

Insect Pests of Field Crops and their Management

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PESTS OF PADDY

Thrips: *Stenchaetothrips biformis*

Symptoms of damage

- Laceration of the tender leaves and suck the plant sap
- Yellow (or) silvery streaks on the leaves of young seedlings
- Terminal rolling and drying of leaves from tip to base

It causes damage both in nursery and main field (Fig 1 & 2)

Identification of insect pest

Adults - are dark brown in colour (Fig 4)

Green leafhopper: *Nephotettix virescens*,

Symptoms of damage

- Yellowing of leaves from tip to downwards. (Fig 5)

Vector for the diseases *viz.*, **Rice tungro virus, rice yellow & transitory yellowing** (Fig 6)

Identification of insect pest

Adults - are green with black spot and black patch on wings. (Fig 7)

Management

Use resistant varieties like **IR 50, CR 1009, Co 46.**

- Apply neem cake @ 12.5 kg/20 cent nursery as basal dose
- The vegetation on the bunds should also be sprayed with the insecticides

Set up light traps

Brown plant leafhopper: *Nilaparvata lugens*

Symptoms of damage

- Nymphs and adults congregate at the base of the plant above the water level
- Affected plant dries up and gives a scorched appearance called “**hopper burn**”. (Fig 11)
- Circular patches of drying and lodging of matured plant

It is vector of **grassy stunt, ragged stunt** (Fig 12)and **wilted stunt diseases**

Identification of insect pest

Adult: Brown body and chestnut brown eyes. It has two forms *viz.*, (Macropterous (long winged) and brachypterous (short winged)).

Management

- Use resistant/tolerant varieties like **Aruna, ADT 36, Co 42, Co 46 IR 36, IR 72.**
- Avoid close planting
- To provide 30 cm rogue spacing at every 2.5 m to reduce the pest incidence.
- Avoid use of excessive nitrogenous fertilizers
- Control irrigation by intermittent draining
- Set up light traps during night
- Yellow pan traps during day time

Conserve natural enemies like *Lycosa pseudoannulata*, *Cyrtorhinus lividipennis*

Avoid synthetic pyrethroids, methyl parathion, fenthion and quinalphos causing resurgence

Drain the water before the use of insecticides

Paddy stemborer: *Scirpophaga incertulas*

Symptoms of damage

- Presence of brown coloured egg mass near leaf tip.
 - Caterpillar bore into central shoot of paddy seedling and tiller
 - Causes drying of the central shoot known as “**dead heart**” (Fig 15)
- Grown up plant whole panicle becomes dried “**white ear**”.(Fig 16)

Identification of insect pest

Egg - Laid in a mass and covered with buff coloured hairs.(Fig 17)

Larva - Pale yellow with dark brown head.(Fig 18)

Pupa - White silken cocoon.

Adult - Female moth - bright yellowish brown fore wings with a black spot possess a tuft of yellow hairs.(Fig 18)

Male moth - Smaller with pale yellow forewings without black spot.

Management

- Resistant varieties: Ratna, Jaya, TKM 6.
- Avoid close planting and continuous water stagnation
- Pull out and destroy the affected tillers
- Set up light traps to attract and kill the moths
- Harvest the crop upto the ground level and disturb the stubbles

Release the egg parasitoid, *Trichogramma japonicum* on twice @ 5 cc/ha/(followed by monocrotophos 36 SL spray thrice @ 1000 ml/ha on 58, 65 and 72 DAT)

Apply *Bacillus thuringiensis* var *kurstaki* and neem seed kernel extract.

Leaf folder (or) leaf roller: *Cnaphalocrocis mainsails* / *Marasmia*.

Patnalis

Symptoms of damage

- Leaves fold longitudinally and a larva remains inside.(Fig 8)
- Larvae scrapes the green tissues of the leaves and becomes white and dry. (Fig 10)
- During severe infestation the whole field, exhibits scorched appearance.

Identification of insect pest

Egg - Flat, oval in shape and yellowish white in colour.

Larva - Greenish translucent (Fig 9)

Adult - Moth is brownish with many dark wavy lines in centre and dark band on margin of wings

Management

- Resistant varieties: TNAU LFR 831311, Cauveri, Akash, TKM 6
- Clipping of the affected leaves
- Keep the bunds clean
- Avoid excessive nitrogenous fertilizers
- Light traps to attract and kill moths
- Release *Trichogramma chilonis* @ 1, 25,000/ha thrice
- Spray NSKE 5 % or chlorpyrifos 20 EC 1250 ml/ ha.

Rice case worm: *Nymphula depunctalis*

Symptoms of damage

- Caterpillars feed on green tissues of the leaves and leave become whitish papery

- Tubular cases around the tillers by cutting the apical portion of leaves
- Floating of tubular cases on the water

Identification of insect pest

Larva - Pale translucent green with orange head. It has filamentous gills on the sides of the body

Adult: Moth is delicate white moth with pale brown wavy markings

Gall midge: *Orseolia oryzae*

Symptom of damage

- Maggot feeds at the base of the growing shoot
- Causing formation of a tube like gall that is similar to “onion leaf” or “Silver-shoot”.
- Infested tillers produce no panicles.

Identification of insect pest

Egg: Reddish, elongate, tubular eggs just near the ligule of the leaf blade

Larva: Maggot is pale to red colour feeds inside the gall.

Pupa: pupates at the base of the gall and moves to tip of the gall

Adult: Adult is orange coloured mosquito like fly.

Management

- Early ploughing
- Resistant varieties: MDU 3, Shakthi, Vikram and Sureka
- Harvest the crop and plough immediately
- Remove the alternate hosts and adjust the time of planting (early)
- Use early maturing varieties
- Optimum recommendation of potash fertilizer
- Setup light trap and monitor the adult flies

Swarming caterpillar: *Spodoptera mauritia*

Symptoms of damage

- Larvae cut the seedlings in large scale
- Severe infestation - cattle grazing appearance to the field.

They feed gregariously and march from field to field.

Identification of insect pest

Egg - Laid in masses on leaves and covered with grey hairs

Larva - Caterpillar is cylindrical dark to pale green with lateral lines along the body

Pupa - Pupates in an earthen cocoon in soil

Adult - Moth is medium sized stoutly build.

Dark brown with a conspicuous triangular spot on fore wings.

