

Review Paper

Emerging insect pests of pulse crops in India-A brief review

Sagarika Bhowmik¹ and Sunil Kumar Yadav²

¹Department of Entomology, Dr. Kalam Agricultural College, Bihar Agricultural University, Kishanganj, Sabour-855 107, Bihar, India

²Department of Entomology, Nalanda College of Horticulture, Bihar Agricultural University, Noorsarai-803 113, Bihar, India

*Corresponding author e-mail: sagarika150192@gmail.com

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ABSTRACT

Pulses rank second in importance to the dietary regimen after cereals due to their rich content in protein, vitamins, and minerals. They are essential for maintaining the nutritional well-being of Indians, particularly for individuals living below the poverty line and lacking the means to purchase animal-based food products. Despite their importance, pulse production has consistently been challenged by biotic stress. Recent global warming and climate variability have further exacerbated these challenges, leading to significant reductions in food output. The spectrum of insect pests has also changed with many pests that were once considered minor now emerging as major threats. These pests have caused extensive crop losses, complicating the efforts to maintain and increase crop production and yield. This article offers a comprehensive account of the shifts in pest status and explores the impact these changes have on pulse production in India. It emphasizes how evolving pest issues have not only worsened existing problems but have also introduced new challenges into the agricultural landscape, requiring updated strategies for pest management and crop protection.

Key words: Climate change, Pulses, Pest emergence, Global warming

INTRODUCTION

Pulses have always been in focus right from the theme declared by the United Nations in 2016 to being an essential component of daily diets in various forms worldwide. Pulses serve a multitude of purposes, providing essential protein for human diets and enhancing soil health through nitrogen fixation. India stands as the global leader in pulse production, contributing 27-28% of the global total, as well as leading in consumption at 27% and importation at 14% (www.dpd.gov.in). Pulses represent about 20% of the food grain sector and contribute 7-10% to India's total food grain production. The cultivation of pulses is notably prominent across several major regions, including Maharashtra, Madhya Pradesh, Rajasthan, Karnataka, Uttar Pradesh, the West Bengal delta region, Tamil Nadu and Kerala (www.agricop.nic.in). The primary pulses grown and consumed in India encompass Bengal gram (Desi Chickpea/Desi Chana), Green gram (Moong bean), Pigeon pea (Arhar / Toor / Red gram), Chickpea (Kabuli Chana), Black-eyed pea (Lobiya), Mungo bean (Urad / Mah / Black gram), Lentil (Masoor), Red kidney bean (Rajma), and White pea (Matar). Despite India's leadership in pulse production and consumption, the country faces a persistent

demand-supply gap, primarily due to stagnant productivity and declining availability.

Among the several factors contributing to the low productivity of pulses in India, biotic stress has been identified as the significant one (Kumar et al. 2021). Over 250 insect pests affect legume crops throughout the country, of which the key pests during the vegetative stage include Leaf webber, Leaf roller, Whitefly, Thrips, Leaf hopper, Bihar hairy caterpillar, Black aphid, and Stem fly, causing substantial damage (Singh and Kumar 2003, Pandey et al. 2024). Insect pests account for an average loss of 30% in pulse crops throughout India (Sharma et al. 2010). The repercussion of biotic pressure on plant growth and development varies on the plant's ability to resist the stress or in a given environment. Insects, as a major biotic stress factor, consistently pose significant threats to overall pulse production and yield. Recently, biotic stress has been at its peak due to multiple factors among which the pre-dominant is change of pest status, where numbers of pests previously considered minor, have gained prominence due to their improved acclimatization abilities driven by mutational changes and various environmental factors (Pandey et al. 2017). Secondly, due to imprudent use of pesticides, several beneficials get devastated as a

