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Pests of Rice in India and their Management: An Overview

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Abstract

Rice is grown in diverse ecosystems in India as the major staple cereal food crop. Currently, India is ranked as the largest producer of rice in the world with a production of 150.2 million tonnes in 2025-26. The statistics show that the market share of insecticides is 22% of the total pesticide market of which the major share is on rice crop. So, it is pertinent to know the status of various insects as pests of rice. Among the pests, rice yellow stem borer, plant hoppers, leaf folders, rice gall midge and rice *gundhi* bug continue to be categorised as pests of national importance causing significant yield losses. There are other pests like rice hispa, thrips, case worms, cutworms, army worms, black bug, termites, root grubs, grass hoppers etc which are of regional significance. However, in recent times, an upsurge could be seen in other stem borers, whorl maggot, sheath or panicle mite and spread of white-backed plant hopper to non-traditional areas. During the last 3-4 years, incidence of Southern Rice Black Streaked Dwarf Virus (SRBSDV) vectored by WBPH and tungro virus by green leaf hopper have been recorded. In certain pockets of rice growing areas, the infestation of mealy bug, white fly and blood worms was observed. This paper discusses the effect of demography, various seasons, cultivation practices, cropping systems, weather conditions, policy decisions etc. that favour the pest infestations in paddy resulting in change of pest status.

Keywords: Rice, insect pests, changing pest scenario, management options

Introduction

Rice is the staple food for more than half of the global population and India ranks first in rice production in 2025-26 with 150.2 million tonnes surpassing China despite low productivity levels. Many factors influence the rice yield and biotic stresses are the chief components which influence grain production. In India herbicides occupy a largest market share at 44%, followed by fungicides (27%) and insecticides (22%). Pesticide consumption in India is 0.5 kg per hectare, compared to other countries where it is as high as 17 kg per hectare. This data suggests that farmers do apply insecticides on a global scale to save their crops. Insect-pests are known to cause major losses of 35.5 million tonnes in rice which may amount up to USD 8467.4 million in India (Dhaliwal *et al.,* 2015). Since the introduction of high-yielding varieties, distinct changes occurred in the insect pest complex of rice in India. The overall yield losses due to insect-pests vary in rice between 24.6-40.9% (Savary *et al.,* 2019). Deutsche *et al.,* (2018) projected that the global yield losses to the staple cereals like rice, maize and wheat would increase by 10 to 25% per degree of global mean surface warming. The losses would be more in areas where warming increases both population growth and metabolic rates of insects. Apart from climate change there are various other factors that influence the occurrence of the pests. So far, 46 pesticides have been banned or phased out and most of the insecticides that were used in early stage pest control in rice have been phased out. (Standing Committee Report

Summary Insecticides and Pesticides - Promotion and Development, December 22, 2023).

In India rice is the only crop that is grown across various ecosystems. Rice cultivation in India extends from 8^0 to 35^0 N latitudes across very diverse ecosystems such as irrigated, rainfed upland, rainfed lowland, semi deep, deep water, areas below sea level as in Kerala as well as coastal and inland saline regions. More than 100 species of insect-pests are known to attack the rice crop in India (Pathak and Khan, 1994), out of which 20 are of significance (Krishnaiah and Verma, 2011). Based on the regularity in occurrence, extent of distribution, intensity of damage and the economic loss they inflict, only a dozen species are of economic significance in India and they are categorized as National Pests, Regional, Sporadic and emerging pests. **(Table 1**). But, of late, though the major pests continue to maintain their status there is a shift in the status of some of the regional and sporadic pests. Some of the minor pests like whorl maggot and case worm have gained the status of major pests in certain pockets in India. With the increase in knowledge through in depth studies and availability of taxonomic resources more species have been identified. In some pest complexes like stem borers and leaf folders, it was observed that though they share the same niche there is variation in time and space.

Table 1: Common Pests of Rice in India

Sl. No.	Common name	Scientific name	Order: Family
National Pests			
1	Rice yellow stem borer (YSB)	*Scirpophaga incertulas* (Walker) *Sesamia inferens* (Walker) *Chilo* spp; *Scirpophaga* spp.	Lepidoptera: Crambidae Lepidoptera: Noctuidae Lepidoptera: Crambidae Lepidoptera: Crambidae
2	Asian Rice Gall midge (ARGM),	*Orseolia oryzae* (Wood-Mason)	Diptera: Cecidomyiidae
3	Brown plant hopper (BPH)	*Nilaparvata lugens* (Stal)	Hemiptera: Delphacidae
4	White-backed plant hopper (WBPH)	*Sogatella furcifera* (Horvath)	Hemiptera: Delphacidae
5	Leaf folder	*Cnaphalocrocis medinalis* (Guenee)	Lepidoptera: Crambidae
6	Gundhi bug	*Leptocorisa oratoria, L .acuta, L. lepida*	Hemiptera: Alydidae
7	Green leafhopper, (GLH)	*Nephotettix virescens* (Distant); *Nephotettix nigropictus* (Stal)	Hemiptera: Cicadellidae
Regional pests			
8	Whorl maggot	*Hydrellia philippina Ferino, Hydrellia sasakii Yuasa and* Isitani	Diptera: Ephydridae
9	Rice hispa	*Dicladispa armigera* (Olivier)	Coleoptera: Chrysomelidae
10	Case worm	*Paraponyx stagnalis* (Zeller)	Lepidoptera: Crambidae
11	Thrips	*Stenchaetothrips biformis*	Thysanoptera: Thripidae
12	Black bugs	*Scotinophara coractata and Scotinophara lurida*	Hemiptera: Pentatomidae
13	Blue beetle	*Leptispa pygmaea* Baly	Coleoptera: Chrysomelidae
14	Chaffer beetles	*Popillia lucida* Newman	Coleoptera: Scarabaeidae
15	Grass hoppers	Grass hoppers (*Oxya nitidula, Hieroglyphus* spp. *Attractomorpha pscittacina* & Long-horned grass hopper	Orthoptera: Acrididae
Sporadic pests			
16	Climbing cutworm/ Rice Ear cutting caterpillar	*Mythimna separata* Walker *Mythimna loreyi* Duponchel	Lepidoptera: Noctuidae
17	Army worm or swarming caterpillar	*Spodoptera mauritia* Boisduval	Lepidoptera: Noctuidae
18	Leaf mites	*Oligonychus indicus*	Acarina: Tetranychidae
Emerging pests			
19	Panicle mites	*Stenotarsonemus spinki* (Smiley)	Acarina: Tarsonemidae
20	Rice mealy bug	*Brevennia rehi* (Lindinger)	Hemiptera: Pseudococcidae
21	Termites	*Microtermes obesi* Holmgren	Blattodea: Termitidae
22	Whitefly	*Bemisia formosana* Takahashi	Hemiptera: Aleyrodidae