Management

- Kerosenate the water while irrigation – suffocation

Allow ducks into the field

Rice skipper: *Pelopidas Mathias*

Symptoms of damage

- Edges of the leaves are fastened with webbing.
- Backward rolling of leaves,

caterpillar feeds from margin to inwards

Identification of insect pest

Larva: Pale green with constructed neck.

Adult: Butterfly with brown coloured wings and curved antenna

Rice horned caterpillar: *Melanitis ismene*

Symptoms of damage

- Larva feeds on leaf blades of rice.

Leaves are defoliated from the margin or tip irregularly

Grasshopper: *Hieroglyphus banian*

Short horned grasshopper: *Oxya nitidula*

Symptoms of damage

- Irregular feeding on seedlings and leaf blade
- Cutting of stem at panicle stage

Completely defoliate the plants leaving only the mid ribs

Spiny beetle / Rice hispa: *Dicladispa armigera*

Symptoms of damage

- Adults feed on chlorophyll by scraping and causing **white parallel streaks**

- White patches along with long axis of leaf.

Grubs mine into the leaves and make **blister near leaf tips**.

White backed plant hopper: *Sogatella furcifera*

Symptoms of damage

- Suck the sap and cause stunted growth.

“Hopper burn” is caused in irregular patches.

Mealybug: *Brevinnia rehi*

Damage

- Large number of insects remains in leaf sheath and suck the sap.
- Plants become weak, yellowish and very much stunted in circular patches.

Presence of white waxy fluff in leaf sheaths

Rice earhead bug: *Leptocorisa acuta*

Symptoms of damage

- Sucking the sap from individual grains, which are in milky stage.
- Individual grains become chaffy
- Black spots on the grains at the site of feeding puncture.

Buggy odour in rice field during milky stage (Fig 19 & 20)

PESTS OF SORGHUM

Shootfly: *Atherigona varia soccata*

Symptoms of damage

- The maggot bores inside the stem and cuts the growing point.
- Central shoots dried and produce “dead heart” symptom.

The infested plant produces side tillers. (Fig 21 & 22)

Identification of the pest

Egg - white, cylindrical, distal somewhat flattened

Adult - Whitish grey fly

Management

- Use resistant varieties like Co-1, CSH 15R, Maldandi and Hagari.
- Take up early sowing of sorghum(South West or North East monsoon)
- Use seeds pelleted with insecticides
- Seed treatment with imidacloprid 70 WS @ 10 g/kg of seeds
- In case of direct seeding, use increased seed rate upto 12.5 kg/per hectare
- Plough soon after harvest, remove and destroy the stubbles.

Set up the TNAU low cost fish meal traps @ 12/ha till the crop is 30 days old.

Stem borer: *Chilo partellus*

Symptoms of damage

- Withering and drying of central shoot -“**dead heart**”
- Red mining in the midrib
- Bore holes visible on the stem near the nodes.
- Tender folded leaves have parallel “**shot hole**”

Affected parts of stem may show internally tunneling of caterpillars

Identification of the pest

Egg - Scale-like flat oval eggs in batches on the under surface of leaves near the midribs.

Larva - Yellowish brown with a brown head and prothoracic shield.

Adult - Moth is medium size, straw coloured.

Management

- Dead hearts should be pulled out and used as fodder (or) buried in manure pits.
- Stubbles should be ploughed up during winter and burnt to destroy the hibernating larvae.
- Sow the lab lab or cowpea as an intercrop (Sorghum: Lab lab 4:1)
- Set up light trap
- Bio-control agents *viz.*, *Trichogramma minutum*, *Bracon chinensis* and *Apanteles flavipes*
- Mix any one of the following insecticides with sand (total quantity of 50 kg)
 - Phorate - 10G@ 8 kg
 - Carbofuran 3G@ 17 kg;

Pink stem borer: *Sesamia inferens*

Symptoms of damage

Central shoots dried and produce the dead hearts.

Identification of the pest

Egg - Bead like laid in rows within the leaf sheath

Larva - Pinkish brown with dark head

Adult - Straw coloured moth with white wings

Ear Head caterpillar: *Helicoverpa armigera*,

Symptoms of damage

- Earheads are partially eaten with chalky appearance.

Feecal pellets are visible within the ear heads.

Shoot bug: *Peregrinus maidis*

Symptoms of damage

- Plants become unhealthy stunted and yellow.
- The leaves wither from top downwards.
- Panicle formation is inhibited and the plants die if attack is severe.
- Honeydew secreted by the bug causes growth of **sooty mould** on leaves.

The midribs of the leaves turn red due to egg-laying and may dry up subsequently.

Earhead bug: *Calocoris angustatus*,

Symptoms of damage

- Nymphs and adult suck the juice from within the grains when they are in the milky stage.
- Grains shrink and turn black in colour and ill filled (or) chaffy.

Presence of large number of nymphs and adults are seen on the ear head.

Sorghum midge: *Contarinia sorghicola*,

Symptoms of damage

- Pollen shedding due to egg laying
- White pupal cases protruding out from the grains

Chaffy grains with holes

PESTS OF MAIZE

Stem fly: *Atherigona orientalis*

Symptoms of damage

The maggot feeds on the young growing shoots results in “**dead hearts**”.

(Fig 23)

Identification of the pest

Adult - Small grey coloured fly.

Management

- Use seeds pelleted with insecticides (see sorghum)
- Seed treatment with imidacloprid 70 WS 10 g/kg of seeds
- Plough soon after harvest, remove and destroy the stubbles.
- Set up the TNAU low cost fish meal trap 12/ha till the crop is 30 days old.
- Spray any one of the following :
- Methyl demeton 25 EC 500 ml/ha
- Dimethoate 30 EC 500 ml/ha
- Neem seed kernel extract 5%

Neem azal 1%

Stem borer: *Chilo partellus*

Symptoms of damage

- Central shoot withers and leading to “dead heart”.
- Larvae mines the midrib enter the stem and feeds on the internal tissues.
- Bore holes visible on the stem near the nodes.
- Young larva crawls and feeds on tender folded leaves causing typical “shot hole” symptom.
- Affected parts of stem may show internally tunnelling caterpillars

Identification of the pest

Larva - Yellowish brown with a brown head

Adult - Moth is medium size, straw coloured

Management

- Sow the lab or cowpea as an intercrop (Maize Lablab 4:1).
- Set up light trap till midnight to attract and kill the stem borer moths.
- Collect the stubbles after harvest and burn to destroy diapausing borers.
- Mix any one of the following insecticides with sand (total quantity of 50 kg) Phorate 10G 8 kg, carbofuran 3G @17 kg (500 lit. spray fluid/ha)

Pink stem borer: *Sesamia inferens*

Symptoms of damage

Pink larva enters into the stem causing dead heart symptom .

