

**B.Sc. Horti. VIth Sem.
Insect pests of Vegetable,
Ornamental, and spice
crops (PPH-322)**

Topic name : Major insect pest of potato and their management



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INTRODUCTION

POTATO (*Solanum tuberosum*)

- In India, potato is grown in tropics as well as in sub-tropics in the cool season.
- About 86% of the crop is grown in the plains during under short-day conditions, about 8% in the hills during summer under long day conditions and around 6% in the plateau during the rainy season.
- It is a staple food of common masses in India.
- Though *India is the largest producer of potato* yet its productivity is lower as compared to potato producing countries of Europe.
- One of the major constraints of low productivity is the insect pests.
- About fifty insect pests in India have been reported attacking potato crop directly or indirectly. Potato crop is infested about by one dozen pests.
- The important pests of the autumn crop are jassids, aphids, tobacco caterpillar & hadda beetle. In the case of the spring crop, besides aphids, the other most important pests are cut worms.

Insects of Potato

COMMON NAME	SCIENTIFIC NAME	ORDER	FAMILY
Aphids	<i>Myzus persicae, Aphis gossypii</i>	Hemiptera	Aphididae
Tuber Moth	<i>Pthorimaea opercullela</i>	Lepidoptera	Gelechiidae
Cut worms	<i>Agrotis segetum, A. Ipsilon</i>	Lepidoptera	Noctuidae
White fly	<i>Bemisia tabaci</i>	Homoptera	Aleurodidae
Leaf hopper	<i>Amrasca biguttuia biguttula</i>	Homoptera	Cicadellidae
Tobacco caterpillar	<i>Spodoptera litura</i>	Lepidoptera	Noctuidae

Major Insects of potato

POTATO TUBER MOTH

S.N. - *Phthorimaea operculella* (Zeller)

Order -Lepidoptera

Family -Gelechiidae

Area of distribution-This insect is not native of India but was *first introduced in Bombay from Italy (exotic pest)* about 75 years ago. In India, it is reported in Uttar Pradesh, Maharashtra State, Bihar, and Punjab.

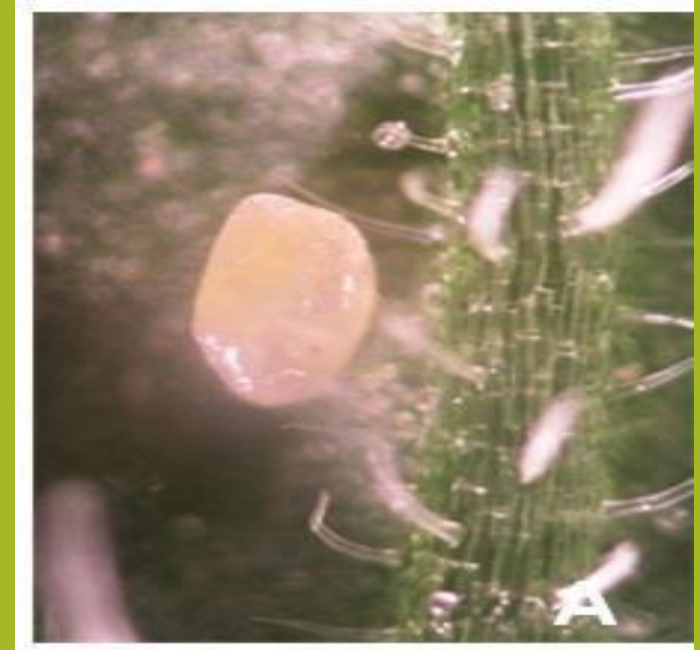
Introduction of Insect and host range:-

This pest occurs especially in hot and dry climates.

- The range of hosts is limited to the family Solanaceae. The most commonly attacked plants of economic importance are potato, tobacco, egg-plant, and, occasionally, tomato.
- It is serious both in field and storage but particularly more serious in storage.
- In the plains it is active throughout the year and passes its life cycle on potato plants in the fields from November to March as a leaf miner or boring into petioles, terminal shoots and tubers underground, and from April to November in storage.
- It has been said that 30-70% tubers get infested under indigenous methods of storage, but in bad case 90% damage is also reported in storage, if not properly attended.
- The temperature 86 to 100°F is found most congenial for the pest activity.