But in recent times there is a change in the pest scenario though the number of pests that cause damage remain almost same. Case worm and whorl maggot have become regular pests in most of the locations. The details of the pest complex and the causes there of are detailed below:

A. National Pests

1. Rice stem borers

Rice stem borers belong to families Crambidae and Noctuidae. The Crambid borers are most common and destructive with high degree of host specificity. The noctuid borers are polyphagous, and occasionally cause severe economic losses. Katti *et al.,* (2011) reported six species of stem borer. Currently, In India, apart from yellow stem borer, which is the dominant species, eight other stem borer spp. have been reported to cause damage though restricted to small pockets. Other stem borer sp. that have been recorded till date are: Pink rice borer or Pink stem borer of rice, *Sesamia inferens* (Walker) in Indo-Gangetic plains (Srivastava *et al.,* 2003*);* in rice-cereal based cropping system (Swarupa *et al.,* 2025)*;* white stem borers - *Scirpophaga fusciflua* (Srivastava *et al.,* 2012a, Ankit Kumar *et al.,* 2018, Tandon, 2018), *S. virginia* from Tamil Nadu (Varun *et al.,* 2017a)*, Scirpophaga spp*, Gold fringed stem borer (GFSB)*, Chilo auricilius* (Dudgeon), (dark headed striped borer (DHSB), *Chilo polychrysa* (Meyrik) (Swarupa *et al.,* 2024), Striped stem borer (SSB) *Chilo suppressalis* (Walker), and Spotted stem borer, *Chilo partellus* Swinhoe. However, Horgan (2023) in his review on stem borer assemblages referred to presence of six sps - *Scirpophaga incertulas*, *Sesamia inferens*, S. *innotata*, *Chilo polychrysus*, *Chilo partellus* and *Chilo suppressalis* from various regions of India between 2000-2009.

But in rice, all the above borers cause similar symptoms of damage like "dead hearts" at vegetative phase and "white ear" in reproductive phase. Thus, it is very difficult to identify the species unless we dissect out the infested tillers. The species can be identified only through a detailed study of the male genitalia. Among the listed species, yellow stem borer is the most dominant species showing its presence in all the rice ecosystems in time and space. Study by Sanyal *et al.,* (2025) demonstrated that bioclimatic variables - annual mean temperature (30 °C), and annual precipitation (10-700 mm) favour its multiplication, infestation, and further spread to new areas. The other stem borers listed do cause damage in rice crop but restricted to certain pockets in India. Data on reaction to insect pests from National Screening Nurseries from AICRPR Entomology program indicates that in most of the locations in India the damage is above ETL (**Figure 1a** and **1b**) (IIRR-IIRR, 2021-2025) warranting 2-8 of insecticide sprays. At times in certain areas we find damage by two or more species at a time within the same plant. Other stem borers (*Chilo* sps and *S. inferens*) species are predominant in Rice based cropping systems. All the insecticides are equally effective against all the species. The identity of the pest species plays a crucial role when we need to deploy any species specific behavioural component of pest management like sex pheromones. Horgan (2023) opined that regional assemblages of stem borers typically include a single dominant lepidopteran species (primary species) that is largely restricted to rice and for which the climate is optimal; one or more secondary species that vary based on the age of rice attacked, rice anatomy, and the proximity to other habitats (including other crops); and occasional species that probably spill over from adjacent grasslands. He suggested that the co-occurrence of lepidopteran with dipteran rice stemborers requires further research attention.

2. **Plant hoppers:** Under field conditions brown plant hopper (BPH), *Nilaparvata lugens* (Stal) and White-backed plant hopper (WBPH), *Sogatella fucifera* (Horvath) co-exist in most of the locations in various proportions and cause typical symptom of 'hopper burn'. WBPH colonises the crop early but BPH takes over due to its competitive ability. In all the command areas and high production systems BPH is a regular pest. It colonises at the plant base and sucks the sap leading to death of tillers and when severe the plants dry in patches leading to the typical symptom of "hopper burn" **(Figure 2)**. Sahoo *et al.,* (2026) revealed that temperature-related variables accounted for 61.04% of habitat suitability for *N. lugens*, with annual mean temperature identified as the most critical environmental factor. While precipitation played a secondary role, contributing 38.96% to the population spread and establishment, the projection indicated extensive areas of high habitat suitability for *N. lugens*, especially in the eastern and southern rice-growing states of Odisha, West Bengal, Tamil Nadu and Andhra Pradesh. Currently, 54.92% of India's

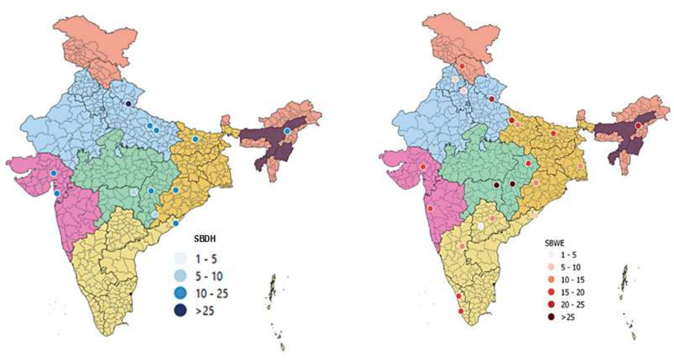

Fig1a. Dead hearts (%) **Fig 1b. White ear (%)**

Fig1:Mean damage by stem borer from 2020-2024 in India at vegetative phase (1a- dead hearts) and reproductive phase (1b- white ears)