Identification of the pest

Egg - Bead like laid in rows within the leaf sheath

Larva - Pinkish brown with dark head

Adult - Straw coloured moth with white wings

Corn worm/Earworm: *Helicoverpa armigera*

Symptoms of damage

Larva feeds on silk and developing grains.

Identification of the pest

- Eggs** - Spherical in shape and creamy white in colour, laid singly
- Larva** - Shows colour variation from greenish to brown.
- It has dark brown grey lines on the body with lateral white lines

Pupa - Brown in colour, occurs in soil, leaf, pod and crop debris **Adult**

- Light pale brownish yellow stout moth.
- Forewings are olive green to pale brown with a dark brown circular spot in the centre. Hind wings are pale smoky white with a broad blackish outer margin.

Web worm: *Cryptoblabes gnidiella*

Symptoms of damage

- larva first feeds on the lemma of the flowers scraping the chlorophyll
- Later on the milky grains.

Webbing of maize cobs and feeding on the flowers and the grains.

Ash weevil: *Mylocherus sp.*,

Symptoms of damage

- Larva feeds on the secondary roots and adults on leaves.

Leafhopper: *Pyrilla perpusilla*

Symptoms of damage

- Leaves become yellow
- Covered with black sooty mould
- Top leaves get dried up and lateral buds germinate

Identification of the pest

- Nymph** - Soft, pale brown dorsally and pale orange ventrally
- Adult** - Straw coloured, head pointing forward as a snout

Shoot bug: *Peregrinus maidis*

Symptoms of damage

- Plants become unhealthy stunted and yellow.
- The leaves wither from top downwards.
- Panicle formation is inhibited and the plants die if attack is severe.
- Honeydew secreted by the bug causes growth of **sooty mould** on leaves.

The midribs of the leaves turn red due to egg-laying and may dry up subsequently.

Ear head bug: *Calocoris angustatus*,

Symptoms of damage

Nymphs and adult suck the juice from within the grains when they are in the milky stage.

Grains shrink and turn black in colour and ill filled (or) chaffy.

Orange and pale green nymphs and adults are seen on the ear head.

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PESTS OF CUMBU

Shoot fly: *Atherigona approximate*

Symptom of damage

Young plants - causes dead hearts

Ear heads - chaffy grains in the tip and well developed grains in the lower portion of ear heads (Fig 24)

Identification of the pest

Adult - Greyish white fly.

Symptoms of damage

Young plants - causes dead hearts

Ear heads - chaffy grains in the tip and well developed grains in the lower
 portion of ear heads

Identification of the pest

Adult - Greyish white fly

Management

Use seeds pelleted with insecticides (see sorghum)

Seed treatment with imidacloprid 70 WS 10 g/kg of seeds

Plough soon after harvest, remove and destroy the stubbles.

Set up the TNAU low cost fishmeal traps 12/ha till the crop is 30 days old.

Pray any one of the following insecticides

- Methyl demeton 25 EC 500 ml/ha
- Dimethoate 30 EC 500 ml/ha
- Neem seed kernel extract 5%

Neem Azal 1%

Stem borer: *Chilo partellus*, (see maize)

Pink stem borer: *Sesamia inferen* (see maize)

Stink bug: *Nezara viridula*

Symptoms of damage

- Grains become chaffy or spotted black and shriveled.
- A stinking smell emanates from the bug.

Identification of the pest

Nymph - Brownish red with multi colour spots.

Adult - Green in colour.

Management

- Apply any one of the insecticides

carbaryl 10D, malathion 5D, spray carbaryl 50WP 750 g

PESTS OF FINGER MILLET

Pink stem borer: *Sesamia inferens* (see maize)

Earhead bug: *Calocoris angustatus*,

Symptoms of damage

- Nymphs and adult suck the juice from within the grains when they are in the milky stage. (Fig 25)
- Grains shrink and turn black in colour and ill filled (or) chaffy.

Presence of large number of nymphs and adults are seen on the ear head.

Aphids: *Rhopalosiphum maidis*,

Symptoms of damage:

- Yellowing of leaves
- Aphid Colonies present on the central leaf whorl and ears

Presence of ants (Fig 26)

Root aphid: *Tetraneura nigriabdominalis*

PESTS OF COTTON

Boll Worms, Borers And Defoliators

Defoliators

Tobacco Cutworm: *Spodoptera litura* Noctuidae: Lepidoptera

Nature of damage & symptoms

The first instar larvae feed gregariously on the leaf, on which the egg mass

Semiloopers	<i>Anomis flava</i>	<i>Xanthodes graelsi</i>	<i>Tarache nitidula</i>
Damage	Defoliation	Defoliation	Defoliation
Larva	Green with five longitudinal white stripes and red prolegs	Green with horseshoe markings and warts	Dark brown
Pupa	Leaf folds	In soil among the dry leaves	In leaf
Adult	Reddish brown wings with markings	Bright lemon yellow forewing with a lunar streak	Bright white wings with dark markings

was laid by scrapping the epidermal layer, leaving the skeleton of veins. The skeletonised leaf may dry up (Fig 27). Then, the larvae move to other leaves and feed by making small holes. In later stages, they consume most of these leaf tissues and because of severe attack, only the stem and side shoots will be standing in the field without any leaf or bolls. Once squares, flowers and bolls are bored they prefer these better than leaves. They bore into them, feed on the internal content completely and cause shedding of squares and young bolls. This type of feeding is seen only during early morning hours and night, and during hot sunny hours the caterpillars will be hiding in the flowers or in the cracks of the soil. This pest is found to cause damage in all stages of crop growth, but fleshy green leaves should be present for egg laying.

