. thesis). Department of Entomology, CoA, Shri Venkateshra, Tirupati, Acharya N.G. Ranga Agricultural University, Hyderabad.

Chitra, N., Yelshetty, S., Malathi, S., Jyosthna, M. K., Reddy, L. P., Singh, S. K., Chattopadhyay, C., Deshmukh, G. P., Harer, P. N., Chavan, A. P., Bantewad, S. D., Das, S. B., Chandrashekara, K., Parmar, R. D., Rao, M. S., Prasad, Y. G., Prabhakar, M., Sharma, O. P., Bhagat, S., Singh, N., Awasthi, M., Singh, D., Sathyakumar, S., Agarwal, M., Singh, N., Ghosh, V. I., Kumari, A., & Vennila, S. (2011). NICRA team of Pigeonpea Pest Surveillance. *Manual for Pigeonpea Pest Surveillance* (29 pp.). National Centre for Integrated Pest Management, New Delhi; Central Research Institute for Dryland Agriculture; Indian Institute of Pulses Research, Kanpur.

Das, S. B., Veda, O. P., & Mazumder, N. D. (2009). Efficacy of Rynaxypyr 20 SC (Coragen) against pod borer complex infesting pigeonpea. Presented at the *National Symposium on IPM Strategies to*

Combat Emerging Pests in the Current Scenario of Climate Change held at Central Agricultural University, Pasighat, Arunachal Pradesh, 59–60.

Gupta, S., Bujarbaruah, K. M., Dhiman, K. R., Pathak, K. A., Das, S. P., & Das, A. (2006). Pulse production technology for North East India. *Research Bulletin, No. 23*, 3.

Hadiya, G. D., Damor, C. B., & Machhar, R. G. (2023). Efficacy of different botanicals against blue butterfly, Lempides boeticus in pigeonpea. *Biological Forum–An International Journal, 15*(1), 286–288.

Joshi, N. V., & Sharma, J. S. (2012). Effect of HaNPV on larval population of lepidopteran pod borer complex infesting pigeonpea Cajanus cajan. *Journal of Insect Sciences Ludhiana, 25*(2), 197–198.

Joshi, N., & Srivastava, C. P. (2006). Yield maximization in pigeonpea through crop protection measures. *Indian Farming, 76*(3), 4–7.

Kaushik, H. K., Dushyant, K., Chandrakar, H. K., Rana, N., Sharma, S., & Singh, V. (2008). Influence of abiotic factors on the pest complex of pigeonpea. Presented at the *National Conference on Pest Management Strategies for Food Security* held at College of Agriculture, I.G.K.V., Raipur (C.G.), 27.

Khanpara, A. V., Kapadia, M. N., & Jethva, D. M. (2011). Behavioural response of Helicoverpa armigera to *Bacillus thuringiensis* var. kurstaki on pigeonpea. *Annals of Plant Protection Sciences, 19*(1), 212–213.

Kumar, A., & Nath, P. (2003). Effect of weather parameters on population buildup of pigeonpea pod borers. *Indian Journal of Entomology, 66*(4), 293–296.

Kumar, A., & Nath, P. (2003). Influence of weather factors on population of insect pests in pigeonpea at vegetative stage and flowering stage. Presented at the *5th National Symposium on Bio-control Agents for Sustainable Management of Pest* held at G.B. Pant University of Agriculture and Technology, Pantnagar, Uttaranchal, 137.

Lal, B., Bhadauria, N. S., & Tomar, S. P. S. (2019). Biology and morphometrics of plume moth, *Exelastis atomosa* (Wals.) on pigeonpea variety-Saket under laboratory conditions in Gwalior, Madhya Pradesh region, India. *International Journal of Current Microbiology and Applied Sciences, 8*(02), 1880–1886.

Landge, K. S. (2009). *Studies on pest complex of pigeonpea Cajanus cajan L. and their management under late sown condition* (M.Sc. thesis). JNKVV, Jabalpur.

Lellapalli, R., Chandran, D. R., Radhakrishnan, N. V., & Balakumar, R. (2023). Pest management strategies in pulses and cereal crops: Major pests of pigeonpea and its management. In *Pest Management Strategies in Pulses and Cereal Crops: Major Pests of Pigeon Pea and Its Management* (Vol. 1, pp. 181–195). KD Publications.

