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Mustard Insect Pest and Their Integrated Pest Management: An Overview

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SUMMARY

The major constraints affecting the yield of mustard are insect pests damaging the crop right from the seedling to the maturity stage. In India, approximately 24 insect pests cause damage to the mustard crop (Rai, 1976). However, with an increase in cropping intensity and changes in cropping patterns under different agro-climatic conditions, the pest complex of the crop also changes. Integrated Pest Management (IPM) is a sustainable, science-based decision-making process that combines biological, cultural, physical, and chemical tools to identify, manage, and reduce risks from pests and pest management tools and strategies in a way that minimises overall economic, health, and environmental risks (USDA).

INTRODUCTION

Mustard is one of the earliest domesticated crop plants, dating back to as early as 5000 BC. It held an important position in the Indian diet as a source of oil and vegetable. Mustard oil is gaining recognition as the most beneficial oil due to its ideal ratio of essential fatty acids and natural antioxidants, which help maintain balanced cholesterol levels. Mustard is predominantly cultivated during the Rabi season and can thrive in diverse agro-climatic conditions, including irrigated or rainfed environments, timely or late sowing, saline soils, and mixed cropping. By cultivating more mustard, India can become self-sufficient in edible oils. Integrated Pest Management (IPM) addresses these economic, environmental, and social aspects, providing safe and affordable food to consumers while generating profits for producers and sellers, all while maintaining environmental health (SK Dara, 2019).

Crop Calendar of Mustard:

The crop calendar expresses crop duration from showing to harvesting (table-1)

Table 1: Crop Calendar of Mustard

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov		Dec	
Fd	Fd	H						S	G	L	I	F	Fd

* S-Sowing, G- Germination, L- Leaf development, I- Inflorescence emergence, F- Flowering, Fd- Fruit development, H- Harvesting

Mustard production scenario: In the global scenario, the estimated area, production, and yield of mustard were 36.59 million hectares (Mha), 72.37 million tonnes (Mt), and 1980 kg/ha, respectively, during the 2018-19 period. India accounts for 19.8% of the total area and 9.8% of the total production worldwide (USDA). Based on the primary survey conducted in these states and the secondary survey conducted in other states, the estimated rapeseed-mustard acreage for 2022-23 is 95.77 lakh hectares, slightly lower than the Ministry of Agriculture's estimate of 98.02 lakh hectares. The average productivity for the year 2022-23 has been projected at 1,203 kg/ha, resulting in a total mustard production of 115.25 lakh tonnes (Jayashree Bhosale, 2023).

Table-2: Crop Production scenario in the states of India

	First	**Second**	**Third**
Area	Rajasthan	UP	MP
Production	Rajasthan (44.95 Lakh tons)	MP (18.03 Lakh tons)	UP (16.69 Lakh tons)
Productivity	Rajasthan	UP	MP

Important Insect Pests of Mustard: Among 43 insect species infesting the mustard crop, Aphids (*Lipaphis erysimi*), Sawflies (*Athalia lugens proxima*), and Painted bugs (*Bagrada cruciferaraum*) are important pests. Cabbage head borer (*Hellula undalis*), Cabbage leaf webber (*Crocidolomia binotalis*), and DBM (*Plutella xylostella*) also infest the crop sporadically. The Pest Profile of Mustard has been given in table-2, which indicates the month-wise pest appearance and damage caused by it.

Table-2: Pest Profile of Mustard

Oct	Nov	Dec	Jan	Feb	Mar
		Diamond back moth			
		Mustard saw fly			
	Painted bug				
			Mustard Aphid		
			Mustard Leaf miner		

Mustard Pests of National Significance:

Mustard Aphid, [*Lipaphis erysimi* Kalt. (Aphididae: Hemiptera)]: Mustard crops are primarily infested by three species of aphids: Mustard aphid (*Lipaphis erysimi*), Cabbage aphid (*Brevicoryne brassicae*), and green peach aphid (*Myzus persicae*). It affects various crops including cauliflower, turnip, kohlrabi, radish, Chinese cabbage, Brussels sprout, broccoli, kale, and also acts as a minor pest on beans, beets, spinach, onions, stock, cucumber, and potatoes (Schmutterer, 1978