Leaf roller, *Sylepta derogate*. Pyraustidae: Lepidoptera

Larva is glistening green with dark head, rolls the leaf in the form of trumpets and remains inside. It is fastened by silken threads on marginal portion. In severe cases, defoliation occurs. Adult is a medium sized moth with wavy markings.

Flower Feeders

Blister Beetle:*Mylabris pustulata* :

Meloidae:Coleoptera

Beetles feed on the flower and pollen.

Flower weevil: *Amorphaidea arcuata*: **Curculionidae:**Coleoptera

Petals with small holes.

Borers

Cotton Bollworms

Cotton bollworms are the most destructive group of insects found on cotton in all cotton growing areas of the world. There are three kinds

of bollworms, viz., spotted bollworm, green bollworm and pink bollworm. Among the three, the spotted bollworm is the earliest to occur, as soon as the cotton plant is about 15 to 20 cm in height and continues to feed on bolls. The other two occur from square formation stage, and pink bollworm continues till picking of kapas and goes even to ginning mills.

a. Spotted bollworms: *Earias vittella* & *E. insulana*

Noctuidae:Lepidoptera

Nature of Damage & Symptom

In the beginning of the season, when the crop is a few weeks old, the small caterpillar on hatching out from the egg leads a free life for a few hours. Then it bores into top tender shoot, the portion of the shoot above the damage

withers, droops and dries up, depending upon the locality up to 50 per cent of the crop may be damaged in this manner. When the squares and bolls begin to develop, these caterpillars move from the shoots and start damaging bolls by making conspicuous holes into them. The squares and small bolls injured by the larvae drop away from the plants. The developing bolls are also damaged and some of the damaged bolls fall to the ground. The infested bolls, which are not shed, are destroyed by the larvae eating the seeds and filling them with excrement. Such affected bolls may open prematurely and badly. (Fig 28)

b. American bollworm : *Helicoverpa armigera*

Noctuidae:Lepidoptera

Nature of Damage & Symptom The caterpillars feed on leaves, squares, flowers and small bolls. When the squares, flowers and bolls are attacked, they feed the internal content completely by thrusting their head

inside leaving the rest of the body outside. The damaged squares and young bolls drop away from the plants. The developed bolls and open bolls are not attacked. (Fig 29)

c. Cotton pink bollworm: *Pectinophora gossypiella*

Gelechiidae:Lepidoptera

Nature of Damage & Symptom

The caterpillars feed on flower buds, flowers and bore into bolls. When they bore into flower buds, they feed on developing anther and style and occasionally on ovary. When they are found in flowers, the flowers do not open and give rosette appearance. The young bolls, when attacked, are shed after a few days, but the larger bolls remain on the plant. Seeds are destroyed and lint gets stained. The aperture through which they make their entry into the boll is closed, and it becomes difficult to differentiate between a healthy and infested boll. (Fig.30)

d. Red boll worm: *Rabila frontalis* Noctuidae:Lepidoptera

Irregular bore holes. Larva is red colour and adult is brownish yellow moth. Other borer pests in cotton

Stem Weevil: *Pempherulus affinis*, Curculionidae:Coleoptera

Swelling on the stem just above the ground level and the young plants are killed. Old plants lack vigour and strength and may break when heavy wind blows. Grub is apodous. Weevil is dark in colour with two small white patches on the elytra.

Shoot weevil:*Alcidodes affaber*, Curculionidae:Coleoptera

Terminal shoots with galls. Bore holes are surrounded by raised margins.

Boll weevil:*Anthonomus grandis*, Curculionidae:Coleoptera

Stem Borer:*Sphenoptera gossypii*, Buprestidae:Coleoptera

Plants with drooping leaves and wilting in patches. Adult is a brown

colour weevil.

Sucking Pests

Cotton aphid: *Aphis gossypii*, Aphididae: Hemiptera

Nature of damage & symptom

It is a potential pest on cotton infesting tender shoots and under surface of the leaves. They occur in large numbers suck the sap and cause stunted growth, gradual drying and result in death of the plants. Development of black sooty mould due to the excretion of honey dew giving the plant a dark appearance.

Description

The aphids are greenish brown, soft bodied and small insects. The alate as well as apterous females multiply parthenogenitically and viviparously. A single female may give birth to 8-22 nymphs in a day which become adult in about 7-9 days. Yellowish or greenish brown nymphs found on the undersurface of leaves. They are often attended by ants for the sweet honey dew secretion. Winged forms may be seen under crowded conditions.

Thrips: *Thrips tabaci*, Thripidae, Thysanoptera

Nature of damage & symptom

Both nymph and adult lacerate the tissue and suck the sap from the upper and lower surface of leaves and in cases of severe infestation they curl up and become crumbled.

Description

Adult is small, slender, yellowish to brown with fringed wings, nymph is very minute, slender, yellowish and microscopic.

Whitefly - *Bemisia tabaci*,

Aleyrodidae, Hemiptera

Nature of damage & symptom

Nymphs and adults suck the sap from leaves at the under surface of leaves. Severe infestation results in premature defoliation, development of sooty mould, shedding of buds and bolls and poor boll opening. It also transmits the leaf curl virus diseases of cotton. The insect is highly polyphagous.

Description

Adult is minute insects with yellow body covered with a white waxy bloom. Nymph is greenish yellow oral in outline, along with puparia on the under surface of the leaves.

Red Cotton Bug :*Dysdercus cingulatus*, Pyrrhocoridae, Hemiptera

Nature of Damage & Symptoms: Nymphs and adults suck the sap from the developing bolls as a result water soaked areas are seen just beneath the wall of the boll and stains the lint also.

Adults are red bug with black spots on the wings and the abdomen is with white lines.

Dusky cotton bug *Oxycarenus hyalinipennis*, Lygaeidae, Hemiptera

It sucks the sap from developing seeds in open bolls and stains the lint black. Seeds discoloured and shrunken.

The adult is a small flat bug with dusky brown in colour.

Mealy bug *Ferrisia virgata*, Pseudococcidae, Hemiptera

Nature of damage & symptom

Yellowing of leaves in older plants. Under surface of leaves and terminal shoots covered with white mealy mass.

