

## Non-insect Pests and Their Management

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### SUMMARY

The main aimed to document the occurrence of non-insect pests of different crops grown in India stored grains in storage. It is estimated that production losses due to insect pests and non-insect pest are around 30 per cent in crop. Non-insect pests are enormous and can cause significant damage to our agriculture. You can't kill some of them as they are protected under Wildlife Protection Act, 1972. One must always select ecofriendly options for pest management rather than just relying on chemical control which often cause environmental pollution.

### INTRODUCTION

Non-insect pests are a class of animals in agriculture that includes mammals, birds, nematodes, mollusks, and mites. They cause damage in the field as well as in storage. Crop losses in production caused by insect and non-insect pests are estimated to be over 30%. Non insect pests are massive and may cause damage on our agriculture. Some of the vertebrates are protected by the Wildlife (Protection) Act of 1972. Instead of relying on chemical control, which often causes pollution, one should always choose eco-friendly pest management strategies. Non-insect pests such as phytophagous nematodes and mites should not be ignored if they become pests. There are also beneficial nematodes and predatory mites that feed on other phytophagous species or other organisms that are either directly or indirectly harmful to us. Crabs, millipedes, snails, and slugs are particular to specific situations and are frequently connected with aquatic environments; therefore, they should be managed in collaboration with the community. Non-insect pests like insect pests, because major damage to crop plants in the field and stored grains in storage. Non-insect pests include mites, rodents, birds, wild boar, elephants, etc.

### Rodents :

#### Field rodents :

Sr. No.	Common Name	Scientific Name	Habit and Habitat	Distinctive character	Distribution
1	Indian mole rat / lesser bandicoot	<i>Bandicota bengalensis</i>	Lives in cultivated plains in gardens, good burrower; most important as per destruction is concerned	Grey, black or blackish grey, much bigger than Louse rat, weighs 900-1400 g, head + body length 15-23 cm, tail length 12- 18 cm	Common in moist alluvial tracts
2	Soft furred field rat / grass rat, south India	<i>Rattus (Millardia) meltada</i>	Lives in cultivated fields, forests and rocks, prevalent in black cotton soil; burrowing type	Pale brownish on the back, grey, greyish white underside, palest one found in desert zones, West and dense soft furred and large rounded ears	Peninsular India, Punjab, Uttar Pradesh, South India
3	Short tailed bandicoot rat	<i>Nesokia indica</i>	Inhabits in cultivated fields but occurs under natural vegetation near crop fields	Bigger, robust built than <i>B. bengalensis</i>	Delhi, Punjab, Haryana, Rajasthan, Uttar Pradesh
4	Indian field mouse	<i>Mus booduga</i>	Common in field bund, compounds & gardens : occasionally in	Pale sandy in deserts, widely brown or dark greyish brown in humid, white bellied	Worldwide distributed in irrigated fields

			houses		
5	Indian long tailed tree mouse	<i>Vandeleuria oleracea</i>	Lives on trees and shrubs	Chestnut red coat above, white bellied; beautiful soft furred with very long tail	All over India

**Rodents in stores :**

Sr. No.	Common Name	Scientific Name	Habit and Habitat	Distinctive character	Distribution
1	House mouse	<i>Mus musculus</i>	Lives indoors, outdoors, gardens and fields near villages/towns, climber, burrower	Brownish gray & lighter outdoors, gardens shades, tail longer than & fields near body, snout pointed, villages/towns, droppings small, scattered, climber, burrower thin & spindle shaped	Worldwide
2	House rat / common rat	<i>Rattus rattus</i> <i>Rattus fuscens</i>	Lives inside the building, not a burrowing type, good climber, rare in sewers	Gray, black, brown or fawn on the dorsal side, may have white belly, tail is longer than the head and body, snout pointed, droppings scattered always in banana shaped	Found everywhere, mainly in port areas
3	Larger Bandicoot /Bandicoot rat	<i>Bandicota indica</i>	Lives in gardens, near garbage bins and human dwellings. Found on the roadside. They get run over by cars and die on the road	Dark gray-brown upper parts with a profusion of long, black hairs. Sides are gray with a few long, black hairs. Short, light gray fur occurs on the ventral surfaces. It has a dark and naked, scaly tail, and dark feet with light colored claws. The young are much lighter in colour	Widely distributed