ICAR-IIRR. 2021-2025. Reaction to insect pests. National screening Nurseries In Screening Nurseries Diseases and Insect pests. Indian Institute of Rice Research, Rajendranagar, Hyderabad

land area is suitable for *N. lugens* establishment, with 7.80% categorised as high-risk zones. The population structure *i.e.,* proportion of BPH to WBPH at a given location which is variable, is also crucial in the development and deployment of resistant varieties as there are very few lines resistant to WBPH. In recent times since 2022, WBPH has gained prominence as it was attributed to the transmission of Southern Rice Black-streaked Dwarf Virus (SRBSDV), also known as Fiji virus (Sharma *et al.,* 2022). The affected states were Punjab, Haryana, Himachal Pradesh and Union territory of Jammu & Kashmir. Patiala district of Punjab has also reported infestations in villages like Ropar, Fatehgarh Sahib, Sangrur, Patiala, Mohali, and Nawans in 2025. Early sowing (before June 15), has been one of the major causes of the spread of the virus. Virus causes dwarfing of plants and the infected plants had narrow upright leaves, weak roots, and are nearly half or one-third of their normal height. When severe, the plants dry and farmers just uproot or plough back the fields. In severe cases, plants may wither and die prematurely, resulting in substantial yield loss. Most of the farmers had uprooted infected crops and re-sown paddy in 2025 amounting to an additional cost of Rs 10,000 to Rs 15,000 per acre on re-sowing and about Rs 15,000/acre for insecticides. PR 131 was the highly susceptible variety (source: https://timesofindia.indiatimes.com /city /chandigarh/dwarf-virus-hits-paddy-fields-farmers-forced-to-re-sow-stare-are- financial-loss/ articleshow /122860132.cms dated July 23, 2025). *Saccharum officinarum* and *Echinochloa colonum* have been proven as alternate hosts for this virus through RT-PCR studies (Vats *et al.,* 2026). PAU, Ludhiana had issued advisories for the management of WBPH.

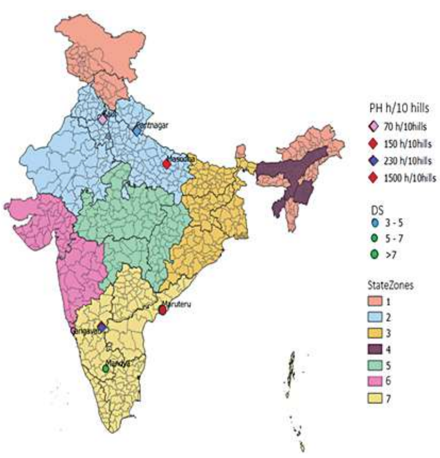

Fig 2. Mean damage by planthoppers from 2020-2024 in India

Source:ICAR-IIRR. 2021-2025

3. Asian Rice Gall midge: Among the major insect pests that limit the potential yield of the crop, the Asian rice gall midge [*Orseolia oryzae* (Wood- Mason)] is ranked third most important insect pest in India, following stem borers and plant hoppers. The immature stage of this dipteran insect feeds on the growing shoot meristem turning them into a tubular structure popularly known as "gall" or "silver shoot "or "onion shoot". This pest occurs in all the major rice growing regions along the coast of Bay of Bengal and Arabian sea apart from Central Maharashtra and Chhattisgarh. It is an endemic pest in rice growing regions of Assam, Tripura, Manipur, Odisha, Telangana, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Goa, Central Maharashtra and Chhattisgarh. The larva (maggot) is the only feeding stage, the duration of which varies from 12-15 days in one generation. The pupa is active and motile and is a non- feeding stage. In these endemic areas it was found to infest the crop from August to September in *kharif* season and during *rabi* peak infestation is observed in the months of January and February. Late planting and humid conditions favour the survival and perpetuation of the insect thus leading to huge infestation in the rice crop. For the past few years, the damage by this pest is increasing largely in the command areas of Cauvery, Tungabhadra and Godavari where there is assured irrigation/ or late release of canal water which leads to late planting of the susceptible varieties and is also causing extensive damage in the *rabi* rice. The damage in endemic areas is above ETL in terms of both plant damage (**Figure 3a**) and silver shoot damage. Till date seven biotypes have been reported from India (**Figure 3b**).

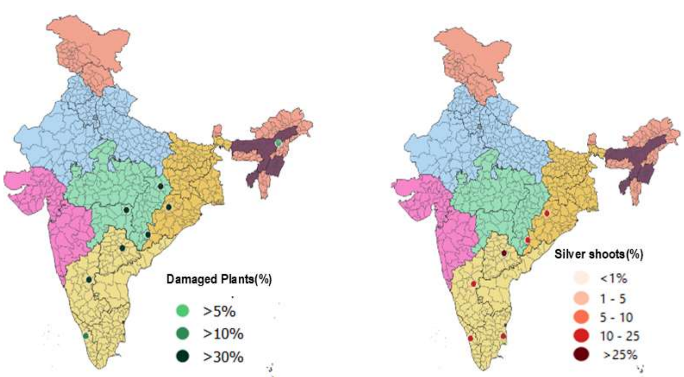

Fig 3a: Damaged plants (%) Fig 3b: Silver shoots (%)

Fig 3. Mean damage by Asian rice gall midge from 2020-2024 in India - per cent damaged plants (2a) and Silver shoots (2b)

Source:ICAR-IIRR. 2021-2025

4. Leaffolders: Though *Cnaphalocrocis medinalis* (Guenée), is the dominant species across India, presence of other species have been reported by many rice workers: Six species from Tamil Nadu *viz., C. medinalis* (Guenee), *C. patnalis* (Bradley), *C. ruralis* (Walker), *C. trapezalis* (Guenee), *C. exigua* (Butler) and *C. poeyalis* (Boisduval) (Lepidoptera: Crambidae) (Varun *et al.,* 2017b); *Marasmia exigua* (Bradley) and *Brachimea arotraea* (Meyrick) from Odisha (Rautaray *et al.,* 2019); *Cnaphalocrocis patnalis* (Bradley) and *Cnaphalocrocis poyealis* (Boisduval) from West Bengal (Moulita *et al.,* 2023) were reported on rice. Baby Rani *et al.,* (2007) reported that the sex ratio varied amongst the species reported from Madurai, Tamil Nadu and males dominated the females. But all these species cause almost similar type of damage, that is folding the leaves and scraping of the chlorophyll. There is an increase in per cent leaf damage (>10% damaged leaves) and spread across locations as depicted in **Figure 4**.