Management of borer pests of cotton

- Avoid continuous cropping of cotton both during winter and summer seasons in the same area as well as ratooning.
 - Avoid mono cropping. Growing of less preferred crops like greengram, blackgram, soyabean, castor, sorghum etc., along with the cotton as intercrop or border crop or alternate crop to reduce the pest infestation.
 - Removal and destruction of crop residues to avoid carryover of the pest to the next season, and avoiding extended period of crop growth by continuous irrigation.
 - Optimizing the use of nitrogenous fertilizers which will not favour the multiplication of the pest.
 - Judicious water management for the crop to prevent excessive vegetative growth and larval harbourage.
 - Application of Nuclear Polyhedrosis Virus (NPV) at 3 x 10¹² POB /ha in evening hours at 7th and 12th week after sowing.
- Inundative release of egg parasitoid, *Trichogramma* spp., at 6.25 cc/ha at
- 15 days interval 3 times from 45 DAS
 - Releasing predator *Chrysoperla carnea* @ 1, 00, 000/ha at 6th, 13th and 14th week after sowing.
 - ULV spray of NPV at 3 x 10¹² POB /ha with 10% cotton seed kernel extract, 10% crude sugar, 0.1% each of Tinopal and Teepol for effective control of *Helicoverpa*.
- During bolling and maturation stage, apply any one of the following insecticides (1000 l of spray fluid/ha):**
- Phosalone 35 EC 2.5 l/ha
 - Quinalphos 25 EC 2.0 l/ha

- Profenofos 50 EC 1.5 l/ha

PESTS OF OIL SEEDS

PESTS OF CASTOR

Castor Semilooper: *Achaea janata*, *Paralellia algira*

Symptoms of damage

- Damage to complete defoliation.

leave bare stems & veins (Fig. 31)

Identification of the pest - *Achoea janata*

Larva- semilooper with varying shades of colour with black head.(Fig 32)

- Abdomen – has a red spot on the third abdominal segment and red tubercles in the anal region

Adult - pale reddish brown moth with hind wing having white spot in the middle and three large white spots on the outer margin (Fig 33)

Identification of the pest: - *Paralellia algira*

Larva- semilooper, olive grey colour with numerous longitudinal lines

Adult

Fore wing - white in colour with suffused band beyond it.

Hind wing: - has white median band, the outer margin grey at centre.

Identification of the pest: *Paralellia algira*

Management

- Hand picking of older larvae during early stages.
- Providing bird perches (10/acre) helps in reducing the incidence.
- Spray neem seed kernel extract (NSKE) 5% synchronising with egg and early larval stage.
- The eggs are parasitised by releasing *Trichogramma* sp @ 50,000/acre.

- Spray quinalphos or chlorpyrifos or monocrotophos

Castor Slug: *Parasa lepida*

Symptoms of damage

- Feed gregariously on the leaves of castor and later spread over to the entire plant.

Cause defoliation – leaving only the midrib and veins

Identification of the pest

Larva- slug like, ventrally flat, greenish body with white lines and four rows of spiny scoli tipped red or black (Fig 34)

Adult: - green moth with brown band at the base of the forewing (Fig 35)

Hairy caterpillars: *Euproctis fraterna*,

- *Porthesia scintillans*,
- *Dasychira mendosa*

Symptoms of damage

- Cause - defoliation

Woolly bear: *Pericallia ricini*

Symptoms of damage

- Cause - defoliation

Identification of the pest

Larva- black with brown head having long brown hairs.

Adult: grey coloured moth. Hind wings are pinkish with dark spots

Management

- To control early stage larvae, spray neem seed kernel extract (NSKE) 5% or spray chlorpyrifos 2.5ml or monocrotophos 2ml or quinolphos 2ml or neem oil 5ml per litre of water.

Capsule Borer: *Conogethes (=Dichocrosis) punctiferalis*

Symptoms of damage

- Capsule with bore holes.
- Damaged capsules webbed together
- Peduncle and capsules showing galleries made of silk and frass.

Identification of the pest

- Larva:** - pale greenish with pinkish tinge and fine hairs with dark head and prothoracic shield

Adult – yellowish with black

PESTS OF GROUND NUT

Red Hairy caterpillars: *Amsacta albistriga*, *A. moorei*

Symptoms of damage

- Caterpillars cause defoliation of the crop- all the leaves eaten away leaving the main stem alone. (Fig 36)

Identification of the pest

- Larvae:** Hairy caterpillar reddish brown with black band on either end having long reddish brown hairs all over the body.
- Adult:** Moth with white wings. (Fig 37)
- Forewing** - white with brownish streak all over and yellowish streak along the anterior margin and head

Hind wing – white with black marking

A .moorei

Forewing - white with brownish streak all over and reddish streak along the anterior margin and head

Management

- Deep summer ploughing
- Early sowing is done to escape insect pest damage.

Inter crop one row of castor for every 5 or 6 rows of groundnut.

- Crop rotation with sorghum/pearl millet or maize should be followed.
- Vegetative traps utilizing *Jatropha* (wild castor) or *Ipomoea* prevent the migration of the grown up larvae.
- Irrigate once to avoid prolonged mid season drought to prevent pre-harvest infestation.
 - Install 12 light traps/ha or bonfire in endemic areas.
 - Collecting and killing of adult moths are found very effective.
 - Collection and destruction of egg masses in the fields around light trap areas.
 - Install 10-12 bird perches/ha.
 - Two hand or mechanical weeding at 15-20 days after sowing.
 - Spray A-NPV (2×10^5 PIB/I) or *Bacillus thuringiensis* (Bt).
 - Release of *Bracon hebetor* @ 5000/ha. twice at 7-10 days interval.
 - Conserve dominant predators like *Coccinella sp.* and *Menochilus sexmaculata* and parasitoids like *Chelonus spp.*
 - Conserve the bio control population of spiders, long horned grasshoppers, preying mantids, robber fly, ants, green lace wing, damsel flies/dragon flies, flower bugs, shield bugs, lady bird beetles, ground beetle, predatory cricket, braconids, trichogrammatids, NPV, green muscardine fungus.
- Inter cropping with pigeon pea, mung bean and soybean provides increase in population of spiders.
- Population of coccinellids is higher on groundnut with maize, mung bean and soybean and *Chrysoperla spp.* is higher with maize and soybean intercrops. Spray quinalphos 25 EC @ 1250 ml/ha or 500 ml of Dichlorvas (76%) 4 ml/ha to control full grown insect pests.