**Management of rodents :****Field rodents :**

Three basic components of IPM as in any other pest are,

- i. Prevention
- ii. Observation
- iii. Intervention

**Prevention :**

- Food and habitat manipulation is the key in preventing rodents
- Summer ploughing
- Keep the field bunds free from weeds.
- Trimming the field bunds and reducing the number of bunds as far as possible.
- Selecting uniform maturing varieties.
- Uniform planting, avoiding staggered sowings /plantings.
- Monitoring rodent population build up particularly after floods / natural calamities.
- Avoiding hay stacks near field to eliminate harbourages.

- Encouraging natural enemies (snakes, birds etc.).

#### Observation :

- Identifying species can be made by visual observer, observation of species or their burrowing pattern.
- Assessment of rodent population by burrow count is handy because single adult whether male or female, inhabits a burrow.

#### Intervention :

- Setting of indigenous traps: Bow traps @ 20-25/ha.
- Smoking burrows with burrow fumigator (originally designed at APRII, Maruteru, AP).
- Baiting on a community approach over a large area. Rats are colour blind and cannot vomit. This character is exploited in baiting.

#### Acute poison :

- Zinc phosphide 2 %.
- Pre baiting should be done 2-3 days before.
- Baiting: Broken rice (local food) - 96 parts, Edible oil - 2 parts, Zinc phosphide - 2 parts
- 10 bait stations ac-1
- Followed by baiting, fumigation with Aluminium phosphide after enumeration of burrows @ 2 pellets (1.2 g) per burrow.
- \*Zinc phosphide burrowing can be done only once during the season.

#### Single dose Anticoagulants :

- Bromadiolone 0.25 CB at same ratio.
- Bait can be used at any number of times at 10 -
- 15 days interval during crop season.

#### Rodents in stores :

- Killing by sticks
- Using traps : Snap neck trap, live catch trap or Wonder trap.
- Encouraging predators like cats, dogs, owls and hawks.
- Use of chronic anti-coagulants.
- Rodafarin 'C' (solid bait) Rodafarin 'C' – one part, 2. Sugar - one part, 3. Vegetable oil – one part, 4. Crushed grain /corn meal - 17 parts
- Rodafarin 'S' (liquid bait) Rodafarin 'S' – one part, 2. Water - 19 parts, 3. Effective in stores as there is lack of water in stores.



#### Birds :

Birds are members of the Aves class, with feathers covering their entire body and the distinctive feature of forelimbs modified as wings. The mouth is extended to create a beak, and they are both homothermous and graminivorous. They cause significant harm to mature grains and fruits in agricultural crops, and they account for around 0.85 % of storage losses. The destruction in fields and stores is significant, both quantitatively and qualitatively. Birds consume 8 to 25 gm of food every day on average. Some of them are responsible for disease transmission. They also cause annoyance and unsanitary conditions in warehouses. Only 25 of India's over 12000 bird species have been found to cause agricultural and field damage. Peacocks can damage cauliflower or cabbage

nurseries 90-95 per cent, if not properly protected. Some of the important birds of agricultural importance are described here below.

Sr. No	Common name	Scientific name	Damaged plant parts
1	Common pigeon, blue rock - pigeon	<i>Columba livia</i>	orous, eat food grains in grain
2	House Sparrow	<i>Passer domesticus</i>	y omni-vorous and gramini-vorous; use and warehouses, eat grains in o
3	House Crow	<i>Corvus splendens</i>	ous feeding on kitchen waste to dea e considered as the best scavenger
4	Parrot	<i>Psitta culacyanocephalus</i>	earl millet, sorghum. maize, mango, fi
5	Peacock	<i>Pavocristatus</i>	edlings like cabbage, cauliflower, orn
6	Common mynah	<i>Acridotheres tristis</i>	food grains in fields and mandies b rehouses



