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CHIKKODI – 591201 District – Belagavi (Karnataka state, India)
(ACCREDITED AT 'A' GRADE BY NAAC WITH CGPA OF 3.26 IN THE THIRD CYCLE)

Department of Zoology (2019 – 20)

PROJECT WORK COMPLETION CERTIFICATE

This is to certify that following eight B.Sc Final year students have undertaken the project entitled Crop Damaging Insects in-partial fulfillment of the syllabus of Rani Channamma University, Belagavi during the year 2019-20. Following eight students have together successfully completed the said project under the guidance of Dr Sridevi I Puranik.

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5	Miss.	Akshata Mirje	Anil	146	S1715611
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7	Miss.	Sonali Mali	Ganapati	186	S1715797
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PROJECT GUIDE

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We extend our warm gratitude to the Head of the Dept. of Zoology, **Dr. N. R. Birsal** Sir for his support and encouragement for this project.

We are thankful to our guide **Prof. S. I. Puranik** madam for her excellent guidance. We are also thankful to our teaching staff for their support.

We thank all the group members and friends who worked together to make this project educative and informative.

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INTRODUCTION

As we know India is an Agriculture based country and the farmers are known as 'ANNADATAS' (The one who provides food) as all we depend on them directly or indirectly for food. Some of the farmers are totally depended on Agriculture for their livelihood (Clement, 2019).

Now-a-days, unfortunately our ANNADATA is suffering from many problems, which are affecting the crops and ultimately the yield and income of those farmers. These problems are mainly classified as Abiotic and Biotic.

Abiotic Problems

- Low precipitation
- Failure of proper irrigation methods
- Adverse climatic conditions
- Loss of soil fertility due to chemical fertilizers
- Improper agricultural practices, etc.

Biotic Problems

- Fungal infections.
- Bacterial infections.
- Viral infections.
- Pests.
- Rodents.
- Insects.

These biotic damagers mainly infect the green tender leaves, shoots, flowers and sometimes fruits for their survival i.e. for nutrition and shelter which ultimately results in the low yield sometime complete loss of crop.

Many types of insects have the potential to damage fruit and the vegetable crops. Various grasshoppers, weevils, beetles and small insect like trips and certain fly larvae can causes significant damage. Among the most common types of detrimental insects are the Lepidoptera (moths, butterflies) and the Homoptera (aphids, leafhoppers) (Douglas, 2018).

Damage caused by moth larvae often consists of ragged, chewed leaf edges or holes in leaves. Homopteran insects like aphids are often difficult to see without a magnifying lens but their

damage can be recognized by yellow speckles accompanied by a sticky film on leaf surfaces. Other insects cause various types of damage including defoliation, stem and fruit tunneling.

When investigating insect damage look for weak or stunted plants with damaged leaves or fruit. Check the base of plant near the ground and check the undersides of the leaves for insects and insects' eggs. Often the best time to spot insects in the process of feeding is at dusk, or in the early morning. Many insects are beneficial either for crop pollination or as predators of nuisance insects. Never use pesticides on an insect you cannot identify, and only use pesticide labeled for that particular insects (James, 2019).

Insect and disease complexes pest and disease problems in plants are often the result of more than one cause. These are called as 'Complexes'. For example, Aphids and leafhoppers often spread various plant diseases in the process of feeding. Or weak plants in nutrient deficient soils are sometime more susceptible to attack by various diseases and insects. In such cases it is not enough to simply treat a crop with a pesticide or fungicide (Kross *et al.,* 2019). Instead all causes of the complex should be addressed

Many insects and disease problems are preventable by maintaining proper crop health. It includes,

- Crop rotation
- Quarantine methods
- Disease resisting crop varieties
- Maintaining of proper soil nutrients
- Proper irrigation techniques
- Practice sanitation.

Information on specific insect and disease problems of some common crops can be found in the "Diagnostic Key Section". While the insects and diseases featured in the Diagnostic Key are by no means the only ones in Minnesota (Li *et al.,* 2020).

In this project, we are mainly dealing with some of the crop damaging insects, their effects on plants, their control measures and integrated pest (insect) management.

Black cutworm

Classification

Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Family	Nocetuidae
Genus	Agrotis
Species	ypsilon

Black cutworms are most often found in corn and cotton, yet it can cause problems in wheat, tobacco and some vegetable crops. Even though severe infestations rarely occur, Black cutworms should be on farmer's list of corn insects' pests to monitor.