Groundnut leaf miner: *Aproaerema modicella*

Symptoms of damage

- Young larvae initially mine into the leaflets, feed on the mesophyll and form small brown blotches on the leaf. (Fig 38)
- Later stages larvae web the leaflets together and feed on them, remaining within the folds.

Severely attacked field looks "burnt" from a distance.

Identification of the pest

Eggs - Shiny white and are laid singly on the underside of the leaflets.

Larvae - Green in colour with dark head and prothorax

Adult - Brownish grey moth, 6 mm long with 10 mm wing span.
Forewings with white spot on the costal margin

Management

- Stray planting of cowpea or soybean as trap crop.
 - Crop rotation with non leguminous crop is advised in case of severe recurring problem.
- Crop rotation of groundnut with soybean and other leguminous crops should be avoided. Collect and destroy egg masses and early instars larvae
- Install light trap @ 12/ha for mass trapping.
 - Release *Trichogramma Chilonis* @ 50000/ha twice (7-10 days interval).
 - Conserve the bio control population of spiders, long horned grasshoppers, preying mantids, robber fly, ants, green lace wing, damsel flies/dragon flies, flower bugs, shield bugs, lady bird beetles, ground beetle, predatory cricket, braconids, trichogrammatids, NPV, green muscardine fungus
 - Mulching with rice straw causes reduction in leaf miner incidence and increase the percentage parasitisation.

□ Intercropping groundnut with *Pennisetum glaucum* enhances the parasitisation *Goniozus spp.* on leaf miner.

□ Effective control could be achieved if insecticide is applied at 45 and 70 days after planting.

Spray quinalphos 25 EC 2ml or methyldemeton 25 EC 1.6ml or dimethoate 30 EC 2ml per litre of water.

Tobacco caterpillar: *Spodoptera litura*

Symptoms of damage

Freshly hatched larvae feed gregariously, scraping the chlorophyll, soon disperse.

Sometimes the feeding is so heavy that only petioles and branches are left behind (Fig 39)

For identification and management (see cotton)

Aphids: *Aphis craccivora*

Symptoms of damage

□ Wilting of tender shoots during hot weather.

□ Stunting and distortion of the foliage and stems.

□ They excrete honeydew on which sooty molds flow forming a black coating.

Act as vector for peanut stripe virus and groundnut rosette virus complex.

Identification of the pest

Nymphs & Adult: Reddish to dark brown coloured with cornicles in the abdomen

Jassids: *Empoasca kerri*,

Symptoms of damage

Nymphs and adults inject toxins resulting in whitening of veins and chlorotic patches especially at the tips of leaflets, in a typical 'V' shape. Heavily attacked crop looks yellow and gives a scorched appearance known as 'hopper burn'.

Thrips: *Scirtothrips dorsalis* a. *Scirtothrips dorsalis*

Symptoms of damage

Tender leaves showing yellowish green patches on the upper surface and brown necrotic areas and silvery sheen on the lower surface. Severe infestations cause stunted plants.

B. *Caliothrips indicus*

Symptoms of damage

Older /lower leaves showing white spots /marks or streaks intermingled with black excreta on the surface.

C. *Frankliniella schultzei*

Symptoms of damage

Young/ terminal leaves showing white scars
Transmits peanut bud necrosis.

Termites: *Odontotermes spp*

Symptoms of damage

- Wilting of plants in patches
- Termites penetrate and hollow out the tap root and stem thus kill the plant.
- Bore holes into pods and damage the seed.

It removes the soft corky tissue from between the veins of pods causing scarification, weaken the shells, make them liable to entry and growth of *Aspergillus flavus* that produces aflatoxins.

PESTS OF MUSTARD

Diamondback moth: *Plutella xylostella*

Symptoms of damage

- Whitish patches due to scrapping of epidermal leaf tissues by young larvae (Fig 40)
- The leaves give a withered appearance but in later stages larvae bore holes in the leaves.
- Leaves may be eaten up completely.
 - It also bores into pods and feeds developing seed

Identification of the pest

Larva - Yellowish green, with fine erect black hairs scattered all over the body.

Adult

- Small grayish brown having pale whitish narrow wings with yellow inner margins (Fig. 41)
- Forewings** - have three white triangular spots along the inner-margin.
- Triangular markings of opposite wings appear as diamond shaped

Hind wings – have a fringe of long fine hairs

Management

- Installing pheromone trap @ 5/ ac. to monitor the moth activity
- Collection and careful destruction of the larvae at gregarious stage at least twice a week.

□ Conserve *Cotesia plutellae*, as it is an important parasitoid for diamond back moth. *Diadegma insulare* is also the most important parasitoid of the diamondback moth For control of grown up larvae apply 5% malathion dust @ 37.5 kg/ha or 925 ml

Mustard sawfly: *Athalia lugens proxima*

Symptoms of damage

□ Initially the larva nibbles leaves, later it feeds from the margins towards the midrib.

□ The grubs cause numerous shot holes and even riddled the entire leaves by voracious feeding.

They devour the epidermis of the shoot, resulting in drying up of seedlings and failure to bear seeds in older plants.

Identification of the pest

Larva - Greenish black with wrinkled body and has eight pairs of pro-legs. On touch the larva falls to ground and feigns death.

Adult

Head and thorax is black in colour. Abdomen is orange colour. Wings are translucent, smoky with black veins

Management

□ Summer ploughing to destroy the pupa.

□ Early sowing should be done.

□ Maintain clean cultivation.

□ Apply irrigation in seedling stage is very crucial for sawfly management because most of the larvae die due to drowning effect. Severe cold reduces pest load.

□ Collection and destruction of grubs of saw fly in morning and evening

Conserve *Perilissus cingulator* (parasitoids of the grubs), and the bacterium *Serratia marcescens* which infect the larvae of sawfly.

Use of bitter gourd seed oil emulsion as an anti-feedant.

Spray the crop with malathion 50 EC @ 1000 ml/ha or quinolphos 25 EC @ 625ml/ha. should be applied in about 600 to 700 liters of water per ha.

Cabbage head borer: *Hellula undalis*

Symptoms of damage

Caterpillars initially mine the leaves and make it white papery.

Later they feed on leaves and bore into stems.

Entrance hole is covered with silk and excreta.