result, creating a congenial situation for those minor pests, which show severe outbreaks and emerge as new pests. In recent years, climate change has become a key factor in insect pest outbreaks. Pest-related yield losses have increased by 10-25% due to rising temperature (Shrestha 2019). Variations in environmental conditions such as temperature, precipitation, humidity, and other meteorological elements affect pest populations and bionomics. Additionally, invasive pest species cause significant economic losses and pose growing threats to Indian farming biodiversity, means of subsistence, human and animal wellness, silviculture, and biodiversity sectors (Singh *et al.* 2016). Resistant pest populations also have a significant role in exacerbating the severity of insect pest attacks. To date, around 954 insect species have shown resistance to various types of insecticides (Kole *et al.* 2020). These resistant insect populations eventually develop new biotypes, making them more difficult to control. All these various factors contribute, in one way or another, to changes in pest dynamics, leading to the emergence of new pests. Literature on emerging pests in pulse crops is scattered across multiple sources, hence, this article aims to present a concise review of these changes in pest status associated with pulse crops, offering researchers a comprehensive reference to guide future experiments related to these crops.

EMERGING AND INVASIVE INSECT SPECIES ON PULSES

An emerging pest can be defined as any pest that has been reported in a particular area on a specific crop and has shown a significant increase in its population, with the potential to cause substantial economic damage over time (Hill 1997). These pests may have previously existed in the region but were not considered a major threat until their populations expanded and their impact on crops became more pronounced. An invasive species, on the other hand, is an organism that is not native or indigenous to a particular region. These species, when introduced to a new environment, can cause significant economic and environmental damage (Keller *et al.* 2011). Invasive species often lack natural predators or control mechanisms in their new habitats, allowing their populations to grow unchecked. This rapid growth can lead to the displacement of native species, disruption of local ecosystems, and considerable harm to agricultural productivity, forestry, biodiversity, and human and animal health. Below mentioned are the present insect pest status attacking pulse crops, which are given in crop wise manner.

Pigeonpea

After gram, pigeonpea is the most extensively cultivated pulse crop and the primary factors limiting the potential yield of pigeon pea are biotic and abiotic stresses common in pulse-growing regions. The biotic stress caused by arthropod pests (Table 1) is a major concern, as outlined below:

This table presents a chronological overview of major pest outbreaks in India, highlighting their emergence and impact. During 1970s-1980s: The earliest recorded outbreaks include Pod borer (1977-78), Pod weevil (1979-80), and Leaf Webber (1982-83). Throughout this period, several pests like Ash weevil, Sri Lankan weevil, and Pigeon pea pod borer also emerged. 1990s: This decade saw new pests like Scale (1989-1993), Eggplant mealybug (1993), Gall weevil (1999), and Spotted pod borer (1996-1999). Many of these were linked to climatic variations such as temperature rise and seasonal fluctuations. 2000s-Present: The 21st century saw further escalation, with Pod wasp (2003), Stem borer (2015), and Pod fly (recent). Pests like Crab caterpillar and Blister beetles also showed increasing prevalence, shifting from minor to major pests. Given the shifting pest dynamics, it is crucial to develop and implement effective management strategies (Table 2) to safeguard crops from potential damage. The following measures are essential for effective pest control.

Chickpea

Chickpea is a vital legume crop cultivated globally, recognized for its significant role in agriculture and nutrition. Due to its importance, chickpea holds a distinguished position among pulses, not only in India but also worldwide, underscoring its value and prominence in various regions across the globe. Several new records of pest outbursts in chickpea are mentioned in Table 3.

The table highlights the severity and geographical spread of key insect pests affecting chickpea production in India. The emergence of insect pests like Chickpea Pod Borer, Black Aphid, and Beet Armyworm across India has significantly impacted crop yields, with pod borer alone causing 44-74% damage in Uttar Pradesh. Pests such as Termites and Cutworms are already serious threats, leading to substantial crop loss, while Black Aphid, initially a minor pest, now causes 20-40% yield reduction. Climate change has contributed to the rise of Blister Beetles as an emerging threat, while pests like Leaf Miner and White Grub remain occasional but potentially damaging. The increasing severity of

Table 1. Details of major and emerging insect pests in pigeonpea.