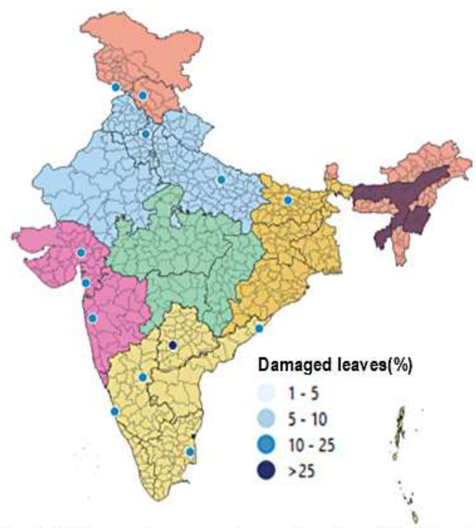

Fig 4. Mean damage by rice leaf folder in India (2020-2024) represented as percent leaf folder damaged leaves

Source:ICAR-IIRR. 2021-2025

5. Gundhi bug: Lahari *et al.* (2024) reported three species of *Leptocorisa* in India on rice of which *Leptocorisa oratoria* is predominant followed by *L. acuta. L lepida* was collected only from Southern Karnataka. Both adult bugs and their nymphs feed on the sap of rice grains, starting at the flowering stage leading to yield reduction with a chaffy pecked appearance and loss of grain quality at the dough stage.

6. Green leafhoppers: Two species have been reported on rice from India. *Nephottetix virescens and N. nigropictus* Distant. Both nymphs and adults are xylem feeders. They suck sap from leaves causing symptoms like yellowing of leaves from tip to downward, Uniform yellowing from mid half of leaf and when the infestation is severe the leaves turn brown with small scratch like marks on leaf. But they are more famous as vectors of Rice Tungro Virus. Rice Tungro has been reported in parts of West Bengal, Assam, Punjab and Tamil Nadu. It results in retarded vigour and stunted growth and withering of plants causing heavy monetary losses.

B. Regional pests

Case worm, Rice hispa, Rice thrips and whorl maggot are the pests of vegetative phase. Among these, incidence of case worm, rice thrips (**Figure 5**) and whorl maggot (**Figure 6**) is on the increase. The caseworm, *P. stagnalis* is commonly found in low lands with poor drainage and flooded fields. Stagnation of water results in pest build- up and causes severe loss in early vegetative phase. The larvae cut the leaf blade, form tubular cases and enclose themselves within these cases. The larva attaches itself to the rice plant and feed on the leaves. Feeding damage includes cutting off the leaf cases and it may result in patches of severe defoliation, stunted growth and death of plants The entire crop may have to be resown and replanted in case of damaged leaves. (Srivastava *et al.,* 2012b). Whorl maggot which was hitherto a vegetative pest has now been found to occur in the booting phase of the crop causing yield loss. Mangal Sain (2000) in his review suggested that whorl maggot was found at ripening phase of the crop and damaged the boot leaf and developing panicles which can lead to only partial filling of grains. Rice hispa is a pest in states like Assam, Telangana, Karnataka and Kerala. Sharma and Srivastava (2018) elaborated on the significant losses caused by rice hispa at different stages of crop growth in hill ecosystem.

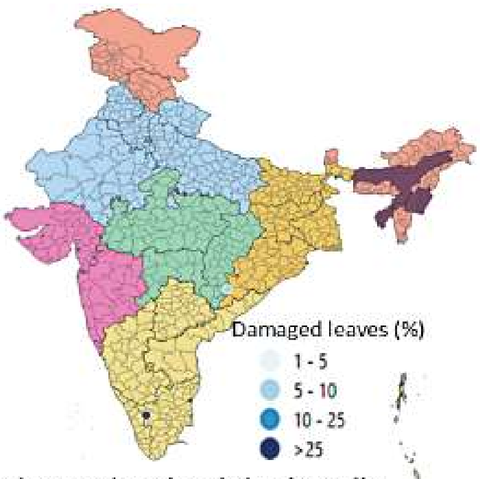

Fig 5. Mean damage by rice thrips in India (2020-2024) represented as percent thrips damaged leaves

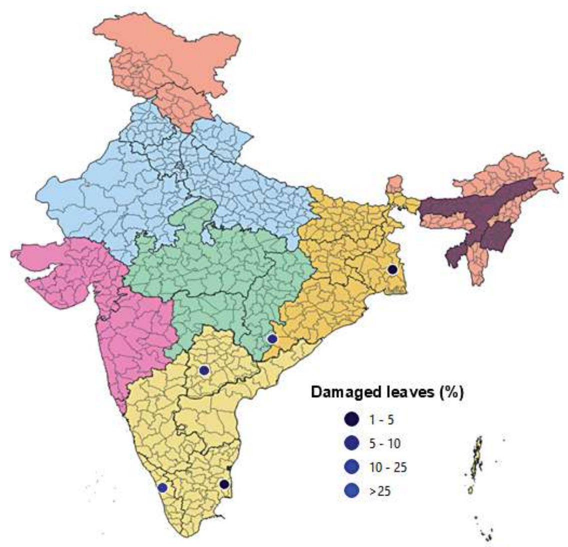

Fig 6. Mean damage by rice whorl maggot in India (2020-2024) represented as percent damaged leaves

Source:ICAR-IIRR. 2021-2025

Rice Black bugs or Malayan black rice bug: Two species are found to be important. *Scotinophara coarctata* is the dominant species that damages rice plants by sucking the sap from stem. The heavily infested field plants turn yellowish brown and die causing characteristic 'bug burned' areas. Incidence of *Scotinophara lurida* (Burm.) was reported from Arunachal Pradesh. Young seedling seemed to be preferred in heavily infested plots (Anandhi *et al.,* 2023).

Grass hoppers: Rice large grass hopper, *Hieroglyphus banian* and small grass hopper, *Oxya nitidula*

(Acrididae: Orthoptera) are mostly pests of hilly areas or areas near vegetation. Nymphs and adults feed on foliage by irregularly cutting leaf margins. In severe cases only midribs and stalks remain. They also cut the panicle at heading stage and are very active at night time. Scraping field bunds and summer ploughings to destroy eggs, application of malathion 5D @ 10 kg/ acre found effective in their management.