Painted bug: *Bargrada hilaris (cruciferarum)*

Symptoms of damage

Young plants wilt and wither as a result of the attack.

Adult bugs excrete resinous substances which spoils the pods.

Identification of the pest

Adult: Bug is black in colour with red and yellow lines

PESTS OF SESAMUM

Leaf webber, roller and capsule borer: *Antigastra catalaunalis*

Symptoms of damage

The young larvae roll together a few top leaves and feed them.

In the early stage of infestation, the plant dies without producing any branch or shoot. (Fig. 42)

In later stage of attack, infested shoots stop growing.

At flowering, larvae feed inside the flowers and on capsule formation, larvae bore into capsule and feed on developing seeds.

Identification of the pest

Larvae: Greenish in colour with black head having short white hairs

Adult: Medium sized moth with reddish yellow forewings. (Fig. 43)

Management

Early sown (first week of July) kharif crop is less infested than late sown crop.

Intercrop with mungbean, pearl millet and groundnut.

Two sprayings of quinalphos 0.05% at 30 and 45 days after sowing.

Two rounds of dusting with phosalone 4% or malathion 5% dust @ 25 kg/ha at 30 and 45 days after sowing.

Hawk or Dead head moth (Sphinx caterpillar): *Acherontia styx*

Symptoms of damage

Caterpillars feed on the leaves and defoliate the plant.

Identification of the pest

Larva: Stout, sturdy, greenish with oblique stripes and with a prominent dorsal curved anal horn on the 8th abdominal segment (Fig. 44)

Linseed gall fly: *Dasyneura sesame*

Symptoms of damage

Fully grown larvae make a hole in the bud and damage the flower.

PESTS OF SUNFLOWER

Capitulum borer (Head borer): *Helicoverpa armigera*

Symptoms of damage

The larva feeds on the developing seeds and bore the head.

Fungal developed and head starts rotting.

The larva consumes leaf in early stage of growth and move towards the capitulum and tunnel the head. (Fig. 45)

Identification of the pest and management (see cotton)

Tobacco caterpillar: *Spodoptera litura*

Symptoms of damage

- The larvae feed on the tender leaves, shoots, bracts and petals.
- Later, the larvae spread in the field causing defoliation. (Fig. 46)
- The larvae also feeds on the developing seeds in capitulum.

Identification of the pest and management (see cotton)

Leaf hopper (jassids): *Amrasca biguttula*

Symptoms of damage

- The adult and nymphs suck the plant sap.
- The infected leaves show pale yellow colouration.

In case of heavy infestation the leaves turn inwards.

The leaf edges may turn light pinkish brown.

Bird damage

Parakeet: *Psittacula krameri*

Symptoms of damage

- The birds damage starts from the milky stage and continues till harvest. (Fig. 47)
- These consumes on an average of 152 seeds/day.

Identification of the pest

It is slim, green parakeet with the typical short, heavy, deeply hooked, red bill. Hollow space in a tree trunk is the nest of the bid.

PESTS OF SAFFLOWER

Gram pod borer/ Capsule borer: *Helicoverpa armigera*

Symptoms of damage

- In early stage of crop growth larvae feed on leaves and shoot apices.
- Later, the larvae shift to the developing capitulum.

The symptoms are perforated leaves, perforated involucre bracts, partially or completely eaten capitulum in the bud stage and bored developing capitulum.

Safflower caterpillar: *Perigaea capensis*

Symptoms of damage

- The larva feeds on the leaves and sometimes on capitulum too.

It also feeds on bracts, flowers, capsules. (Fig. 48)

Identification of the pest

Larva: Stout, green and smooth. The anal segment is humped and the body has some purple markings.

Adult - Dark brown in colour, medium sized moth on; Forewings are dark brown with pale wavy marks; Hind wings are light brown.

Management

- Intercropping with non-host crop like wheat.
- Excessive application of nitrogen should be avoided.

Spraying of fenvalerate 20 EC @ 250 ml/ha.

Capsule fly/Safflower bud fly: *Acanthiophilus helianthi rossi*

Symptoms of damage

- Newly hatched larvae feed on the soft parts of the capsules
- Affected buds show small bore holes

The infested buds rotten with a foul smelling ooze coming out of the apices

PESTS OF PULSES

Gram pod borer: *Helicoverpa armigera*

Symptoms of damage

- Defoliation in early stages
- Larva's head alone thrust inside the pods and the rest of the body hanging out. (Fig. 49) Pods with round holes

Identification of the pest

Eggs – are spherical in shape and creamy white in colour, laid singly

Larva - shows colour variation from greenish to brown. Green with dark brown grey lines laterally on the body with lateral white lines and also has dark and pale bands.

Pupa – brown in colour, occurs in soil, leaf, pod and crop debris

Adult - light pale brownish yellow stout moth. Fore wing grey to pale brown with V shaped speck. Hind wings are pale smoky white with a broad blackish outer margin.

Spotted pod borer: *Maruca testulalis*

Symptoms of damage

- Bore holes on the buds, flower or pods
- Infested pods and flowers are webbed together. (Fig. 50)

Identification of the pest

Larva - Greenish white with brown head. It has two pairs of dark spots on the back of each segment

Adult - Forewings- light brown colour with white markings; **Hindwings**

– white colour with brown markings at the lateral edge

Symptoms of damage

- Dropping of flowers and young pods

Older pods marked with a brown spot where a larvae has entered

Identification of the pest

Larval – greenish initially, turns pink before pupation.

It has 5 black spots on the prothorax

Adult

- Brownish grey moth
- Prothorax** – orange in colour

Fore wing - has a white stripe along the anterior margin

Blue butterfly: *Lampides boeticus*

Symptoms of damage

- Buds, flowers and young pods with boreholes
- Presence of slug like caterpillar.

Honey dew secretion with black ant movements

Identification of the pest

Larva – It is flat and slightly rounded; Pale green with a rough skin.

Adult - moth is greyish blue with prominent black spots in the hind wings and a long tail; Ventral side of wings with numerous stripes and brown spots (Fig. 51).

