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Identification and Integrated Management of Major Rice insects

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Abstract: -

Rice is attacked by more than 100 insect species, of which nearly 20 are economically important, making insect pests one of the leading causes of yield loss after weeds. This article presents a field-oriented identification and management guide for the eight major insect pests of rice: stem borer, brown plant hopper, leaf folder, case worm, gall midge, cut worm, gandhi bug, and panicle rice mite. For each pest, the key identifying features, damage symptoms, and life-cycle characteristics are described, followed by practical, integrated management recommendations spanning cultural practices (resistant varieties, timely sowing and transplanting, balanced fertilization, and optimal plant spacing), mechanical and physical methods (light traps, pheromone traps, water management, and field sanitation), conservation of natural enemies, and judicious, threshold-based use of chemical insecticides and acaricides. The article concludes by cautioning against the risks of excessive and indiscriminate pesticide use, including insect resistance and harm to beneficial organisms, and advocates integrated pest management as a safer and more sustainable path to protecting rice production.

Keywords: *Rice, insect pests, integrated pest management, economic threshold level etc.*

Introduction:

Rice crop productivity is largely influenced by the use of improved varieties, balanced nutrient management, adequate irrigation, effective weed control, and timely management of insect pests and diseases. Rice is vulnerable to attack by more than 100 insect species, of which nearly 20 are considered economically important. These insect pests can infest the crop at all growth stages, from the nursery and transplanting to crop maturity.

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Among them, plant hoppers, stem borers, and leaf folders are the most destructive and continue to pose a major challenge to sustainable rice production. Every year crops suffer up to 30 percent loss from insects, diseases, and weeds, of which 35 percent is caused by weeds, 26 percent by diseases, 20 percent by insects, 7 percent by storage, and 15 percent by other causes. Thus, after weeds, insect pests and diseases are the leading causes of yield reduction in rice. Under favorable environmental conditions, pest and disease outbreaks can reach epidemic levels, resulting in severe crop damage or even complete crop failure. During the Kharif season, warm and humid weather promotes rapid multiplication of insect pests, leading to substantial reductions in rice productivity. Therefore, timely and integrated pest management practices are essential for minimizing yield losses and ensuring sustainable rice production.

Major Rice insect-pests and their management

1. Stem Borer (Yellow Stem Borer)

The larva of this pest damages all stages of the crop. In the tillering stage the larva attacks the main stem (the central leaf whorl), so that the stem fails to open; it turns brownish and forms a dried stem (dead heart). At the ear head stage larva cuts the lower part of the panicle and produces dried ears (white ears) that bear empty grains and slip out easily when pulled. The adult female moth has yellowish forewings with a dark black spot in the centre, whereas the male is small and brown. It completes one life cycle in 31–40 days, and 4–5 generations develop in a year.

Management

- Deep ploughing of the fields in May destroys most of the insects, either through the high temperature or by exposing them as food for predatory organisms and birds.
- Select high-yielding and pest-resistant or tolerant varieties such as Sasyashree and Vikas (stem-borer tolerant) for crop production.

Adult Female and Male insects | Egg Stage | Larva Stage | Damage Symptom

- Growing the popular rice variety Swarna together with Pusa Basmati-1 (a trap variety attractive to the stem borer) in a 9:1 ratio reduces the pest incidence.
- Five days before uprooting the nursery seedlings, treat the nursery with the granular insecticide carbofuran at 2 kg a.i./hectare, or treat the seed with 0.2% chlorpyriphos.
- In the nursery, keep collecting and destroying the egg masses laid on the leaves of the seedlings (behan), and also move through the field picking and collecting egg masses. This lowers the intensity of infestation by nearly 40 percent.
- Install light traps in the crop area to keep the presence and number of insects under continuous watch, and destroy the adult insects.
- Install pheromone traps at 25 per hectare and change the lures (septa) every third week.
- To maintain the presence of the natural enemies of harmful insects, keep the economic injury level in mind.
- When infestation reaches 1 egg mass/m^2, 10% dead heart, or 1 moth /m^2, apply granular fipronil 0.3 G at 20 kg/ha or chlorantraniliprole 4 G at 10 kg/ha mixed with fertilizer or sand at the nursery, tillering, or booting stage; or spray chlorantraniliprole 18.5 SC at 150 ml, flubendiamide 480 SC at 250 ml, or fipronil 5% SC at 1000 ml per hectare in 500 liters of water.