**Management :**

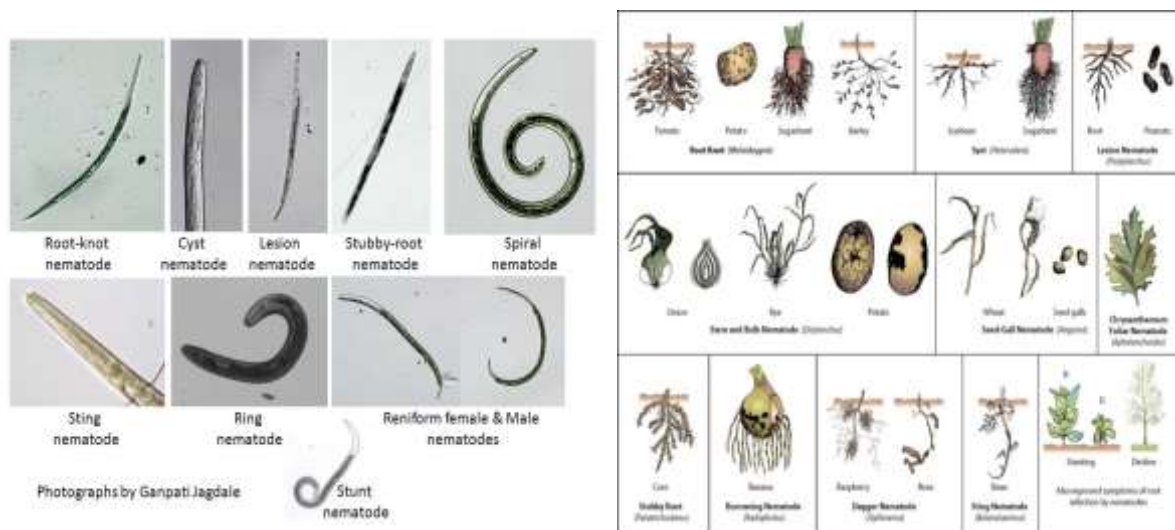
- Bird damage can be prevented by scaring them away using mechanical bird scarers, beating empty drums, pyrotechniques (art of making fireworks) and bioacoustics (making distress calls) setup in orchards/fields.
- Use of metalized reflective ribbons /plastic garbage bags of various colours to repel them.
- Baiting with misorol (4-amino pyridine), a behavioural repellent. It must be applied with preferred food for particular bird species e.g., guava for parrots while meat for vultures.
- Fencing and netting especially for peacocks, keeping in mind their small flight range as well as existence of an object suited for the sortie.
- Playing of distress calls prevents brown-eared bulbuls-damaging fruits in orchards.
- Destruction of eggs and nests
- Use of non-toxic and sticky material like “Lassa”
- Growing bird resistant varieties like - Ganga 3 in maize and red sorghum
- Use of repellents like cupric oxide, methiocarb.
- Use of chemosterilants like mestranol, ornitrol and avitrol.
- Fumigation of holes

**Nematodes :**

Nematodes are minute worm like animals without true body cavity and with unsegmented, bilaterally symmetrical, and externally cuticularized body. Nematodes are popularly known as round worms. They are found in the soil, in all types of aquatic environment and in animals and plants as parasites and otherwise. Nematodes belong to the phylum Nematoda. Plant parasitic nematodes or Phyto parasitic nematodes constitute one of the important groups of organisms which live in soil around plant roots. They are often microscopic, long and slender eel worm, confined usually to the top soil of 20-25 cm. Plant parasitic nematodes cause extensive damage to cultivated plants, resulting in heavy losses. The damage may be caused directly, or indirectly when the Phyto parasitic nematodes transmit plant viruses or allow other pathogens to enter the plant through damaged areas created by these nematodes. All the plant parasitic nematodes possess a sharp, pointed, protrusible buccal stylet to puncture plant cells. The parasitic nematodes suck the cell sap from the punctured cells and injects saliva into



plant cell while feeding which is toxic to plants and causes many symptoms in the plants. In plants, they are either endoparasites or ectoparasites. Economically important plant parasitic nematodes, their damages and management are explained in this section.



**White tip nematode of rice/ spring dwarf nematode : *Aphelenchoides besseyi***

- It is widely distributed in Tamil Nadu.
- Remain alive as pre adult, beneath the hull of paddy seed for two years.
- When seed are sown, immature forms become active and move up the plant along a thin film of moisture and feed on foliage as ectoparasites.
- Adults lay eggs on foliage. Larvae move to panicle when it is formed and enter grains.