Bean Aphids: *Aphis craccivora*

Symptoms of damage

Leaves, inflorescence stalk and young pods covered with dark coloured

- aphids

Honey dew secretion with black ant movements

Identification of the pest

Nymphs and Adult – dark coloured with cornicles in the abdomen

Leaf hopper: *Empoasca kerri*

Symptoms of damage

- Leave mottled and yellowish in colour

Green colour insects found under surface of leaves

Identification of the pest

Adult – **elongate**, active, wedge shape, green insects

Pod bugs: *Riptortus pedestris*

Symptoms of damage

- Pods with black spots
- Shedding of green pods

Poorly filled pods with shriveled grains inside

Identification of the pest - *Riptortus pedestris*

- Brownish black and hemispherical
- Nymphs – resemble dark brown ants

Stem Fly: *Melanagromyza spp*

Symptoms of damage

- The eggs are laid on leaves.
- After hatching from the egg yellowish maggots bore the nearest vein of the leaf.
- The maggot then reach the stem through petiole and bore down the stem.
- If the infected stem is opened by splitting, distinct zig zag reddish

tunnel can be seen with maggot or pupae inside it. (Fig. 52)

The maggots feed on cortical layers of the stem, may extend to tap root, killing of the plant.

Identification of the pest

Maggot: White in colour and remains inside the stem.

Adult: Flies are shining black and about 2 mm long.

Management

- Deep summer ploughing.
 - Avoid pre monsoon sowing.
 - Use optimum seed rate and plant spacing.
 - Proper crop rotation with dissimilar crops should be followed.
 - Remove and destroy the damaged plant parts.
 - Spray monocrotophos 36 WSC @ 1 l/ha, twice, at the crop age of one and three weeks. In case of severe infestation, apply phorate in the soil @ 10 kg/ha before sowing.
 - Soil application of phorate 10 G @ 10 kg/ha or carbofuran 3 G @ 30 kg/ha at the time of sowing will prevent early infestation by stem fly.
- One or two sprays of dimethoate 30 EC or 0.05% quinalphos 25 EC can stop the damage.

PESTS OF SUGARCANE

Early shoot borer: *Chilo infuscatellus*

Symptoms of damage

- Dead heart in 1-3 months old crop, which can be easily pulled out
- Rotten portion of the straw coloured dead heart emits an offensive odour (Fig. 53)

Bore holes at the base just above the ground level (Fig. 54)

Identification of the pest

Larva - Five dark violet stripes and dark brown head(Fig. 55)

Adult - Pale greyish brown moth with white hind wings(Fig. 57)

Management

- Early planting during main season.
- Intercrop: Daincha – low shoot borer incidence
- Trash mulching: 10 – 15 cm thickness on 3 days after planting
- Earthing up: 45 th Days After Planting (DAP).
- Remove and destroy dead hearts
- Spray Granulosis virus 106 – 107 twice on 35 and 50 days after planting (DAP)
- Tachinid parasite: *Sturmiopsis inferens* @ 125 gravid females from 30-50 days of planting
- Whorl application: Sevidol 4G @ 12.5 kg or Soil application: Carbofuran 3G @ 33 kg/ ha or chlorpyrifos @ 12.5kg/ ha
- Spray chlorpyrifos 20 EC @1000 ml / ha or NSKE 5 % twice.

Stem or internode borer: *Chilo sacchariphagus indicus*

Symptoms of damage

- Internodes constricted and shortened with a number bore holes and frass in the nodal region (Fig. 57
- Affected tissues reddened(Fig.)

Identification of the pest

Larva - four violet or pink stripes and light brown head

Adult - Pale brown with white hind wings

Management

- Collect and destroy the eggs periodically
- Detrash: 150 and 210 DAP

- Avoid use of excessive nitrogen fertilizers
- Egg parasitoid: *Trichogramma chilonis* @ 2.5 c.c / ha (6 releases from 4th month onwards at 15 days interval)

Top shoot borer: *Scripophaga excerptalis*

Symptoms of damage

- Parallel rows of shot holes in the emerging leaves and (Fig. 60)
- Red tunnels in the midribs of leaves
- Dead heart in grown up canes which cannot be easily pulled
- Dead heart reddish brown in colour
- Bunchy top due to growth of side shoots (Fig. 61 & 62)

Identification of the pest

Larva - Smooth, white or cream coloured with a red coloured mid dorsal line

Adult - White coloured moth. Female has buff coloured anal tuft in abdominal tips

Management

- Collect and destroy the egg masses
- Release Ichneumonid parasitoid: *Isotima javensis* @ 125 females / ha (prepupal parasitoid) [NOTE: fields showing more than 10 percent top borer infestation.

Leafhopper: *Pyrilla perpusilla*

Symptoms of damage

- Leaves become yellow
- Covered with black sooty mould
- Top leaves get dried up and lateral buds germinate

Scale insect: *Melanaspis glomerata*

Symptoms of damage

- Dark encrustations on the internode

Identification of the pest

- Greyish black or brown circular scale

Woolly Aphid: *Ceratovacuna lanigera* ; *C. graminum*

Symptoms of damage

- Nymph and adults suck the sap from leaves
- Honey dew excrete – development of sooty mould fungus
- White chalk powder coating on the ground and leaves.

Identification of the pest

Nymph - Third and fourth instar nymphs covered with white wooly secretion

Adult - Apterous adults covered with white wooly secretion

Ceratovacuna lanigera - Light green colour

- C. graminum* - Light yellow in colour. Winged adult is black in colour

Termite: *Odontotermes obesus*

Symptoms of damage

- Poor germination of setts (After Planting)
 - Characteristic semi- circular feeding marks on the leaves in the standing crop (Fig. 65)
 - Entire shoot dries up and can be pulled out easily (Fig. 66)
 - Setts hollow inside and may be filled with soil
 - Cane collapses if disturbed
 - Rind filled with mud

Root grub: *Holotrichia consanguinea*; *H. serrata*,

Leucopholis lepidophora

Symptoms of damage

- Yellowing and wilting of leaves
- Drying of crown
- Affected canes come off easily

Identification of the pest

i) *Holotrichia consanguinea*; *H. serrata*,

- **Egg** - White, almost round.
- **Larva** - Young grubs are translucent, whitish yellow in colour, fleshy

‘C’ - shaped

- **Adults** - Dark brown beetle

Management

- Set up light trap
- Provide adequate irrigation
- Crop rotation in endemic areas
- Collect and destroy the adult beetles present on neem, Ailanthus and Acacia