C. Sporadic pests

Rice swarming caterpillars, army worm and climbing cut worms are reported as sporadic pests on rice**.** In India, swarming caterpillar *Spodoptera mauritia* Boisduval (Noctuidae: Lepidoptera) was considered as a sporadic and a minor pest of rice but for the last one decade, it has emerged as a serious pest of rice seedlings. It has attained the status of a major pest of rice in eastern India especially in Orissa, Chhattisgarh, Jharkhand and Bihar. But in recent times it is also reported from parts of Telangana, Kerala, Karnataka and Assam. Some of the other species reported are *Spodoptera exigua*, *Spodoptera litura* and Armyworm (*Pseudaletia unipuncta*). Neonate larvae nibble at first and later feed voraciously on the seedlings in the nursery and reduce the plants to mere stumps. They migrate from field to field feeding at night and hide during the day. Flooding the nursery brings out hiding larvae which are picked up by birds (Tanwar *et al.,* 2010).

Paddy armyworm, true armyworm (*Mythimna separata and Mythimna loryei*) (Noctuidae: Lepidoptera): also known as climbing cut worm. Mature larvae are 3-4 cm long, green to pink in colour and provided with longitudinal light grey to black stripes running along the entire length of their bodies. Head is brown to orange with an A-marking. It appears in swarms at ear head stage in Nov-Dec. Late instars have the characteristic habit of climbing and cutting the ear heads. The cutworms are becoming serious in many rice growing areas in the eastern part of the country. For last few seasons, the climbing cutworm, *Mythimna separata*, has been regularly occurring in coastal Andhra Pradesh and in the Eastern States. Similarly, the swarming caterpillar, *Spodoptera mauritia* has acquired a status of major pest in Odisha, Bihar and Jharkhand during *kharif* -2007-09, 2012, 2013 and devastated paddy crop in early stage in considerable areas (Prakash *et al.,* 2014) and continue to affect the crop in various parts of India in the early stages of crop growth leading to resowing of the crop.

Factors affecting pest incidence

a. Rice pests *vs* crop growth stages: Rice is affected by insect pests right from nursery till harvest. But the niche is important. Leaf folder, case worm, thrips, whorl maggot, hispa, leaf mite affect the leaves of the plant thus affecting the photosynthesis. In case of leaffolder, the damage is more critical if flag leaf is affected as it directly affects the grain filling (Padmavathi *et al.,* 2013). Identification of correct species plays a major role when adopting biorational approaches like pheromones. Case worm and thrips are important both in the nursery and in the early seedling stage warranting insecticide sprays. Gall midge, stem borers, brown plant hopper, white- backed plant hopper, green leaf hoppers, black bug, affect the primary yield components like tillers at both vegetative and reproductive phase, leading to significant yield losses. Hence careful monitoring is essential to keep the population below ETL. *Gundhi* bug and Panicle Mite affect the panicles and the milky grains leading to chaffy grains. So, the damage to the major traits for yield, translates to direct yield losses.

b. Ecology and rice pest dynamics: Based on the available information the list of pests that occur on paddy in different ecologies are summarized in (**Table 2).** Most of the major pests like Yellow stem borer, gall midge, leaf folder, and plant hoppers and leaf hopers are pests of the irrigated ecology. Yellow stem borer is the pest of deep water ecology. Caseworm and cut worms are found in ill drained and water logged fields. Army worms, Cutworms are recorded when there is long dry spell in the early *kharif* season. White stem borer, Grass hoppers, Chaffer bettles, and hispa are often found in hilly regions. However, it also depends on the altitude of the location. Grass hoppers, root aphids, mealy bugs, termites are reported from upland/ aerobic or in fields with alternate wetting and drying. It is clearly evident that the prevailing climatic conditions, micro climate and various other factors influence the occurrence of the pests.

Table 2: List of pests that infest rice crop grown in various ecologies in India

Sl No.	Irrigated/ Transplanted	Direct seeded/ AWD/ Aerobic	Upland rice	Shallow low land / Low land	Kuttanad rice (Below sea level.)	Hill rices*	Deep Water
1	Yellow stem borer	Yellow stem borer	Yellow stem borer	Yellow stem borer	Yellow stem borer	White stem borer	Yellow stem borer
2	BPH	BPH	BPH	BPH	BPH	BPH	Case worm
3	WBPH	WBPH	WBPH	WBPH	WBPH	WBPH	
4	Leaf folder	Leaf folder	Leaf folder	Leaf folder	Leaf folder	Leaf folder	
5	Gall midge	Gall midge	Gall midge	Gall midge	Gall midge	Hispa	
6	Green leaf hopper	Green leaf hopper	Green leaf hopper	Green leaf hopper	Case worm	case worm	
7	Case worm	Whorl maggot	Whorl maggot	Case worm	Whorl maggot	Whorl maggot	
8	Whorl maggot	Gundhi bug	Gundhi bug	Whorl maggot	Gundhi bug	Gundhi bug	
9	Gundhi bug	Mealy bug	Leaf mite	Gundhi bug	Blue beetle	Chaffer beetles	
10	Black bug	Thrips	Mealy bug	Swarming caterpillar	Leaf mite	Scarabaeid beetles	
11	Rice Hispa	Leaf mite	Thrips		Pink stem borer	Grass hoppers	
12	Thrips	Root aphid	Root aphid		White stem borer	Green stink bug	
13	Blue beetle	Root weevil	Swarming caterpillar				
14	Swarming caterpillar	Swarming caterpillar	Army worms				
15	Army worms	Army worms	Pink stem borer				
16	Pink stem borer and other stem borer species	Pink stem borer	Root knot nematode				
17	Panicle mite	Root knot nematode					

D. Changing pest scenario: Jena *et al.,* (2018) reviewed the changing pest dynamics in rice ecosystem in 2017, and 21 insect pests were documented. It was observed that we could record a change in the status of the pests and the current number is 23 which includes the mite pests and the root knot nematode (**Figure 7**). Since last five years we could not observe damage by blue beetle, chaffer beetle, termites, but there was an increase in the incidence of black bug, case worm, whorl maggot, panicle mite, climbing cutworm and various stem borer species; spread of WBPH, BPH and leaf folder to non- traditional areas. White fly was reported on rice (Mallikarjuna, personal communication), in KVK, Undi, Andhra Pradesh. Damage manifests as yellowing, formation of sooty mould, crinkling and twisting of panicles leading to chaffy panicles and the reason attributed was injudicious use of insecticides especially spraying of pyrethroids. Mealy bug is reported from upland rice, but the etiology is not well studied. Incidence of mealy bug is not well documented due to the cryptic nature of the pest. The non insect pest like panicle mite and root knot nematode have also increased their presence. There are also reports of a chirinomid, commonly called as 'blood worm" which is soil borne. It is suspected to have been feeding on the roots leading to drying of plants in the early stage. More detailed studies are required to quantify the actual loss by this pest.