Eggs

- When foliage is not available potato tuberworm moths can crawl a short distance through cracks in loose soil to find a tuber they will use as an oviposition site.
- In four days, the adult female can deposit 60 to 200 eggs singly or in small clusters directly on host plant parts such as the stem, underside of leaves or in the eye cracks and indentations on tubers.
- Eggs are smooth, oval, and can be pearly white to yellowish (before hatching) in color. The eggs usually hatch after five days



Larva

- Larvae are 0.5 to 0.6 inch long, white or yellow with a brown head and prothorax (midsection of the insect body) (**Raman 1980, Alvarez et al. 2005**).
- The thorax has small black points and bristles on each segment.
- The color of larvae changes from white or yellow to pink or green as they mature.
- The larvae feed on their host plants for up to two weeks before pupation.
- The larva [caterpillar] on hatching is 1-2 mm long and grows through four instars [stages] to reach a length of 15-20 mm.
- *Young larvae are grey or yellow-white; mature, healthy larvae are tinged with pink or green. All instars have a dark brown head.*
- Larval period: 16-24 days.



Larva of the potato tuberworm, *Phthorimaea operculella* (Zeller).

- Pupae are formed in a silken cocoon covered with soil particles and debris for camouflage. Pupation [change from a larva to a pupa] occurs among dead potato leaves, on the soil, or on stored potato tubers. Pupal period: 6-9 days.
- As many as 6-8 generations may occur in the field during summer.
- *As the temperature drops the population declines*, and the duration of the life cycle gradually lengthens.
- In stored potatoes the population continues to breed all the year round, the length of the life cycle depending on storage temperature.



Late larval instars and pupae of the potato tuberworm,
Phthorimaea operculella (Zeller) on a damaged potato.