**Symptoms :**

- Leaf tips (2-5 cm) turn yellow, brown and finally turn white, dry up and hang down.
- Tips of developing leaves become twisted and crinkled.
- Kernels distorted and in severe cases it becomes chaffy.

**Management :**

- Treatment of paddy seeds with hot water at 52 -55°C for 15 minutes.
- Seed treatment with N - 244 @ 3 ml a.i. for every litre gives 100 % control.

**Wheat gall nematode/ ear cockle nematode : *Anguina tritici***

- It is a major pest in all wheat-growing regions around the world.
- When sown under favorable moisture conditions, second instar larvae inside seed galls become activated and emerge from the seed. The larva climbs the plant through a thin layer of moisture. As an ectoparasite, it feeds on tender foliage. It enters young green grain and converts it into a gall, where it grows and reproduces.
- Each female inside the gall lays hundreds of eggs, and the larvae that hatch remain in the seed and can survive in dry seeds for years. When those seeds are planted, the cycle repeats again.

**Symptoms :**

- Affected plant stunted with wrinkled and twisted leaves.
- Infested grains ripen slowly, smaller in size with irregular contour.
- Whole or part of the grain converted into galls, cockles or pepper galls Nematode infestation is associated with "Tundu disease" or "yellow slime" disease caused by a bacterium, *Corynebacterium tritici* causing rotting of spikelet with oozing of yellow slime (yellow slime disease). This results in twisting of leaves, distortion of ear heads, rotting of spikelets with profuse oozing of yellow slimy liquid.

**Management :**

- Seeds for sowing should be immersed in salt solution by dissolving 10 kg of common salt in 60 liters of water. The floating seeds should be rejected (or) Seeds presoaked in water about 2h and after rejecting seeds that float, (light and chaffy seeds) the remaining seeds are kept in hot water at 50°C for 2h.
- Seeds treated by either of the above methods should be shade dried by spreading on floor in a thin layer Resistant variety is Kanred (USA).

**Root knot nematode : *Meloidogyne* spp.**

- *M. incognita* and *M. javanica* infest all vegetables, other crops like cotton, sugarcane, chilies, wheat, barley, tea. *M. incognita* infests brinjal, chilies, tomato and bhindi while *M. arenaria* infests chilies and tomato.
- Infections with this nematode result in the invasion of pathogens such as *Fusarium* and *Rhizoctonia*.
- Female lays 200-500 eggs in a gelatinous sac surrounding the female's posterior tip. The egg mass can be seen protruding from the galled roots.
- The second stage larva is long, slender, and cylindrical. Female larva swells up after entering the roots at each moults.
- The adult female is flask-shaped and spherical. Males are slender.
- As a result of feeding by nematode, infested roots show Knot-like galls on roots, Stunted plants with chlorotic leaves.

**Management :**

- Fallowing field in summer after 2 or 3 deep ploughings and drying
- Keeping the field in flooded condition for a few days, wherever possible.
- Ploughing nursery area and spreading paddy husk uniformly @ 20 kg m<sup>-2</sup> (about 15 cm thickness), burning it and ploughing back facilitates production of nematode free seedlings.
- Crop rotation with mustard
- Application of chopped leaves of pongamia and crotalaria reduces disease severity.
- Preplant soil fumigation with DD mixture.
- Nursery treatment with carbofuran 3G @ 65 gm and in main field carbofuran 3G @ 4 kg a.i. ha<sup>-1</sup> is effective.

**Mites :**

Mites are very small members of the class Arachnida, sometimes microscopic, arthropods with an oval or elongated body. The body plan has two regions, a cephalothorax (with no separate head) or prosoma, and an opisthosoma or abdomen. Segmentation has almost entirely been lost and the prosoma and opisthosoma are fused, only the positioning of the limbs indicating the location of the segments. The legs are 3 pairs in larvae and nymph while adult has four pairs of legs, although some have only two or three pairs. Most mites have four pairs of legs, each with six segments, which may be modified for swimming or other purposes. The mouthparts, called chelicerae, are adapted for piercing, sucking, and lacerating. Respiration is taken care by trachea but in absence of tracheal respiration cutaneous respiration plays role. The phytophagous mites belong mainly to the families Tetranychidae and Eriophyid.