Sl. No.	Pest	Location	First Reported / Major Outbreak	Details	References
1.	Pod borer	Guntur, Andhra Pradesh, North India	First outbreak in 1977-78; recent outbreak due to climate change	First major outbreak due to temperature changes and unseasonal rains; annual losses estimated at US \$500 billion; damage of 35-70% recorded	Rao <i>et al.</i> (1990), Shanower <i>et al.</i> (1999), Sharma <i>et al.</i> (2010, 2014)
2.	Leaf Webber	Eastern Uttar Pradesh, Bundelkhand	1982-83	First identified as minor pest then shifted from minor to major pest; damage of 15% recorded	Shukla <i>et al.</i> (1984), Sahoo and Senapati (2000), Sinam and Singh (2004), Kumar <i>et al.</i> (2014), Sharma <i>et al.</i> (2015)
3.	White-tailed mealybug	Delhi	1984	Reported as a new pest in October-November	Gautam and Saxena (1986)
4.	Ash weevil	Eastern Uttar Pradesh	1982-83	Evolved as a new pest	Shukla <i>et al.</i> (1984)
5.	Sri Lankan weevil	Eastern Uttar Pradesh	1982-83	Noted as a new pest	Shukla <i>et al.</i> (1984)
6.	Pigeon pea pod borer	Orissa, Tripura	1982	Emerged as new pest during 1982; recorded as major pest in 2015	Samalo and Patnaik (1984), Nair <i>et al.</i> (2017)
7.	Scale	Gujarat, Madhya Pradesh, Tamil Nadu	1989-1993	Outbreaks linked to rainy seasons, dry spells, and high temperatures	Patel <i>et al.</i> (1991), Ganapathy <i>et al.</i> (1994), Shaw <i>et al.</i> (1999)
8.	Pod weevil	Bihar, West Bengal	1979-80, 2001-2003	Recorded in Muzaffarpur, Samastipur, Bihar, and West Bengal	Sinha and Yadav (1983), Bandyopadhyay <i>et al.</i> (2009),
9.	Eggplant mealybug	Vamban, Tamil Nadu	1993	Found as a pest in pigeon pea	Ganapathy <i>et al.</i> (1994)
10.	Gall weevil	Dharwad, Karnataka	1999	Significant pest, reducing plant populations by 25-30%	Giraddiet <i>et al.</i> (2000), Rakshitha <i>et al.</i> (2019)
11.	Spotted pod borer	Karnataka, Madhya Pradesh, Andhra Pradesh	1996-1999 Rabi season	Major losses in pigeon pea; consumes buds and blooms; significant pest in India due to high humidity and optimal temperatures. Damage documented up to 42% & in early pigeon pea upto 84% yield loss	Giraddi <i>et al.</i> (2000), Singh (1997), Kumar <i>et al.</i> (2021) Halder and Srinivasan (2011), Chakravarty <i>et al.</i> (2017), Chatterjee <i>et al.</i> (2019)
12.	Crab caterpillar	North and South India	Recent escalation	Initially minor in South India, now serious in North India	NBAIR; Chakravarty <i>et al.</i> (2017)
13.	Blister beetles	Southern India	Post-1995	Previously minor pests, now prominent. Flower damage of more than 50% has been recorded	Durairaj (1995), Durairaj and Ganapathy (2000), Singh <i>et al.</i> (2022)
14.	Pod wasp	Southern India	2003	Severe outbreak reported	Durairaj <i>et al.</i> (2003)
15.	Stem borer	Anantapur, Andhra Pradesh	2015	Identified as a new pest	Nagamani <i>et al.</i> (2015)
16.	Pod fly	Bundelkhand	Recent	Causes 10-50% damage	Durairaj and Ganapathy (2000), Sharma <i>et al.</i> (2010), Sah <i>et al.</i> (2024)

Table 2. Nature of damage and management of emerging insect pests in pigeonpea.