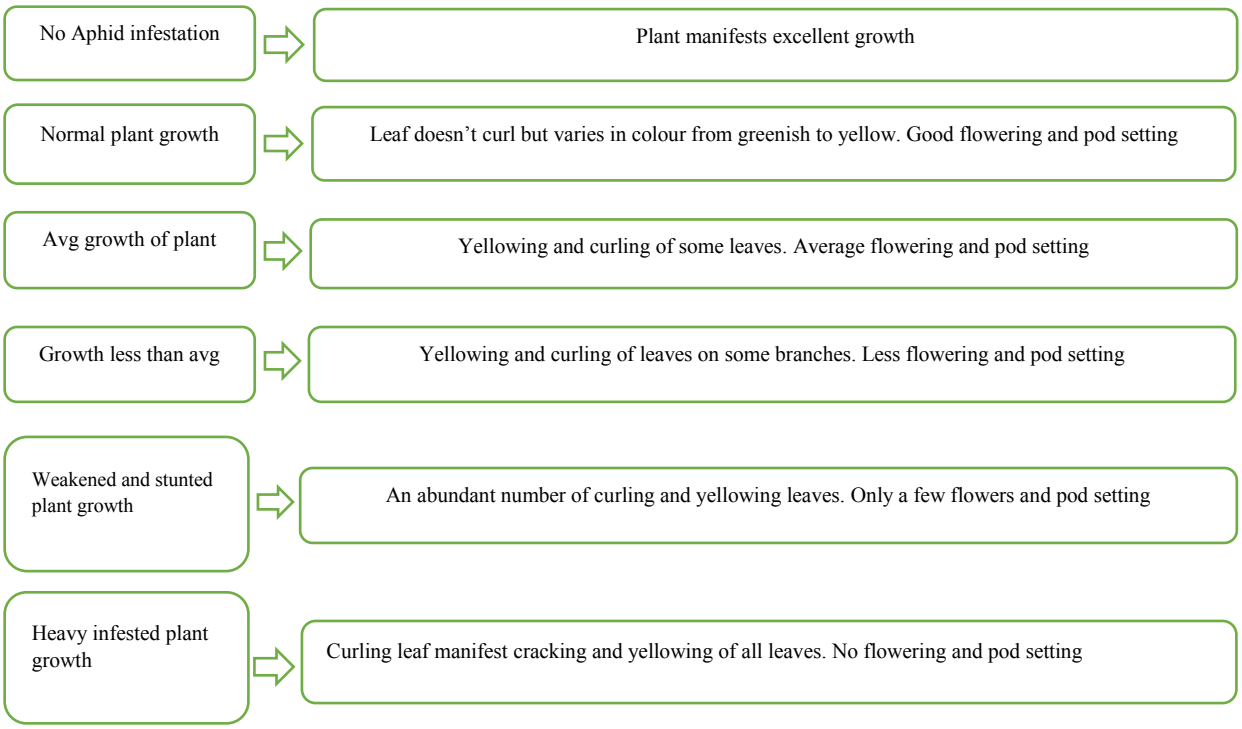

Fig-1: Aphid infestation index (The scoring of plants measured depending on the following grade)

Painted Bug, [*Bagrada cruciferarum* Kirkaldy (Pentatomidae: Hemiptera)]: Adult female bagrada bugs lay eggs singly on the undersides of cotyledons, leaves, stems, and in the soil near the base of plants (Reed and Perring 2012, Palumbo and Natwick 2010). The insects feed on both leaf surfaces and inject saliva to aid in breaking down the inner leaf tissue (Palumbo and Natwick 2010).

Mustard saw fly, [*Athalia lugens proxima* Klug (Tenthridinidae: Hymenoptera)]: The female adult of *Athalia lugens proxima* (Klug) lays eggs singly along the undersides of the leaf margin, creating slits with a saw-like ovipositor. Freshly laid eggs are smooth, creamy white, and oval-shaped, turning black by the end of the egg stage. The incubation period ranges from 6-8 days (Jain et al., 2016). The larva undergoes six instars and possesses three

thoracic pairs of legs and eight pairs of abdominal prolegs. Crochets are absent in the prolegs, distinguishing them from lepidopteran larvae.