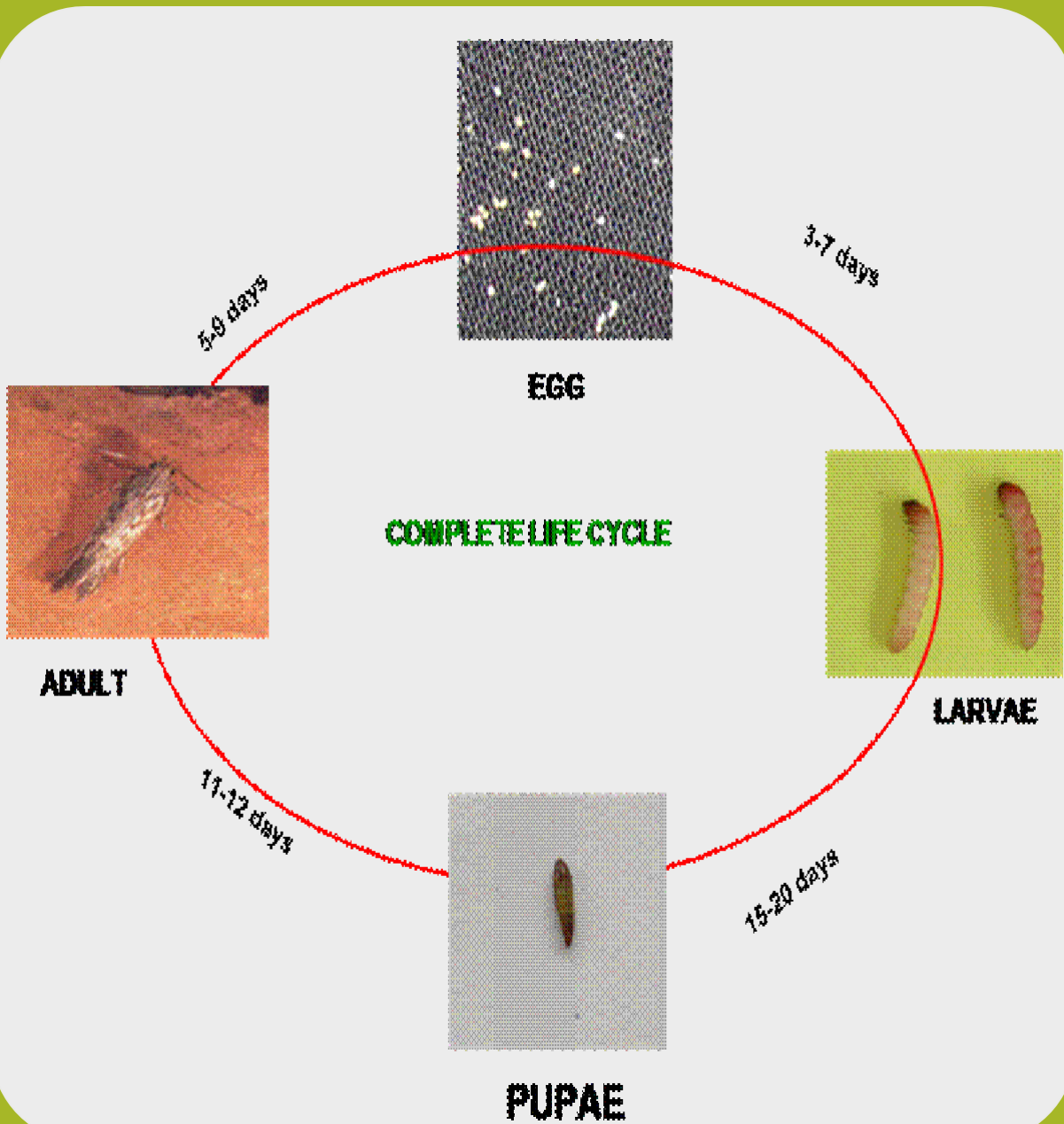
Adult

- The moths are narrow bodied, silver grey in color, 0.4 inch long with a wing span of 0.5 inch.
- Wings are grayish-brown, fringed and elongate with small brown or black markings.
- Both pairs of wings have fringed edges. At rest, the wings are held close to the body giving the moth a slender appearance.
- The forewings are yellowish grey with dark spots (2-3 dots on males and characteristic “X” pattern on females); the hind wings are grey (**Raman 1980, Alvarez et al. 2005**).
- The adults are fast fliers and like most other moths require an insect-collecting net for capturing.
- These moths live for one to two weeks, are crepuscular (active at dawn and dusk), and feed on nectar.
- Females are slightly larger than males. Mating begins 24 hours after emergence.



The potato tuberworm, *Phthorimaea operculella* (Zeller) adults. The forewings have 2-3 dark spots on males (right), and a characteristic “X” pattern on females (left).

Life cycle



- The adult potato tuber *moth has a narrow silver-grey body and greyish-brown wings patterned with small, dark specks.*
- The body length is about 10 mm and the wing-span is about 12 mm. The moths are active *mainly at dusk*, but during the day can be seen *flying sporadically within potato crops.*
- The oval eggs are laid singly on the underside of potato leaves and on exposed tubers.
- When first laid they are pearly white, changing to yellow on maturity and to black just before hatching. Egg period: 2-6 days.
- The larva [caterpillar] on hatching is 1-2 mm long and grows through four instars [stages] to reach a length of 15-20 mm.
- *Young larvae are grey or yellow-white*; mature, healthy larvae are tinged with pink or green. All instars *have a dark brown head.* Larval period: 16-24 days.