SL. No.	Pest	Taxonomic Position	Host(s) & Damage	Control Measures	References
1. Lepidopteran pests	Leaf webber	<i>Grapholita (Cydia) critica</i> Meyrick Tortricidae, Lepidoptera	Affects vegetative stage by folding and webbing leaves, forming white patches, leading to drying.	Larval parasitoid <i>Apanteles mohandasi</i> , emamectin benzoate 5% SG, chlorantraniliprole 18.5% SC	Gaikwad <i>et al.</i> (2014), Pandey <i>et al.</i> (2024), Gupta <i>et al.</i> (2011), Sharma <i>et al.</i> (2015)
	Pigeon pea pod borer	<i>Nanaguna breviscula</i> Nolidae, Lepidoptera	Webs flowers, pods, and leaves; damages pods by scraping green tissue	Chlorantraniliprole 18.5% SC, novaluron 10% EC, buprofezin 25% EC; <i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i>	Nair <i>et al.</i> (2017), Nayanthara (2020)
	Spotted pod borer	<i>Maruca Vitrata</i> Pyralidae, Lepidoptera	Infests legumes; damages leaf axils, flowers, and pods by webbing	<i>Coccinella septempunctata</i> , <i>Cheilomenes sexmaculata</i> , Bt @1.5 kg/ha, lambda cyhalothrin, rynaxypyr, indoxacarb, spinosad	Agunbiade <i>et al.</i> (2017), Sharma (1998)
	Crab caterpillar	<i>Neostauropus alternus</i> Notodontidae, Lepidoptera	Damages leaves and flower buds in pigeonpea and plantation crops	Mechanical removal, <i>Apanteles taprobanae</i> , <i>Brachymeria lasus</i>	Chakravarty <i>et al.</i> (2017), Patel (2021)
2. Sucking Pests	White-tailed mealy bug	<i>Ferrisia virgata</i> Pseudococcidae, Hemiptera	Found on copperleaf, croton, hibiscus, seagrape, citrus, and garden vegetables; causes flower withering and drop.	Dimethoate (30EC) 0.06% or spinosad (0.25 ml/l) spray	Gautam and Saxena (1986), Gahukar (2018)
	Scale	<i>Ceroplastodes cajani</i> Diaspididae, Hemiptera	Feeds on stem and occasionally on leaves	Systemic insecticides during crawler stage; ant control to support natural enemies	Sharma <i>et al.</i> (2010)
	Ash weevil	<i>Lepropus lateralis</i> Curculionidae, Coleoptera	Feeds on pigeon pea, cotton, and mango	Not specified	Myint (2009)
3. Coleopteran Pests	Sri Lankan weevil	<i>Myllocerus undecimpustulatus</i> Curculionidae, Coleoptera	Chews leaf margins; grubs feed on roots and pupate in soil.	<i>Entrust</i> and <i>Botanigard</i> Biopesticides; Padan (neonicotinoid), spinosad	Ranga Rao and Shanower (1999)
	Pod weevil	<i>Apion clavipes</i> Apionidae, Coleoptera	Damages leaflets, buds, flowers, and pods from seedling to harvest stage; deforms pods	Not specified	Nair <i>et al.</i> (2017)
	Gall weevil	<i>Alcidodes collaris</i> Curculionidae, Coleoptera	Attacks pigeonpea at seedling stage, causing gall formation on stem	Seed treatment with imidacloprid 600FS, followed by chlorantraniliprole 18.5SC spray	Rakshitha <i>et al.</i> (2023)
	Blister beetle	<i>Mylabris pustulata</i> Meloidae, Coleoptera	Damages flower buds, flowers, pods, and young leaves, reducing yield	Thiodicarb, chlorpyrifos, quinalphos, cypermethrin	Singh <i>et al.</i> (2022), Rolania <i>et al.</i> (2016)
4. Hymenopteran Pests	Pod wasp	<i>Tanaostigmodes cajaninae</i> Tanaostigmatidae, Hymenoptera	Damages pigeonpea pods, producing atrophied, undeveloped pods	Not specified	Ranga Rao and Shanower (1999)