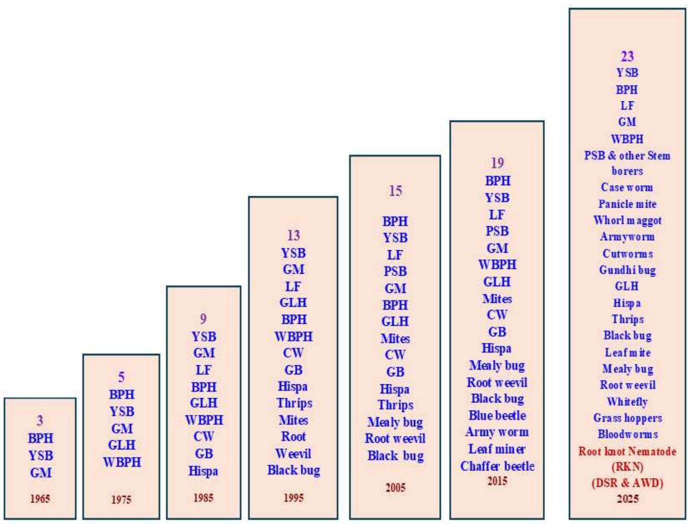

Fig 7. Changing Scenario of insect pests, mites and nematodes in rice -Decadal changes

YSB-Yellow stem borer, GM-Gall midge, BPH-Brown plant hopper, WBPH-White- backed plant hopper, LF-Leaf folder, GLH-Green leaf hopper,CW-Case worm, GB-Gundhi bug, PSB-Pink stem borer, DSR- direct seeded rice,AWD- Alternate wetting and drying

Mite pests: Panicle mite / Sheath mite**,** *Steneotarsonemus spinki* (Tarsonemidae: Acarina) is reported from states of Andhra Pradesh, Telangana, Chhattisgarh, Odisha, Gujarat, West Bengal, Tamil Nadu, Karnataka. It occurs at vegetative phase. Both nymphs and adults colonise midribs of leaves and lacerate tissues up to maximum tillering stage causing brown necrotic patches on midribs. At panicle initiation stage mites move to leaf sheath to feed causing brown necrotic lesions on leaf sheath. Maximum incidence occurs at boot leaf stage. At panicle emergence, mites enter florets, feed on ovaries and stamens causing sterile and discoloured grains in the panicle. Later these grains turn black invaded by saprophytic fungus. It was reported that the major fungus associated with *S. spinki* was the sheath rot fungus, *Sarocladium oryzae* (*Acrocylindrium oryzae*) and *S. spinki* acted as vector of this fungus. Paddy leaf mite / yellow mite, *Oligonychus oryzae* (Tetranychidae: Acarina) infestation is found on the under surface of the rice leaves whenever there is a prolonged dry spell. This mite damages rice in nymphal and adult stages by sucking the sap of leaves and inflicting damage on mesophyll cells of the interveinal tissues. This results in characteristic whitish patches on leaves, which later turn to ash colour and dry from tip down-ward.

Nematode Pests: There is an increase in Root knot nematode *Meloidogyne graminicola* infestation in direct seeded rice (Katti and Padmavathi, 2022)

c. Effect of Cultivation Practices:

System of rice cultivation: Stem borer is one pest which may create havoc, if not properly managed. Similarly, wider spacing adopted in SRI cultivation may favour increased hispa but reduced gall midge incidence in early stage. In the tillering stage, vigorous plant growth with cluster of tillers may attract defoliators such as cut worms, ear cutting caterpillars and leaf folder. However, significant increase in number of tillers and leaves should be able to sufficiently compensate the loss due to defoliation. In the later stages, SRI cultivation may reduce BPH incidence due to increased aeration resulting from wider spacing. Studies over a period of 5 years under All-India Coordinated Rice Improvement Project (AICRP) concluded that SRI methods of cultivation showed a lower incidence of stem borer, plant hoppers, and gall midge compared to conventional methods. Whorl maggots and thrips, on the other hand, were observed to be higher (Padmavathi *et al*., 2023).

Transplanted *vs* direct seeded rice: The population of plant hoppers was significantly lower in direct seeded rice (DSR), population of *N. lugens* [370.0 and 420.7 BPH/10 hills; *S. furcifera* was 255.0 and 349.0 WBPH/10 hills; and *N. virescens* 3.9 and 4.2 GLH/10 hills] during *kharif*, 2019 and 2020, respectively

(Kamboj *et al.,* 2025) in rice wheat system of Indo-gangetic plain.

There is a shift in weed species in direct seeded rice. The dominance and increasing occurrence of *Echinochloa colona* over *Echinochloa crusgalli* in weed population and weed dry biomass was recorded across the locations in the long term trial on weed dynamics in Direct Seeded Rice (ICAR-IIRR, 2026). *E. colona* is the major alternate host for most of the major insect pests of rice like gall midges (Padmakumari *et al*., 2004), gundhi bug, leaf folders (Padmavathi *et al*., 2015) etc. Hence, appropriate measures should be taken to maintain clean cultivation.

Effect of organic manuring on rice pest incidence: Field trials on effect of five organic manures compared to recommended fertilisers under protected and unprotected conditions revealed that: Neem cake and poultry manure applications reduced stem borer damage as well as rice root nematode populations. Vermicompost application also resulted in low nematode population and decrease in whorl maggot damage.

d. **Use of right insecticides:** With the ban imposed on many broad spectrum insecticides which were commonly used on rice, the early stage pest control has become a challenge. Even today, the use of insecticides is governed by the dealers. Most of the dealers favour a spray of synthetic pyrethroids in the early season which leads to resurgence of the sucking complex. There is an increase in the trend in the availability of combination products. Though the situation warrants a single spray of a particular molecule, farmer is forced to buy a combination product and apply, which is not necessary. Sometimes the recommended molecules are not very much available in the market or some of the states impose legislation and restrict the use. For example, in Punjab, thiamethoxam is not recommended on Basmati rice. Similarly, in Kerala carbofuran 3 CG is not advocated though it is very effective against rice gall midge. Apart from this, increase in labour cost for spraying and use of drones for pesticide application is bringing a silent revolution in rice plant protection scenario. Farmers are now looking for compatibility of insecticides, fungicides and herbicides to reduces cost of application. Hence more research is essential to advocate the right dose and combination of pesticides.

e. **State policy:** Late planting in the tail end areas of the canal irrigated fields are more prone to pests like gall midge. A policy for cutoff date for plantings and restrict the movement of infested nurseries is very much essential to minimize the incidence of rice gall midge in endemic areas. Similarly, for stem borers in Punjab and WBPH in North western states is very much essential.