Nature & symptoms of damage:

- Both foliage and tubers suffer extensive damage.
- This is caused by the larvae, which normally spend their entire lives in either one of these food sources; the only exception to this is when infested foliage is destroyed, forcing larvae to abandon it and search for tubers.
- In early stage of the crop growth, the *pest is injurious to the plant as leaf miner. Foliage-mining by larvae create transparent leaf blisters.* Foliar infestation may be sufficiently severe to destroy the plant.
- It also *bores into petioles (leaf stalks) and terminal shoots.*
- The main danger is to tubers both in the field and under storage.
- *Tuber-mining larvae usually enter through the "eyes" from eggs laid nearby, and make slender, dirty-looking tunnels throughout the tuber.*
- The caterpillars bore the tubers and feed, as a result of damage, the potato tubers rot.
- The presence of black excreta near the eye buds helps to detect its presence in the tubers.
- On cutting such tubers one can find the larva in the pulp.
- High levels of tuber infestation occur in the field during summer, and *stored potatoes can suffer severe damage all the year round.*



Damage on potato tuber caused by *Phthorimaea operculella* (Zeller)



Leaf mines caused by the potato tuberworm, *Phthorimaea operculella* (Zeller).

Management in field:

- *Timely earthing-up of the crop to cover the exposed tubers helps in reducing the intensity of infestation.*
- *Two sprays with 0.05% quinalphos, 0.1% carbaryl at 15 days interval starting 60 days after planting controls the pest effectively.*
- *Heaps of harvested potatoes should not be kept exposed in the field but covered with straw and *infested tubers should be rejected before storage.**
- *Experience with *Copidosoma koehleri* B. an egg-larval parasite of potato tuber worm found to reduce the pest infestation by 50-55% when released at the rate of 20,000 mummies/ha at 7 days interval starting 45 days after planting.*

Management in storage:

- Construct potato stores away from godowns.
- The potatoes should be stored in well-ventilated cool and dry places with temperature not exceeding 21⁰C.
- Walls of godown should be sprayed with 1% Malathion at an interval of three months.
- Dispose infested potatoes before storage.
- *Cover tubers with a thin (2.5-5.0 cm) layer of dry sand, during storage.* The surface of sand cover of the potatoes should be dusted with one 1% malathion dust.
- In case of large quantities and where fumigation facilities are available, it is ideal to fumigate the produce with methyl bromide @ 2.5 to 5.0 kg/100 cm for 3 hours.
- Treatment of seed potato tubers with 5% Malathion at the rate of 125 gm/100kg is also reported to offer good protection against the pest. Such treated potatoes, however, should not be used for consumption.
- If cold storage facilities are available, the produce can be safely stored for a longer period.
- Fumigate the tubers with CS₂ at the rate of 1kg/27 cu.m for 48 hours at 70⁰F or ethyl bromide at the rate of 1 kg/27 cu.m for the least three hours before storage.

Aphids (*Myzus persicae*, *Aphis gossypii*)

Order - Hemiptera

Family- Aphididae

Introduction:

The two most common aphids on potatoes are the green peach aphid and the potato aphid. Both species occur statewide. The green peach aphid is usually the most common and abundant species; infestations typically begin on the bottom most leaves of the plant. Potato aphid infestations are generally scattered over the plant.

Winged adults of the green peach aphid are pale or bright green and black, with a large, dusky blotch on the dorsum of the abdomen. The immature forms are yellow, pinkish, or pale green. The mature, wingless forms are pale or bright green. Pink and green forms of the potato aphid are found in potatoes. This aphid is larger than the green peach aphid with longer cornicles and legs. Potato aphid colonies are made up of adults with offspring closely clustered together. The two species can be most reliably distinguished by looking at the tubercles between the base of the antennae. The tubercles of the potato aphid slope outward and those of the green peach aphid converge.

Damage symptoms:

Direct damage: Aphids damage plants by puncturing them and sucking their juices. They damage the young and soft parts of plants, such as new leaves and shoots. Signs of damage are leaves not opening properly and being smaller in size. Severe infestation can cause shoots to wilt and dry out.