Mahalle, S. C. (2008). *Studies on pest complex of pigeonpea Cajanus cajan L. and management of pod borer complex* (M.Sc. thesis). JNKVV, Jabalpur.

Mahendra, R. C., Babu, S. J., Girish, R., & Basanth, Y. S. (2011). Evaluation of new insecticides against Helicoverpa armigera on pigeonpea crop. *Environment and Ecology, 29*(1A), 282–283.

Mandal, S. M., & Mishra, B. K. (2003). Bioefficacy of insecticides and biopesticides against pod borers and pod fly on pigeonpea. *Journal of Applied Zoology Research, 14*(1), 42–43.

Meena, B., Srivastava, C. P., & Sharma, R. P. (2010). Seasonal incidence of pod fly, *Melanagromyza obtuse* (Malloch) on long-duration pigeonpea *Cajanus cajan* L. *Annals of Plant Protection Sciences, 18*(2), 394–399.

Meena, R. S., Srivastava, C. P., & Joshi, N. (2006). Bioefficacy of some newer insecticides against the major insect pests of short-duration pigeonpea. *Pestology, 30*(7), 13–16.

Minja, E. M., Ongaro, T. G., Shanower, J. M. N., & Deritu, Songa, J. M. (1999). Natural enemies associated with arthropod pests of pigeonpea in eastern Africa. *International Chickpea and Pigeonpea Newsletter, (6)*, 47–50.

Mohapatra, S. D., & Srivastava, C. P. (2008). Toxicity of biorational insecticides against spotted pod borer, *Maruca vitrata* (Geyer) in short-duration pigeonpea. *Indian Journal of Entomology, 70*(1), 61–63.

Pandey, A. K., Ram Keval, & Narasimhamurthy, A. K. (2011). Effect of some newer insecticides against major pests on short-duration pigeonpea *Cajanus cajan* L. Millsp. *Journal of Plant Protection and Environment, 8*(2), 49–52.

Pandit, T. R., & Dwivedi, S. A. (2021). A study on biology and management of spotted pod borer, *Maruca vitrata* (Geyer) in legumes. *Biological Forum – An International Journal, 13*(2), 220–227.

Patel, J. J., Patel, N. C., Jayani, D. B., Patel, J. R., & Patel, B. D. (1997). Bioefficacy of synthetic and botanical insecticides for controlling pod borer (*Helicoverpa armigera*) and pod fly (*Melanagromyza obtusa*) infesting vegetable-purpose pigeonpea. *Indian Journal of Agricultural Sciences, 67*(3), 117–119.

Pawar, U. (2010). *Studies on pest complex of pigeonpea Cajanus cajan L. Millsp. and their management* (M.Sc. thesis). JNKVV, Jabalpur.

Prabhakara, M. S., & Srinivasa, N. (1998). Field persistence of *Bacillus thuringiensis* formulations against pigeonpea pod borer. *Indian Journal of Pulses Research, 11*(1), 63–67.

Puntambekar, U. S., Mukherjee, S. N., & Ranjekar, P. K. (1997). Laboratory screening of different *Bacillus thuringiensis* strains against certain lepidopteran pests and subsequent field evaluation on the pod-boring pest complex of pigeonpea (*Cajanus cajan*). *Antonie van Leeuwenhoek, 71*(4), 319–323.

Rajshekhar, D. W., Awakhava, J. S., Yelshetty, S., & Lingappa, S. (1998). Effectiveness and economics of different insecticides in pigeonpea. *Advances in Agricultural Research in India, 10*(39), 44.

Rana, N. S., Rana, D. K., Gupta, A., & Shukla, B. C. (2008). Sharma, R. N. Study of population dynamics of insect pests of pigeonpea. Presented in the “National Conference of Pest Management Strategies for Food Security” held at College of Agriculture, I.G.K.V., Raipur (C.G.), 33.

Sadawarte, A. K., & Sarode, S. V. (1997). Efficacy of neem seed extract, cow dung, and cow urine alone and in combination against the pod borer complex of pigeonpea. *International Chickpea and Pigeonpea Newsletter, (4)*, 36–37.

Sanap, M. M., Aher, R. P., & Deshmukh, R. B. (1994). Relative efficacy of synthetic pyrethroids for the control of pod borer complex on pigeonpea. *Indian Journal of Pulses Research, 7*(1), 45–47.