Some of the practices advocated for management of major pests of rice are:

Host plant resistance (HPR): A successful variety is one which has good level of resistance to one or two major insect pests along with high grain yield and good cooking quality. Such varieties would keep the pest populations below ETL but it is very rare to have all these traits in an acceptable background. Padmakumari *et al.,* (2024) reviewed the status of host plant resistance in rice. Through extensive screening of germplasm and breeding lines in both field and glass houses, donors conferring resistance to BPH, WBPH, gall midge, leaf folder and stem borer have been identified under AICRPR program. PTB33, RP 2068-18-3-5, IC 76013, IC75975, IR 75870-5-8-5-B-5-HWR15, IR 33382-80-9-3-13-2-2-1-3-B-HWR 16, RP6837-RMS-ISMA13, RPBio4918-230S for brown plant hopper and IC0641981 for both BPH and WBPH; Aganni, INRC3021 and INRC202 for gall midge; two BPT mutants, SM92 (IC646828) for resistance to stem borer and INGR 22104 (IC 646826) for leaf folder were registered as genetic stocks and can be effectively used as donors in the breeding program for developing pest resistant varieties (Balakrishnan *et al.,* 2025). Monitoring virulence to BPH and rice gall midge in endemic areas is carried out through a set of host plant differentials to identify the changes in the virulence. To tackle gall midge, pyramided lines of *Gm4+Gm8* in the back ground of WGL 14, ISM and Akshayadhan, Tellahamsa and MTU1010 have been developed.

Cultural practices: Xu *et al.,* (2017) have given an overview of the non- chemical and eco-friendly management practices which can reduce the pest population and consequently minimise the number of chemical sprays and most of the practices can be adopted under Indian conditions also. Some of the cultural practices that can be practised are:

- Rice stubbles serve as a major source of inoculum for all the major insect pests like yellow stem borer, gall midge, brown plant hopper. Deep ploughing minimizes the survival of immature stages in the stubbles. But in recent times mechanical transplanters are used for harvesting and they leave stubble of 10-15 cm height which serves as niche for the survival of immature stages and helps in build-up and carry over of most rice pests like stem borers, gall midge, plant hoppers, panicle mite to the next season. Xu *et al.,* (2015) reported that if rice stubble heights are adjusted to a range of 5–10 cm, the survived stem borers (Chilo sp.) can be reduced by 70%–90%.
- Harvest crop close to soil surface and deep ploughing or flooding after harvest to be practiced.
- Selection of resistant / tolerant varieties against key pests suitable to local situations and protection of nursery from pests.
- Timely planting is recommended. Late planting will increase pest infestation.
- Monitor the crop for pests that occur regularly in your area.
- Bird perches may be placed in the field at 2-3 ft height in the field @ 15 to 20 per acre.
- Apply nitrogenous fertilizers at recommended doses.
- Clipping tips of leaf blades before transplanting to eliminate eggs of rice yellow stem borer and hispa.
- Formation of alleys or path ways of 20 cm width for every 2 metres of planting to facilitate spraying at the base of the plants and for ease in mobility aeration and light.
- Avoid close spacing in BPH endemic areas.
- Ensure proper drainage and water and weed management.
- Alternate wetting and drying to be followed in plant hopper endemic areas.
- Monitoring incidence of pests through light traps or pheromone traps for rice stem borer, leaf folder is essential.
- Ensure that the natural enemy to pest ratio is maintained at 2:1.
- Passing a rope over the crop in vegetative phase against leaf folder and caseworm
- **Trap crops:** Planting of one row of a susceptible aromatic rice for every 9 rows of main crop had minimised the damage by yellow stem borer with a favourable cost benefit ratio by adjusting the sowing date of the trap crop so that the trap crop flowers one week before the main crop (Padmakumari *et al.,* 2017)
- **Bund crops:** Lemon grass was planted in bunds to discourage rice black bug from making the rice crop a primary target, while Azolla application aimed to limit pest proliferation. Lemon grass, known for its mosquito-repelling properties, showed relative effectiveness in deterring black bugs, with a significant reduction in their incidence. Azolla @ 25 kg/ha, lemon grass in bunds and neem oil (3%) foliar spray at 10, 30, and 60 days after transplanting resulted in the lowest pest incidence. (Leena *et al.,* 2024).
- **Ecological engineering practices:** Increasing floral diversity selectively will improve both longevity and parasitism rates of egg parasitoids and can be effectively harnessed to keep the hopper pests at lower population levels. The positive impact of bund flora on parasitization of hoppers, indicate

a viable cultural strategy for their management. Due to injudicious use of insecticides, brown plant hopper outbreaks are increasing globally. Such techniques offer a viable, ecofriendly option as an integral part of rice pest management. In addition to *in situ* conservation of flowering weeds, studies on various bund crops such as *Tagetus erecta* L. (Asteraceae), *Vigna unguiculata* L., *V. mungo* (L.) Hepper, *V. radiata* (L.) R. Wilczek, *Crotalaria jun*cea L. (Fabaceae), *Coriandrum sativum* L. (Apiaceae), and *Abelmoschus esculentus* (L.) Moench (Malvaceae) were tested and validated in multi-location Trial under AICRP-rice (Shanker and Katti, 2017). Commercial flowers, pulses, vegetables green manure crops can be grown on bunds. Flowering plants on rice bunds had significant impact on biodiversity of parasitoids such as *Anagrus, Oligosita* and others parasitoids. Field studies through baiting and laboratory studies for longevity indicated enhanced parasitization rates and six to ten times increase in longevity of parasitoids. Plants from families Fabaceae and Asteracease are amenable for habitat management (Shanker and Rani, 2022).

Chemical control

- Use of botanical pesticides such as neem seed kernel extract, neem oil or citronellol oil or eucalyptus oil are useful. But when botanical insecticides alone are used, 2-3 sprays at 10 day interval are required to minimise the damage.
- Application of insecticides to be carried out on the basis of economic threshold level. (ETL).
- Apply right insecticide at the right dose at the right time for effective control.
- Do not repeat the application of same insecticide. Rotation of insecticide molecules based on mode of action to be practiced.
- Do not apply Synthetic pyrethroids in rice.