Table 3. Details of major and emerging insect pests in chickpea

SL. No.	Pest Name	Location	Severity	Comments	References
1.	Chickpea Pod Borer	Throughout India	Highly Serious	Major pest causing significant crop damage (44–74% has been recorded in U.P.)	Pandey (2012)
2.	Termite	North India	Serious	Causes 25–26% crop damage per square meter	Pandey (2012)
3.	Cutworm	Throughout India	Serious	Noted as a major pest across India	Islam <i>et al.</i> (1987), Lal (1996), Sharma <i>et al.</i> (2020)
4.	Beet Armyworm	South India	Highly Serious and emerging pest	Major pest in southern regions	Shankar <i>et al.</i> (2014)
5.	Black Aphid	All over India	Emerging Major Pest	Previously minor but has emerged as a major pest; causes 20–40 percent yield loss	Islam <i>et al.</i> (1987), Lal (1996), Acharjee and Sharma (2013)
6.	Semi-looper	North India	Occasional	Occurs infrequently	Islam <i>et al.</i> (1987), Lal (1996),
7.	White Grub	Gujarat, Rajasthan	Occasional	Primarily affects crops in alluvial soils	Islam <i>et al.</i> (1987), Lal (1996),
8.	Leaf Miner	Kabuli and broadleaf cultivars	Occasional	Mainly affects Kabuli-type cultivars	Islam <i>et al.</i> (1987), Lal (1996),
9.	Root Beetle	Sporadic	Occasional	Damages roots, leading to plant desiccation	Islam <i>et al.</i> (1987), Lal (1996),
10.	Blister Beetle	Reported in various regions	Emerging Pest	Emerged due to climate change	Kumar <i>et al.</i> (2021)

Table 4. Nature of damage and management of emerging insect pests in chickpea

SL. No.	Pest	Taxonomic Position	Host(s) & Damage Description	Control Measures	References
1. Lepidopteran Pests	Gram pod borer	<i>Helicoverpa armigera</i> Noctuidae, Lepidoptera	A significant pest of chickpea that also targets pigeon pea, moong bean, lentil, soybean, okra, maize, berseem, sunflower, sorghum, tobacco, and tomato. It damages buds, flowers, and pods; in the absence of pods, larvae feed on foliage. Causes multiple peaks of infestation from vegetative to maturity stages.	Cultural practices (intercropping, timely sowing, proper spacing, water and nutrition management, crop rotation); sunflower as a trap crop; high-quality HaNPV applications have shown success.	Ranga Rao <i>et al.</i> (2013)
	Black cutworm	<i>Agrotis ipsilon</i> Noctuidae, Lepidoptera	Larvae cut seedling stems at ground level, causing plant death. Found in soil or leaf litter near damaged plants.	Chemical control with chlorantraniliprole; larvae feed on foliage and may be effectively targeted by soil or foliar applications.	Ranga Rao <i>et al.</i> (2013), He <i>et al.</i> (2019)
	Beet armyworm	<i>Spodoptera exigua</i> Noctuidae, Lepidoptera	Attacks various crops including cotton, tomato, cabbage, chili, and alfalfa, but can be particularly damaging to chickpea at the seedling stage. Young larvae feed gregariously on foliage; mature larvae target leaves and pods, creating large, irregular holes.	Neem products control larvae; petroleum oil kills eggs, while 5% cottonseed oil (though potentially damaging) kills eggs and young larvae; pheromone traps disrupt mating; synthetic insecticides like chlorantraniliprole can also be effective.	Shankar <i>et al.</i> (2014), Prabhaker <i>et al.</i> (1986), Butler & Henneberry (1990), Wakamura and Takai (1992), Rabelo <i>et al.</i> (2022)
2. Soil dwelling pest	Termites	<i>Odontotermes</i> spp. Termitidae, Isoptera	Polyphagous species that damage chickpeas by burrowing into roots and stems, leading to plant mortality at various growth stages.	Cultural methods like removal of termite mounds near fields; chlorpyrifos (5 ml per liter of water, 2–3 liters per mound) applied into mounds.	Ranga Rao <i>et al.</i> (2013)
3. Sucking pest	Black Aphid	<i>Aphis craccivora</i> Aphididae, Hemiptera	Causes yield loss by nutrient drainage, virus transmission, phytotoxicity, and excretion of honeydew, leading to black sooty mold and leaf shedding.	Neem seed extract (5%) effectively reduces aphid population; chemical control with Chlorpyrifos and Cypermethrin.	Dhawal <i>et al.</i> (2019), Prasannath & Mahendran (2013)