Indirect damage:

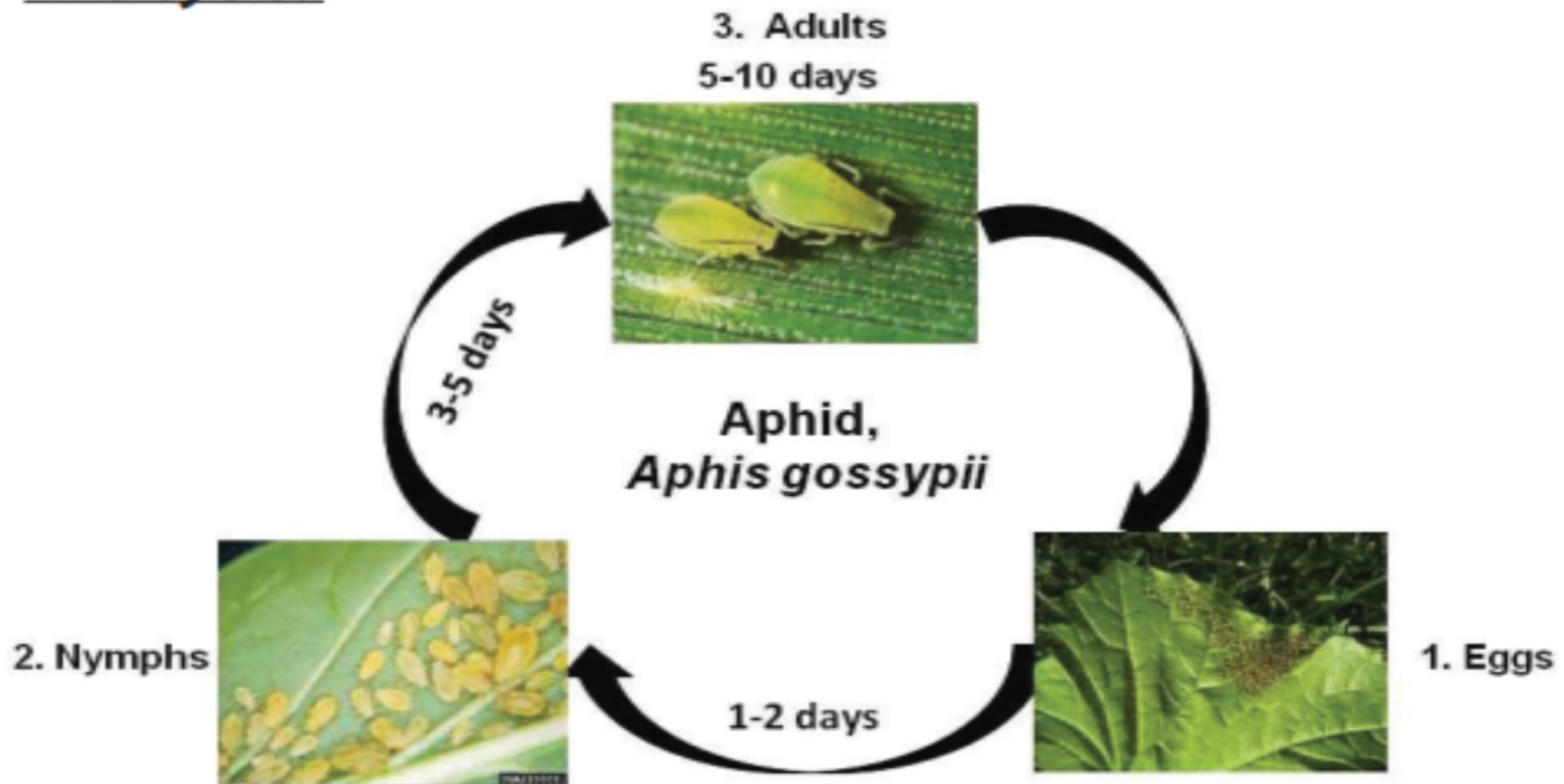
Aphids have wings and can move from plant to plant spreading viral diseases, picked up from infected plants. Aphids secrete a sugary liquid that stimulates black sooty mold growth. It can cover the surface of leaves which affects the way they absorb sunlight.

- Favorable conditions:**
- A relative humidity of 66 + 2.8% and 11 – 140 C temperature are ideal for development of this aphid.
 - Its population sharply decreases with increase in RH over 73 percent.