Savde, V. G., Kadam, D. R., Sapkal, S. D., & Sanjekar, M. B. (2018). Biology and morphometrics of plume moth, *Exelastis atomosa* (Wals.) on pigeonpea variety BDN-711 under laboratory conditions. *Journal of Entomology and Zoology Studies, 6*(4), 1908–1910.

Saxena, H., Bandi, S., & Devindrappa, M. (2018). Pests of pulses. In *Pests and Their Management* (pp. 99–136). Springer, Singapore.

Singh, N. K., Thakur, A., & Shrivastava, O. P. (2008). Evaluation of certain newer insecticides against insect pest complex on pigeonpea *Cajanus cajan* L Millsp. *Journal of Applied Zoology Research, 19*(1), 46–49.

Singh, R. S., Nath, P., & Kumar, A. (2013). Effect of biorational approaches for the management of blue butterfly, *Lampides boeticus* in pigeonpea. *Agricultural Science Digest, 33*(4), 299–303.

Singh, S. P., Singh, Y., & Singh, Y. (2001). Control of pod borers on pigeonpea. *Indian Journal of Entomology, 63*(3), 356–359.

Singh, S. R., & Van Emden, H. F. (1979). Insect pests of grain legumes. *Annual Review of Entomology, 24*, 255–278.

Sreekanth, M., & Seshamahalakshmi, M. (2012). Studies on relative toxicity of biopesticides to *Helicoverpa armigera* Hubner and *Maruca vitrata* (Geyer) on pigeonpea *Cajanus cajan* L. *Journal of Biopesticides, 5*(2), 191–195.

Sreekanth, M., Rao, G. M. V. P., Lakshmi, M. S. M., & Ramana, M. (2021). Impact of different insecticidal modules on pod borer complex in pigeonpea. *Biological Forum – An International Journal, 13*(3a), 374–379.

Srinivasan, T., & Durairaj, C. (2007). Newer insecticides against pod borer complex of pigeonpea with special reference to *Helicoverpa armigera* and *Melanagromyza obtusa*. *Indian Journal of Plant Protection Sciences, 35*(1), 47–49.

Subharani, S., & Singh, T. K. (2007). Influence of meteorological factors on population dynamics of pod fly, *Melanagromyza obtusa* Malloch (Diptera: Agromyzidae) in pigeonpea agro-climatic conditions of Manipur. *Indian Journal of Entomology, 69*(1), 78–80.

Subharani, S., & Singh, T. K. (2008). Biological studies of plume moth, *Exelastis atomosa* Wals. on *Cajanus cajan* (L.) Millsp. *Annals of Plant Protection Sciences, 16*(2), 367–369.

Suganthi, A., Jayakumar, R., & Kuttalam, S. (2006). Bioefficacy and phytotoxicity of pyridalyl 10 EC against *Helicoverpa armigera* (Hub.) on pigeonpea. *Pestology, 30*(7), 17–20.

Thilagam, P., & Kennedy, J. S. (2007). Evaluation of *Bacillus thuringiensis* (Spic-BioReg.) against pod borer complex of pigeonpea. *Journal of Ecotoxicology & Environmental Monitoring, 1*(3), 275–280.

Ughade, J., Sarkate, M. B., Tupat, P. P., & Chavhan, K. R. (2008). Comparative performance of different insecticides against *Helicoverpa armigera* and *Exelastis atomosa* damage in pigeonpea *Cajanus cajan* L. at harvest. *Crop Research Hisar, 36*(1/3), 299–300.

Ujagir. (1999). Field efficacy of insecticides against pod borer complex in early pigeonpea, *Cajanus cajan* (L.) Millsp. at Pantnagar, Northern India. *Annals of Plant Protection Sciences, 7*(1), 19–25.

Vijayachander, A., & Arivudainambi, S. (2007). Biology of pulse blue butterfly. *Annals of Plant Protection Sciences, 15*, 53–56.

Yadav, G. S., & Dahiya, B. (2004). Evaluation of new insecticides/chemicals against pod borer and pod fly on pigeonpea. *Annals of Biology, 20*(1), 55–56.

Yelshetty, S., Patil, B. V., & Lingappa, S. (2005). Role of insectivorous birds in the management of pigeonpea pod borer, *Helicoverpa armigera* (Hubner). *Indian Journal of Pulses Research, 18*(2), 226–229.

Peer-review history:
The peer review history for this paper can be accessed here:
https://prh.globalpresshub.com/review-history/1790