these pests highlights the urgent need for improved pest management strategies (Table 4) to mitigate economic losses and sustain chickpea production.

Vigna crops (Cowpea, mungbean and urdbean)

Vigna crops, including cowpea (*Vigna unguiculata*), mungbean (*Vigna radiata*), and urdbean (*Vigna mungo*), are crucial for sustainable agriculture and nutritional security but are highly susceptible to insect pests that can significantly impact yield and quality. In recent years, the emergence of new insect pests (Table 5) has posed serious challenges to their cultivation, driven by factors such as changing climatic conditions, shifting pest dynamics, and altered cropping patterns. Many pests that were previously considered minor have now evolved into

major threats due to favorable ecological conditions and the widespread adoption of intensive farming practices

The table highlights major insect pests affecting cowpea and other legumes in India, with the Spotted Pod Borer and Pod Bugs causing up to 80% yield loss, while the Hadda Beetle leads to severe defoliation. Whiteflies act as vectors for Mosaic Virus, and Thrips, once minor, now cause 13-64% yield loss. Emerging pests like the Pod Fly and Stem Fly are becoming serious concerns, especially in Bundelkhand. To prevent outbreaks, Integrated Pest Management (IPM) is crucial, including crop rotation, resistant varieties, biological control, judicious pesticide use, pest monitoring, and climate-smart farming. These strategies (Table-6)

Table 5. Details of major and emerging insect pests in *Vigna* crops.

SL. No.	Pest Name	Locations	Severity	Comments	References
1.	Spotted Pod Borer	All cowpea-growing regions in India	Significant	Major pest of cowpea, causing up to 80% yield loss if untreated; also affects mung and urd bean	Halder and Srinivasan (2011), Halder <i>et al.</i> (2011), Ekesi <i>et al.</i> (2002), OECD (2015)
2.	Hadda Beetle	Eastern Uttar Pradesh, Bihar	Severe and emerging pest	Grim feeder on cowpea foliage; infested over 80% of leaves during 2009-10	Halder and Srinivasan (2011), Halder <i>et al.</i> (2011)
3.	Whitefly	Various regions in India	Vector for Mosaic Virus	Not a major pest itself but transmits mosaic virus, significantly reducing yield	Kumar <i>et al.</i> (2021)
4.	Pod Bug	Various regions	Major	Causes up to 80% yield loss without pesticides	Ekesi <i>et al.</i> (2002), OECD (2015)
5.	Aphid	Both southern and northern India	Major	Affects mung and urd beans; part of a complex of sucking pests	Durairaj <i>et al.</i> (2009)
6.	Sucking Pests	Both southern and northern India	Major	Includes various species affecting legumes; often found in pigeon pea as well	Durairaj <i>et al.</i> (2009)
7.	Thrips	Various regions	Emerging Major Pests	Previously minor pests, now increasing in severity; can cause 13% to 64% yield losses during severe infestation	Farajallah 2013, Sah <i>et al.</i> (2024)
8.	Pod Fly	Bundelkhand region of India	Emerging Pests	Appearing in severe form	Sah <i>et al.</i> (2024)
9.	Stem Fly	Various regions	Early Stage Pest	Notable increase in attack during early stages of crops	Durairaj <i>et al.</i> (2009)

Table 6. Nature of damage and management of emerging insect pests in *Vigna* Crops