2. Brown Plant Hopper

The brown plant hopper is also one of the major pests of rice. Under adverse conditions it has been estimated to cause 20–40 percent crop loss. Its infestation extends from the tillering stage to the panicle-emergence stage; both nymphs and adults damage the crop by sucking sap from the lower surface of the plants. When infestation is severe, the crop appears scorched in circular patches (hopper burn).

Nymph and adult insects

Damage Symptom (Hopper burn)

Management

- Select pest-resistant or tolerant varieties such as Triguna and Vidhi (hopper-resistant) for crop production.
- As far as possible, complete sowing by 15 June and transplanting by 15 July.
- Keep 15–20 cm spacing between plants and leave a 30 cm empty strip after every 3 meters to serve as an inspection path; this helps check the spread of the brown plant hopper.
- Nitrogen increases insect attack; therefore apply nitrogen, phosphorus, and potash fertilizers in a balanced 3:2:1 ratio according to the soil type and the duration of the variety.
- The activity of the coccinellid (ladybird) beetle helps control the hopper. For this it is useful to grow crops such as cowpea on the field bunds, because they harbor the prey insects on which the beetle feeds.
- In a hopper-infested field, lower the water level for 3–4 days so that the brown plant hopper moves down with the water and lays eggs; refilling the water afterwards destroys the eggs and reduces the intensity of infestation.
- Apply insecticide when the pest population reaches the economic threshold level (ETL) of 10–20 hoppers per hill. Spray any one of the following insecticides at the recommended dose, mixed in 400–500 L of water per hectare: Imidacloprid 17.8 SL @ 250 ml/ha, or Buprofezin 25 SC @ 1000 ml/ha, or Dinotefuran 20 SG @ 150–200 g/ha, or Acetamiprid 20 SP @ 100 g/ha, or Triflumezopyrim 10 SC @ 235 ml/ha, or Flonicamid 50 WG @ 150 g/ha. The spray should be applied during the evening hours with the spray nozzle directed towards the base of the rice plants to ensure thorough contact with the insect population.

3. Leaf Folder

Its larvae join the two edges of a leaf together and feed by scraping off the green

Adult insect | Larva stage | Damage Symptom

matter, so that the leaves appear white, membranous, folded, and scorched. The adult is orange-brown, with many scattered lines and spots on the wings and a dark band along the margins. The insect completes its whole life cycle in 27–32 days, and under severe infestation plant growth is checked, which can reduce production by about 10 percent.

Management

- As far as possible, complete direct sowing by **15 June** and transplanting by **15 July**, as timely crop establishment significantly reduces the incidence of leaf folder infestation.
- Maintain wider plant spacing (22.5 × 20 cm or 30 × 20 cm) and avoid excessive application of nitrogen fertilizers, as these practices help reduce the incidence of leaf folder infestation.
- Leaf folder infestation is generally more severe under shaded conditions. Therefore, remove factors that create excessive shade within the field to reduce pest incidence.
- Apply insecticide when two completely damaged leaves along with one larva per hill are observed, indicating that the pest population has reached the economic threshold level (ETL). Spray any one of the following insecticides at the recommended dose per hectare: Chlorantraniliprole 18.5 SC @ 150 ml/ha, or Flubendiamide 480 SC @ 250 ml/ha, or Fipronil 5 SC @ 800 ml/ha. Apply the spray uniformly to ensure thorough coverage of the crop for effective control of leaf folder infestation.

4. Case Worm

This pest is more prevalent during the early vegetative stage of the rice crop, particularly in low-lying fields where runoff water from surrounding fields accumulates. The larvae cut the leaf tips and fold them into a tubular or case-like structure, within which they remain protected while feeding on the green leaf tissue. As a result, the leaves appear cut from the tip and exhibit characteristic white streaks or scraped patches. Under severe infestation, numerous small, floating, boat-shaped leaf cases containing larvae can be observed on the water surface in the rice field, indicating heavy pest incidence.

Management

- Carry out sowing and transplanting early, which reduces the effect of the case worm.
- Nitrogen increases insect attack, so use chemical fertilizers in balanced amounts.
- Wider spacing between plants (22.5×20 cm and 30×20 cm) reduces its incidence.