A General Schedule of application of insecticides in rice for tackling major insect pests of rice

Nursery	**Stem borer, gall midge, thrips**	• Seed treatment with Thiamethoxam 25% WG in gall midge endemic areas • In gall midge/stem-borer-endemic areas apply carbofuran 3CG @ 33 kg/ha 5 to7 days before pulling the seedlings for transplanting • or Fipronil 0.3 GR @ 25 kg/ha of nursery, 5 to 7 days before pulling the seedlings for transplanting
		• In the yellow stem-borer endemic areas, install sex pheromone traps with 5 mg lure @ 3 traps placed in a triangular fashion at a distance of 60 m per acre for pest monitoring. A pheromone threshold catch of 30-33 moths/week / per trap suggests that there is a need for insecticide spray.
Main field		
Vegetative Phase	**Gall midge**	• In gall midge endemic areas use carbosulfan 25% DS 10 g/kg seed or thiamethoxam 70% WS 7.5 g for seed treatment. • Apply carbofuran 3 CG @ 33 kg/ha in the nursery • Cartap hydrochloride 4G @ 25 kg/ha in the main field or Fipronil 0.3 GR @ 25 kg/ha • Spray formulations are less effective for gall midge
	Yellow Stem-borer Other stem borers Leaf folder	• Apply carbofuran 3 CG @33 kg/ha • Apply Cartap hydrochloride 4G @ 25 kg/ha • or Fipronil 0.3 GR @ 25 kg/ha • Or Chlorantraniliprole 0.4% GR @ 40 g ai/ha or 10 kg/ha
	Rice Hispa Whorl maggot Thrips	• Apply Fipronil 0.3 GR @ 25 kg/ha or Fipronil 0.6 GR @ 15 kg/ha • Or Spray Fipronil 5 SC @ 1500 ml/ha or Acephate 75SP @ 950 g/ha
	Plant hoppers / Green leafhopper	Spray Imidacloprid 200 SL @ 125 ml/ha or Thiamethoxam 25 WG @ 100 g/ha or Ethofenprox 10 EC @ 500 ml/ha or Acephate 75SP @ 950 g/ha or Clothianidin 50 WDG 30 g/ha. or Fipronil 5 SC @ 1500 ml/ha

Reproductive Phase	**Stem-borer**	• Spray Cartap 50 WP @ 1000 g/ha • Or Chlorantraniliprole 18.5% Sc @ 150 ml/ha • Or Chlorantraniliprole 0.4% GR @ 40 g ai/ha or 10 kg/ha • (apply each molecule only once. Do not repeat the same molecule twice in a season) • *PS: In stem borer endemic areas a prophylactic spray of any of the above insecticides at booting stage is recommended.
	Brown plant hopper, White backed plant hopper or mixed population of plant hoppers	Spray Imidacloprid 200 SL @ 125 ml/ha or Pymetrozine 50% WG @ 375 g/ha • or Triflumezopyrim @ 150 ml per ha at 50 -55 DAT (to be applied only once) • or Dinotefuran 20% SG150-200 g/ha (apply each molecule only once. Do not repeat the same molecule twice in a season) Do not apply Dinotefuran immediately after application of imidacloprid.
	Leaf folder	• Spray Cartap 50 WP / SP @ 1000 g/ha • or Acephate 75SP @ 950 g/ha • or Fipronil 5 SC @ 1500 ml/ha
	Gundhi bug	• Spray Imidacloprid 200 SL @ 125 ml/ha; Malathion 25EC 200 ml/acre or 1ml /litre of water
	Panicle mite	• Spiromesifin 240 at 72 g a.i/ha.or profenophos @ 1 ml/litre of water
Nursery / main field	**Root-knot nematode, root nematode and white tip nematode**	• Apply carbofuran 3 CG @ 33 kg/ha

B. Bio-rational components

- Use of pheromone traps: Install sex pheromone traps with 5 mg lure @ 8 traps/ha for pest monitoring or 20 traps /ha for direct control through mass trapping of male yellow stem borer moths. The lure has to be changed after a month to ensure effective trap catches. A pheromone action threshold of 33 male moths/ trap / week suggests the point where chemical control needs to be initiated.

- Application of silicon compounds either to soil or spray would enhance the resistance in the crop to insect pests. Soil application of imidazole, a silicon solublizer alone and in combination with rice husk ash through split application had minimised the yellow stem borer damage (Jeer *et al.,* 2018).

- **Biocontrol:** Inundative release of egg parasitoid, *Trichogramma japonicum* 5 to 6 times @ 100,000 adults / ha starting from 15 days after transplanting. The release of parasitoids has to be timed with the presence of adults in the field. For rice leaf folder too, inundative release of egg parasitoid, *Trichogramma chilonis* 5 to 6 times @ 100,000 adults/ ha starting from 15 days after transplanting has been proven to give good results. Care should be taken that no insecticides are sprayed at the time of release of these parasitoids.

- **Microbial pesticides:** Isolates of *Bacillus thuringiensis, Beauvaria bassiana, B. alba* and *Metarrhizium anisopliae* when applied as spray have proven their efficacy under Indian conditions against major lepidopteran pests in terms of low damage (ICAR-IIRR, 2025). But 2-3 sprays to be given at frequent intervals of 10 or 15 days and they need to be timed with the pest incidence. However, *Zhang et al.,* (2026) discussed at length on the *pros and cons* on the use of microbials in pest management.

Conclusions

Keeping in view the changing pest scenario, we should have information on **KYP-Know Your Pest** and **KYE-Know Your Ecosystem** (cropping season, pattern, variety grown, pest incidence pattern, information on the prevailing natural enemies and the available insecticides). Pest surveillance and monitoring is an important activity. Monitoring virulence of najor insect pests and insecticide resistance is crucial to maintain populations below ETL through appropriate control measures. It is very important to understand the behaviour of the pest with reference to crop stage. When multiple pests occur in the field their dynamics is very important in taking decisions for appropriate control measures. Location specific deployment of resistant varieties with durable, broad-spectrum resistance good yield and quality traits for BPH, GM and Stem borer is the need of the hour. We need to sensitize agricultural officers for dissemination of location specific IPM modules.

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