**Important species of mites :****Mites infesting crops**

Sr. No.	Common name	Scientific name	Family
1	Two spotted spider mites	<i>Tetranychus urticae</i>	Tetranychidae
2	Cucurbitaceous mite	<i>Tetranychus cucurbitae</i>	Tetranychidae
3	Mango mite	<i>Aceria mangiferae</i>	Eriophyidae
4	Sorghum mite	<i>Oligonychus indicus</i>	Tetranychidae
5	Cotton mite	<i>Tetranychus macfarlanei</i>	Tetranychidae
6	Cotton leaf mite	<i>Tetranychus telarius</i> , <i>T. bimaculatus</i>	Tetranychidae
7	Wooly mite of cotton	<i>Aceria gossypii</i>	Eriophyidae
8	Sugarcane mite	<i>Schizotetranychus andropogoni</i>	Tetranychidae
9	Chilli mites/broad mite/yellow mite	<i>Polyphagotarsonemus latus</i>	Tarsonemidae
10	Cocunut mite	<i>Aceria guerreonis</i>	Tetranychidae
11	Tea mites Red spider mite Purple mite Pink mite Scarlet mite	<i>Oligonychus coffeae</i> <i>Calacarus carinatus</i> <i>Acaphyllathea</i> <i>Brevipalpus australis</i>	Tetranychidae Eriophyidae Eriophyidae Tenuipalpidae

**Mites infesting storage grains :**

Sr. No.	Common name	Scientific name	Family
1	Grain Mite	<i>Acarus siro</i> Linnaeus	Acaridae
2	Mold Mite	<i>Tyrophagus putrescentiae</i>	Acaridae

**Mites of Medical and public health importance :**

Sr. No.	Common name	Scientific name	Family
1	Cheese Mite	<i>Tyrolichus casei</i>	Acaridae
2	House Dust Mite	<i>Dermatophagoides</i> spp.	Pyroglyphidae

**Mites infesting beneficial insects :**

Sr. No.	Common name	Scientific name	Family
1	Honey bees mite	<i>Varroa</i> spp.	Varroidae
2	Honey bee tracheal mite	<i>Acarapis woodi</i>	Tarsonemidae

**Mites in Biological control :**

Sr. No.	Common name	Scientific name	Family
1	Predatory mite	<i>Phytoseiulus persimilis</i>	Phytoseiidae

**Spider mites :**

The two-spotted spider mites, *Tetranychus urticae* Koch are the most prevalent plant pests. Leaf flecking, discoloration (bronzing), and burning are all injury indicators that can lead to leaf loss and plant death. Webbing is produced by many spider mites, especially when they are in huge numbers. This netting protects the mites and their eggs against natural enemies and changes in the environment. Spider mites flourish in dry environments, which explain why they are so common in the country's arid regions. Because the lower humidity permits them to remove surplus water, they feed more under dry conditions. Simultaneously, most of their natural adversaries prefer moister habitats and are stressed by aridity. Furthermore, plants that are stressed by drought can change their chemistry, making them more nutritious to spider mites. Irrigation and moisture management can be important cultural controls for spider mites.



**Management :**

**Cultural :**

- Avoiding monoculture
- Intercropping with non - host crops
- Destroying mite damaged parts in case of Erinium patches and malformations
- Adopting clean cultivation

**Biological :**

- **Predatory mites:** *Amblyseius longispinosus*, *A. cucumeris*
- **Thrips:** *Scolothrips indicus*
- **Lygaeids:** *Geocoris* sp.

**Chemicals :**

- Chemicals which kill ticks and mites are called “Acaricides”.
- Specific acaricides- Dicofol (KELTHANE), Tetradifon (TIDEON) and Barium polysulphide (SOLBAR).
- Insecticides with acaricidal properties - Phosphamidon, Dimethoate, Methyl demeton, Formothion, Phosalone, Monocrotophos, Ethion, Phorate granules and Disulfoton granules.