SL. No.	Pest	Taxonomic Position	Host(s) & Damage Description	Control Measures	References
1.	Coleopteran Pest Hadda beetle	<i>Henosepilachna vigintioctopunctata</i> Coccinellidae, Coleoptera	Hosts include solanaceous (brinjal, potato, tomato, black nightshade), cucurbitaceous (teasel gourd, ribbed gourd, sweet gourd), and leguminous plants (long-podded cowpea, snake bean). Severe infestations by grubs and adults cause chlorophyll scraping, skeletonizing leaves, forming a papery structure, poor plant growth, and reduced yield.	<i>Metarhizium anisopliae</i> fungus is highly effective on second instar grubs; chemical controls include Thiacloprid 21.7 SC, Chlorantraniliprole 18.5 SC, and Imidacloprid 17.8 SL.	Satpathi (2021), Kodandaram <i>et al.</i> (2014)

2. Sucking Pests	Whiteflies	<i>Bemisia tabaci</i> Aleyrodidae, Hemiptera	Cause damage by sap-sucking and excreting honeydew, leading to sooty mold growth. Feeding weakens plants, causing leaf yellowing, early leaf fall, and reduced photosynthesis, especially in young plants.	Drip irrigation reduces whitefly density; foliar sprays using turmeric root, buttermilk, and detergents; predators like coccinellid beetles, lacewings, and mites; transgenic crops with pesticidal toxins; common chemicals include pyriproxyfen, buprofezen, spiromesifen, spirotetramat, cyantraniliprole, and chlorantraniliprole.	Gangwar & Gangwar (2018), Abubakar <i>et al.</i> (2022)
	Pod bug	<i>Clavigralla tomentosicollis</i> Coreidae, Hemiptera	Affects cowpea pods, causing them to shrivel and dry prematurely, leading to yield losses of 20-100%.	Botanical insecticides made from <i>Sesamum indicum</i> are effective; chemical controls include Flonicamid 50 WG and Acephate 75 SP.	Negbenebor <i>et al.</i> (2020), Chethan <i>et al.</i> (2018)
	Pod fly	<i>Melanagromyza obtusa</i> Agromyzidae, Diptera	Larvae damage pigeonpea by feeding on and destroying developing seeds, resulting in reduced germination and yield.	<i>Euderus lividus</i> , a larval-pupal parasitoid, is effective in controlling pod fly populations.	Shanower <i>et al.</i> (1998), Sharma <i>et al.</i> (2010)
3. Rasping & Sucking pest	Thrips	<i>Megalurothrips usitatus</i> Thripidae, Thysanoptera	Damage flowers and young pods, causing premature flower drop and yield loss in crops like yard-long beans. Infestation occurs during flowering to podding stages.	Intercropping with non-host plants like capsicum reduces thrips movement; botanical extracts from neem, garlic, ginger, and papaya are effective alternatives to insecticides. <i>Orius strigicollis</i> is a natural predator of thrips.	Faiz (2024), Jackson (2017), Farajallah (2013), Srinivasan <i>et al.</i> (2019), Lee <i>et al.</i> (1991)

will help ensure sustainable pest control and crop protection.

CONCLUSION

Pest attacks have consistently posed a threat to pulse crops, and with the intensifying impacts of climate change and global warming, this risk is now at its peak. Pests such as the crab caterpillar and blister beetle in pigeon pea, along with black aphids in chickpea, have escalated from minor to major threats. Changes in crop composition and climate conditions have further aggravated pest-related losses, as seen with pod borers and spotted pod borers in pigeon pea, which have become serious concern. As a result, developing pest-resistant varieties is essential to address these evolving pest challenges and sustain pulse production. For applied entomologists, the primary challenge is to design, validate, and disseminate region-specific biointensive Integrated Pest Management (IPM) modules. To overcome limitations in traditional biological pest control, molecular techniques, including RNA interference (RNAi), should be regularly employed. Although RNAi has shown success against certain pests, routine application is needed for greater effectiveness.

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