Mustard leaf miner, [*Liriomyza brassicae*, (Agromyzidae: Diptera)]: The fly breeds from late spring to the autumn. It overwinters as puparia. The first larval stage enters into the mesophyll tissue. The second larval instar also feeds in the mesophyll tissue. The third stage larva feeds on the upper leaf surface. When it is mature, it cuts a longitudinal slit in the leaf and comes to the leaf surface or falls on the ground for pupation. Mines are whitish or greenish, linear, or irregular with occasional thread-like black frass (Ronald et.al 2017).

Cabbage head borer, [*Hellula undalis* (F.) (Crambidae: Lepidoptera)]: Cabbage webworm feeds mustard, radish, rutabaga, broccoli, cabbage, Chinese cabbage, collard, kale, shepherd's purse, and turnip (Chittenden et, al 1912).. Larvae create and feed inside the webs. In addition, larvae feed on the midribs of leaves, which can cause the midribs to weaken (McAvoy and Kok 1992). In young mustard plants, larvae often bore into the main stem and stalk, causing the plants to wilt and die (Latheef and Irwin 1983).

Table: 3: Recommended insecticides for mustard insect pests

Insect pest	Insecticide	Dosage
Mustard saw fly *Athalia lugens proxima*	Dimethoate 30%EC	1.5 ml/l
	Imidacloprid 70%WS	700 gm/ha
	Quinalphos 25%EC	2.5 ml/l
Mustard aphid *Lipaphis erysimi*	Chlorpyriphos 20%EC	1 ml/l
	Dimethoate30%EC	1.5 ml/l
	Oxydemeton methyl 25%EC	2 ml/l
	Thiamethoxam 25%WG	0.1-0.2 ml/l
Painted bug, *Bagrada hilaris*	Imidacloprid 70%WS	700 gm/ha
Leaf miner, *Phytomyza horticola*	Carbofuran 03%CG	66 kg/ha
	Dimethoate 30%EC	1.5 ml/l
Whitefly	Carbofuran 03%CG	33 kg/ha

Integrated insect pest management in mustard: Integrated pest management (IPM) is the combination of all the available pest control strategies in a compatible manner to bring the pest population below the economic threshold level without any adverse effect on the environment and human health. IPM is a continuous process starting from sowing to the harvesting of the crop which not only includes cultural practices like timely sowing, and integrated nutrient management but also emphasizes the use of biopesticides and botanicals, conservation and augmentation of natural enemies and need-based application of insecticides. Periodic monitoring of the pest and natural enemies in the crop ecosystem is the foundation on which the entire pest management system depends.

CONCLUSION

IPM is a continuous process starting from sowing till the harvesting of the crop which not only includes cultural practices like timely sowing, and integrated nutrient management but also emphasizes on the use of biopesticides and botanicals, conservation and augmentation of natural enemies and need-based application of insecticides. But farmers tend to apply chemical pesticides at first instance in the event of pest attack, which results in increased adverse effects on agroecosystem and increase in cost of agricultural production. Farmers are often reluctant to give up agrochemicals because of ease of use, cost-effectiveness in most of production situations, and because they are seen to guarantee fewer production losses. Sincere efforts are being made by the resource personnel to incorporate ecologically based principles and field-proven technologies for the guidance of the extension officers to educate, motivate and guide the farmers to adopt AESA-based IPM strategies, which are environmentally sustainable. AESA-based IPM in conjunction with ecological engineering for pest management

promotes bio-intensive strategies against present chemical-intensive approaches while retaining the option to apply chemical pesticides as a measure of last resort. The suggested practices, which aim at enhancing biodiversity, biointensive strategies for pest management and promotion of plant health enable the farmers to make informed decisions based on experiential learning and it will also result in the use of chemical pesticides only as a last resort & safely and judiciously.

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