Biology:

- Aphids reproduce in two ways: by laying eggs and giving birth to young ones. Which birth process is used depends on environmental conditions and the availability of food.
- When food is plentiful, aphids give birth to live young. Populations develop quickly as this pest has many young ones, a short lifespan and pre-adult insects can also give birth.
- Eggs hatch after three or four days. Young aphids, called nymphs, need five to eight days to become adults.

Life cycle:



Management of aphid

Cultural control:

- Use healthy seed, hot and cold weather cultivation, green manuring, irrigation, fertilizer application.
- Plant early bulking and/or maturing cultivars to help seed production programme in areas having short aphid-free periods so that the seed crop may escape the population pressure of aphid vectors.

Biological control:

- **Natural enemies of aphid:** Parasitoids: *Lysiphlebus sp.*, *Diaeretiella sp.*, *Aphelinus sp.*, *Aphidius colemani* etc.
- **Predators:** Ladybird beetle, lacewing, spider, hover fly etc.
- Spray NSKE 5%.

Chemical control:

- Apply carbofuran 3% CG @ 6.64 Kg/ acre or oxydemeton–methyl 25% EC @ 0.4 l in 200- 400 l of water/acre or thiamethoxam 25% WG @ 40 g in 200 l of water/acre or phorate 10% CG @ 4 Kg/ acre or soil drenching of thiamethoxam 25% WG @ 80 g in 200 l water/ acre for aphid control.
- Spray carbofuran 3% CG @ 1.328 Kg/ acre for controlling leaf hopper.
- Spray dimethoate 30% EC @ 264 ml in 200- 400 l water/acre for controlling thrips.

Cut worms (*Agrotis segetum*, *A. Ipsilon*)

Order- Lepidoptera

Family- Noctuidae

Description of the Pest

The most common species encountered are the black cutworm and the variegated cutworm. The adults are dull-colored brown to grayish moths. The larvae are usually earthen-colored with various stripes or spotted color patterns. They are smooth-bodied worms that may be 2 inches in length when mature. Many species curl into a C-shape when disturbed.

Damage symptoms:

- These pests damage plants and tubers during dark.
- They attack young plants by severing their stems, pulling all parts of the plant into the ground and devouring them.
- Plants with severed stems have difficulty growing again.
- This pest can cause serious damage; particularly when crops are at 25 – 35 days after planting.
- Signs of damage on tubers are bore holes larger than those made by potato tuber moths.

Favorable conditions:

- Persistent dry weather with lesser or no rainfall, reduced humidity & 16 - 23 OC temperature favor the development of cutworm.



Tubers and leaf showing damage symptoms

Biology of cutworm:

Cutworms damage potato plants, and affect almost all types of plants including weeds. Cutworms reproduce by laying eggs. Their life cycle includes eggs, larvae, pupae and moths. It takes up to 36 days for them to develop from eggs to adult insects. The various stages display the following characteristics:

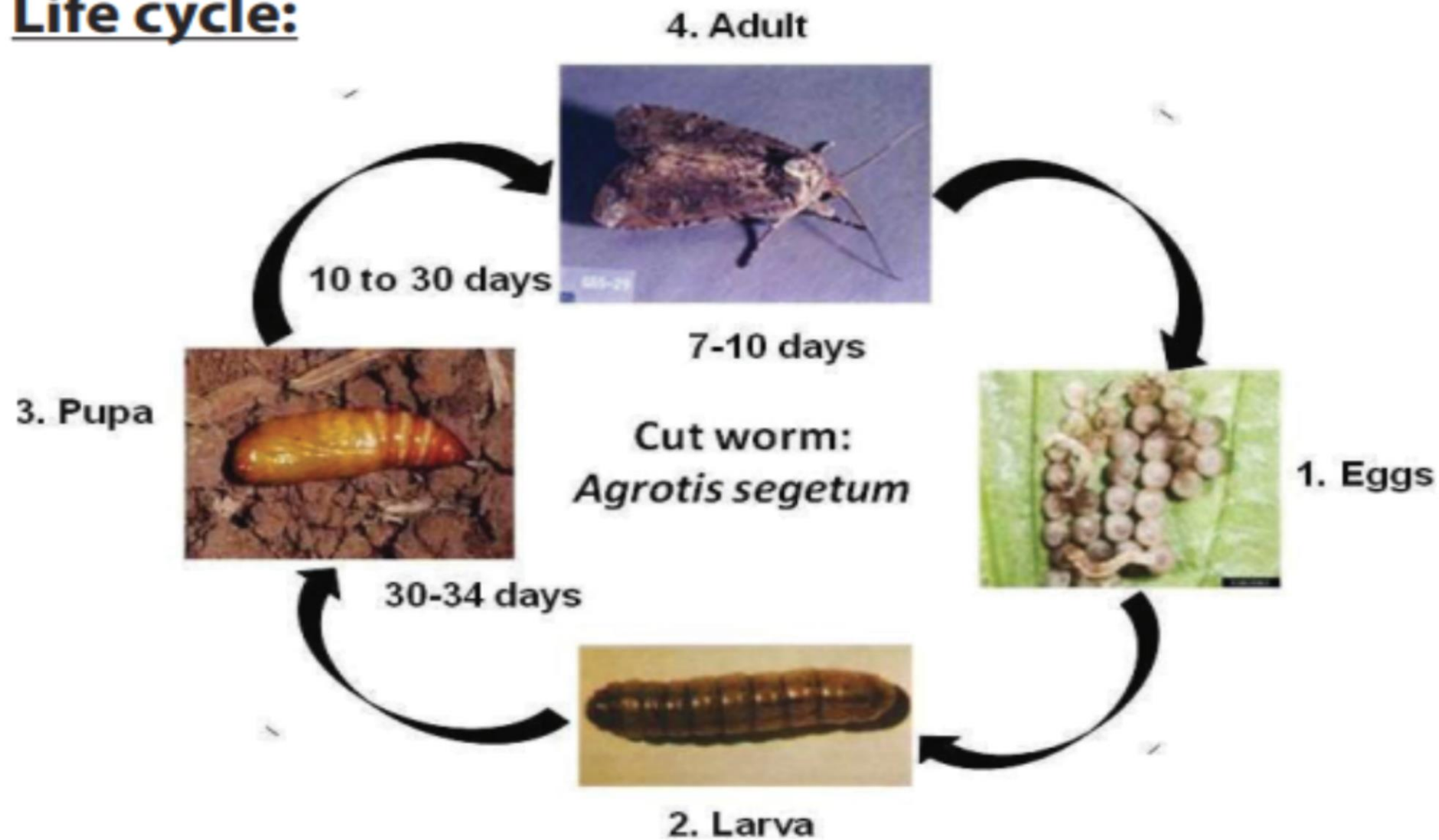
Egg: Eggs are creamy white, dome-shaped laid on the surface of the soil, but are very difficult to see. Each female moths come out at dusk and lay eggs (200-350) in clusters of about 30 each, either on the under surface of the leaves of host plants or in the soil.

Larva: Newly emerged young larva is yellow or blackish- green in colour, 1.5 mm long with a shiny, black head and a black shield on the prothorax. The full-grown larva is about 42-45 mm long and is dark or dark brown with a plump and greasy body and lives in the soil. They have striped markings running down the sides of their bodies. The larval stage varies from 30-34 days,

Pupa: Pupae are brown to dark brown, about 1.5 to 2.0 cm in length and are usually found in or on piles of leaf mould. Pupation takes place underground in an earthen chamber is completed in 10 to 30 days **Adult:** It measures about 25 mm from the head to the tip of the abdomen and looks dark with some grayish patches on the back and dark streaks on the forewings.

Adults live for 7-10 days. The moths usually emerge at night. The life cycle is completed in 48 to 77 days. This pest generally completes three generations in a year.

Life cycle:



Management:

- Flood the infested fields
- Handpick and destroy the larvae in morning and evening hours on cracks and crevices in the field
- Plough the soil during summer months to expose larvae and pupae to avian predators
- Set up light trap @ 1/ha
- Pheromone traps @ 12/ha to attract male moths
- Spray insecticides like chlorpyrifos 20 EC @ 1 lit/ha or neem oil @ 3%

Thank you