- Add kerosene to the field water (mix 1 litre of kerosene with 25 kg of soil and broadcast per hectare) and then run a rope over the rice tips (ponga); the insects fall into the water and are killed, or become food for predators.
- When infestation reaches 1–2 cases per plant hill, spray fipronil 5% SC or quinalphos 25 EC at 800–1000 ml per hectare.

from **August to November**. The adult insect resembles a mosquito-like fly with long legs and an orange-colored abdomen.

Management

- Destroying old stubbles and ratoon (volunteer) rice plants helps in reducing the incidence of this pest.
- Regular removal of weeds growing inside the field and on the bunds is necessary.

Adult stage | Larva stage | Damage symptom

5. Gall Midge

This pest mainly damages the crop in the tillering stage of rice. Its larva (maggot) feeds on and destroys the growing point (shoot apex) of the plant, so that plant growth stops and a gall forms. The gall gradually elongates and produces a long, hollow, pale-yellow, silvery central portion of the rice plant known as the ‘silver shoot’. In place of the stem a tubular pipe (ponga) forms, which bears no panicle and this can cause 8–50 percent loss. The activity of this pest is influenced by climatic conditions and is generally observed

- Select high-yielding and pest-resistant varieties such as IR-36, Mahamaya, Danteshwari, and Suraksha for crop production.
- Draining water from the field at intervals of 5–7 days helps reduce the population of this pest.
- Nitrogen increases insect attack; therefore apply nitrogen, phosphorus, and potash fertilizers in a balanced 3:2:1 ratio according to soil type and variety duration.

- When one ponga (infested tiller) per m^2 is observed, apply granular insecticide by mixing it uniformly with sand and broadcasting it in the field at the recommended dose: **Fipronil 0.3 G @ 25 kg/ha,** or **Cartap hydrochloride 4 G @ 18–25 kg/ha.** Apply the treatment immediately after pest incidence is noticed for effective control.

completely destroying the leaves. At the grain-filling stage, the larvae may cut the panicles and cause them to fall into the field. Under severe infestation, the entire crop may be destroyed. Since the larvae are nocturnal, they are not visible during the daytime and become active after sunset. In the morning, only cut and fallen panicles can be seen in the field. If the tillers are opened, as many as 10–12 larvae

Adult insect Damage symptom (Silver Shoot)

6. Cut Worm

This pest is also called the army worm or soldier insect. The larvae damage transplanted rice by feeding on the leaf tissues while leaving the midribs intact, often

may be found in a single clump. The pest infestation generally begins in September and reaches its peak during the first and second weeks of October. The adult insect is medium-sized, dull grey or brown in colour, with dark

Adult stage Larva stage Pupa stage

spots on the forewings and pale brown hind wings. The pest completes its life cycle in about 30–40 days.

Management

- ☞ When cutworm larvae appear, flooding the fields makes the larvae food for insect predators.
- ☞ In canal-irrigated areas, when water moves from one field to another, placing a net in the path of the incoming water to block the entry of cutworm larvae is useful.
- ☞ When infestation reaches 1 larva per plant, spray chlorpyriphos 20 EC at 2500 ml, dichlorvos 80% EC at 600 ml, or lambda-cyhalothrin at 800–1000 ml per hectare in the evening.

7. Gandhi Bug

The **gandhi bug** is a slender, long-legged insect that appears in rice fields in June. With the onset of monsoon rains, it begins laying eggs on grasses around the fields. As soon as the rice plants emerge, both the nymph and adult stages feed by sucking sap from tender leaves, stems, and developing grains. During the milk stage, this feeding causes the grains to become hollow and lightweight, while the husk turns whitish. The rice crop suffers the greatest damage, about **20–25%,** during the milk stage (September–October). Infestation by this pest is also associated with an unpleasant odour in the field, which is why it is commonly known as the gandhi bug**.**

Management

- Install light traps in the crop area to keep the presence and number of insects under continuous watch, and destroy the adult insects.
- When infestation reaches 15–20 bugs/m^2, spray abamectin at 500 ml per hectare.