**Snails and Slugs :**

Members of this group are softbodied and belong to the phylum Mollusca's order Stylommatophora and class Gastropod. They are asymmetrical, unsegmented, spirally coiled animals without a backbone. Slugs, as opposed to snails, have only a rudimentary shell that is frequently encased in a visceral hump. The snails are huge, bisexual, and nocturnal in nature. There are 1500 species of land snails in India, but only a few kinds of slugs.

**Some common species of snails :**

- Common Garden snail: *Helix* spp.
- Green house snail: *Opeasgracilis*
- Giant African snail: *Achatina fulica*
- African giant snail damage mainly plantation crops viz., coffee, rubber and arecanut.

**Damage symptoms :**

- During the rainy season, snails emerge from their hiding places and harm numerous vegetable, ornamental, plantation, and fruit crops.
- They hide beneath fallen leaves and stones during the day; they also climb on papaya, banana, and a variety of other plants, remaining clanged to the lower and sheltered surface of the leaves.
- The golden snail is another species that can be damaging to newly planted rice, particularly in Indonesia, and causes replanting.

**Slugs : *Limax* spp.****Damage symptoms :**

- Slugs are nocturnal; however, they can be seen actively feeding during the day, particularly in the morning when the weather is gloomy or rainy.
- They cut and devour sensitive plant elements from the margins, such as blossoms and leaves.
- Their nuisance value is noticeable throughout the wet season, particularly in lawns during morning walks.

**Management :**

- During the off season, the snail's hiding spots can be investigated, and the snails gathered and exterminated.
- During the rainy season, damp gunny sacks or leaves can be stacked near the harvested area's fence, and the snails that congregate under these can be retrieved and killed the following morning.
- Hermit crabs keep it in check by killing, eating, and occupying the snail's shell.
- A predator millipede, *Orthomorpha* sp., inactivates and consumes the snail.
- For biological management of this snail, the two exotic predatory snails *Euglandina rosea* (Ferussac) and *Gonaxis quadrilateralis* Preston can be introduced.
- The commonly used Molluscide is Metaldehyde, available in market as Snail Kill.

**Crabs :****Rice field crab: *Paratelpus ahydromus* (Herbst) (Decapoda, Crustacea) :**

- The body is oval, with the abdomen tucked beneath the thoracic region.
- It lives in holes drilled into the sides of field bunds, irrigation channels, and fields.
- About 3,00,700 crabs are usually seen over a hectare of an attacked field.
- They are mostly active after dusk and at night.



**Damage symptoms :**

- Young seedlings in nurseries and newly transplanted ones in the main field are damaged, usually within a fortnight of planting.
- The seedlings are cut into small pieces at ground level and carried to the feeding holes.
- The outer sheaths of older plants are cut open and the tender inner portions consumed.
- Bits of leaves and stems can be seen floating in water in an attacked field. In Tamil Nadu, severe damage to the Samba crop is observed in September-October.

**Management :**

- Spraying methyl parathion 50 EC at 1 lit. ha<sup>-1</sup> over a thin sheet of water in the field and draining three days after application has given about 80% control.
- Granular application of phorate 10 G at 2 kg ha<sup>-1</sup> in between rice field and bund is effective.

**Millipedes :** Tapioca millipede : *Harpurostreptus* sp. (Harpagophoridae: Diplopoda) :

- It has a length of 8.7 cm and is brownish black in coloration.
- Adults and juveniles have been recorded feeding on the fragile buds and roots of newly planted tapioca setts, causing stunting and plant mortality in some cases.
- Chilli roots are also eaten by them.
- Baiting with 10 parts carbaryl, 2 parts jaggery, and 18 parts rice bran, or soaking the soil to a depth of 5 to 8 cm with chlorpyrifos 0.02% emulsion, will help reduce the insect.
- Another millipede, *Lulus* sp., has been found to inflict substantial damage to jowar in Maharashtra.

**CONCLUSION**

Non-insect pests cause large losses in agricultural environments, comparable to insect pests. As a result, early intervention and management are essential; also, those creatures protected under the Wildlife Protection Act of 1972 must be managed using eco-friendly, chemical-free management practices.

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