8. Panicle Rice Mite

The **panicle mite** is too small to be seen with the naked eye; a hand lens of at least 20× magnification is required to observe it inside the leaf sheath. The adult mites are straw-coloured, oval-shaped, and approximately 250 microns in length. Males are more active and can often be seen moving

Gandhi bug Nymph and adult stage

on the leaf surface. Depending on temperature conditions, the mite completes its life cycle in about 7–21 days. From the seedling stage to crop maturity, this pest directly damages the leaf veins, leaf sheath, and grains, and also indirectly facilitates the entry of pathogens. As a result, symptoms such as sterile grain syndrome, loose and brown leaf sheaths (sheath rot), neck bending, and the formation of deformed grains with brown spots are commonly observed. These grains are often empty or partially filled. Damage to the leaf sheath also reduces photosynthetic activity and the reproductive potential of the plant.

Mite

Damage plant

Management

- In infested fields, ploughing should be done immediately after harvest so that new ratoon or volunteer rice plants do not emerge during the winter season.
- In the affected areas, replace rice with an alternative crop (crop rotation).
- To detect mite numbers at a low level, take samples 15 days after ransplanting, and avoid growing a rice crop in the rabi season.
- Since the mite is not an insect but a type of spider (arachnid), use an acaricide rather than an insecticide for its chemical management. Give the first spray at the booting stage and the second when 2–3 panicles have emerged, using hexythiazox 5.45% EC at 250 ml/acre or propargite 57% EC at 500 ml/acre or spiromesifen 22.9% SC at 150 ml/acre or abamectin 1.8% at 100 ml/acre, or fenpyroximate 5% EC at 300 ml/hectare. Mix any one of these acaricides with propiconazole 25 EC at 2 ml per litre of water and spray in the morning or evening.

General Instructions for Pest Management

- Use chemical pesticides only after identifying the insects, and on the basis of their intensity and the number of their natural enemies.
- At the time of land preparation, apply farmyard manure and green manure in

adequate quantity at 25 quintals per hectare.

- As far as possible, do not irrigate by the field-to-field flooding method.
- Use a milky-white bulb in the light trap and run the trap from 6 p.m. to 10 p.m. to monitor the insects.
- Conservation and promotion of the natural enemies of harmful insects, and of beneficial (friendly) insects, is essential.
- For this, keep inspecting the crop continuously. If the ratio of beneficial to harmful insects is 2:1, no pesticide is needed; only when the situation is reversed (1:2) should insecticides be used.
- To conserve the natural enemies of harmful insect pests, the economic threshold level (ETL) should be carefully followed, and control measures should be taken only when the pest population exceeds this level.
- To encourage the activity of insectivorous birds in the field, install **T-shaped or Y-shaped wooden perches** at regular intervals within the crop.
- Excessive use of nitrogen fertilizer, or of synthetic pyrethroids or highly toxic insecticides, makes the hopper problem severe.
- A strong insecticide applied against the stem borer at the panicle stage increases the hopper population in the crop.
- Spraying insecticide against the hopper after the crop has mature is useless.
- Always use a solution of the recommended dose and concentration of the pesticide in the fields.
- Prepare the required pesticide solution separately in a plastic container and then fill the sprayer, rather than taking water in the sprayer and adding the pesticide to it.
- Do not apply granular pesticides after the booting stage of rice.
- When using granular pesticides, keep the water level in the field below 6–7 cm, and after applying the pesticide retain the water for 3–4 days.
- At the flowering stage, spray only in the evening.
- For effective control of white and brown hoppers, spray or dust only the lower part of the plant.
- If rainfall occurs within 3 hours of spraying, the application should be repeated through re-spraying or re-broadcasting of the pesticide.
- Do not spray pesticides during strong winds or against the direction of wind flow.

- Take safety precautions while spraying chemical pesticides.
- Chemical insecticides sometimes become ineffective. The main reasons are substandard quality of the insecticides, failure to adopt the correct method of application, and failure to follow the instructions on the prescribed dose and concentration.
- Continuous survey of the field at fixed intervals is essential.

Conclusion

The way crop-protection chemicals are currently being used cannot be called safe for the future. The insecticides now available are so hazardous that their use poses a serious risk to human life and the environment. Excessive use of chemicals is also increasing insect resistance, and various new pests and diseases are developing. The beneficial insects in the surroundings, and the birds that feed on crop-pest insects, are being almost eliminated by these lethal chemicals. Given these risks, it is necessary to control the use of insecticides and to adopt alternative measures. This approach is called integrated pest management.

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