Insect Black cutworm larvae spend the day just beneath the soil surface, feeding on corn and cotton seedlings, which then likely wilt and die. When soil moisture is adequate, the larvae climb to just above the soil surface at night to feed cut off the young plants at the base. Although plant loss in infested corn fields can range from 10% to 80%, a complete field loss is unlikely. Severe Black cutworm damage usually only occurs in patches within a field (Miller *et al.*, 2019).

Scouting

Being scouting for black cutworms soon after crop emergence. Look just below the soil surface where black cutworms can chew into seedling and pull it under a soil clod or a hole to feed on it. Pay extra attention to late planted fields and those with early season weeds.

Identification

Black cutworms are a common corn pest throughout the corn Belt and in the South. The black cutworm's species ranges from light grey to black in color, and larvae are 1-1/2 inches long when fully grown.

More than 45 days are required for eggs to develop into a larvae and adult moths after the pupal stage, adult moths emerge and lay eggs on surrounding weeds, patches of grass and crop residue.

Life Cycle

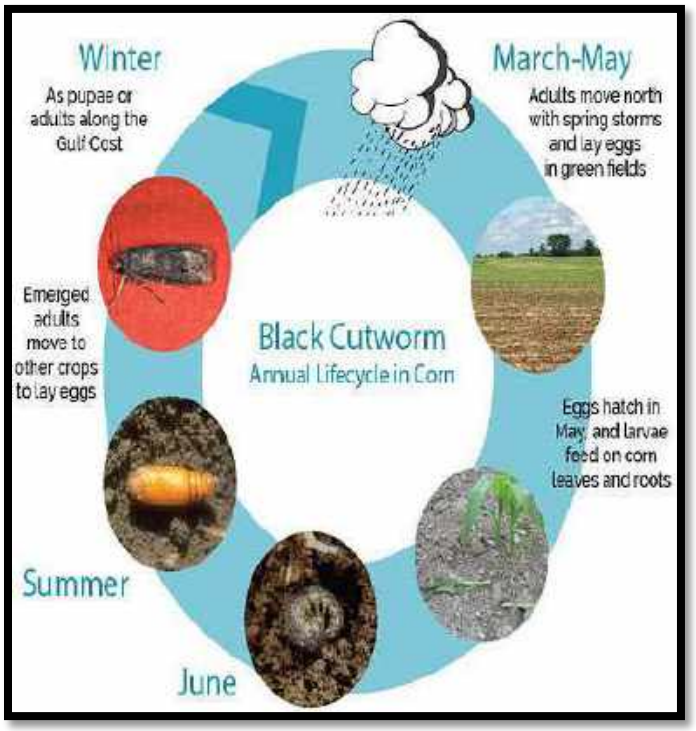


Figure 1. Life cycle of Black cutworm (Du Point Pioneer)

Best Management practices to control Black cutworm

In no-till or limited-till situations, Black cutworms may become established in the soil, overwinter and feed on newly planted seedlings. Because a wide variety of vegetation-including redroot pigweed and other weeds are hosts for black cutworm, remove existing crop residue through tillage, a burn down herbicide and residual pre plant herbicides taking out.

Taking out existing vegetation prior to planting will also provide better penetration 0f insecticide spray or granules. Season –long weed control helps prevent black cutworms from causing crop damage and harming yields and will help improve effectiveness of in – season insecticide treatment

The best approach to managing black cutworms in corn in prevention.

Aphis craccivora

Classification

Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Hemiptera
Family	Aphididae
Genus	Aphis
Species	craccivora

Aphis craccivora, variously known as the cowpea aphid, groundnut aphid or black legume aphid, is the true bug in the family aphididae. Originally of probable palearctic origin, it is now an invasive species of cosmopolitan distribution.

Aphis craccivoraia a small species of aphid. The female has a glossy black or dark brown body with prominent cauda (tail-like protrusion), and legs in some shade of brown or yellow. The antennae have six segments and there and the limb segments, cauda and cornicles are pale proximally (close to the body) and dark distally (further from the body). The adults do not have wax on their dorsal surface but the nymphs are lightly dusted with wax. Winged females are upto 2.2mm (0.1in) long and have cross-barring on the abdomen. Wingless females are a little smaller.

Life cycle

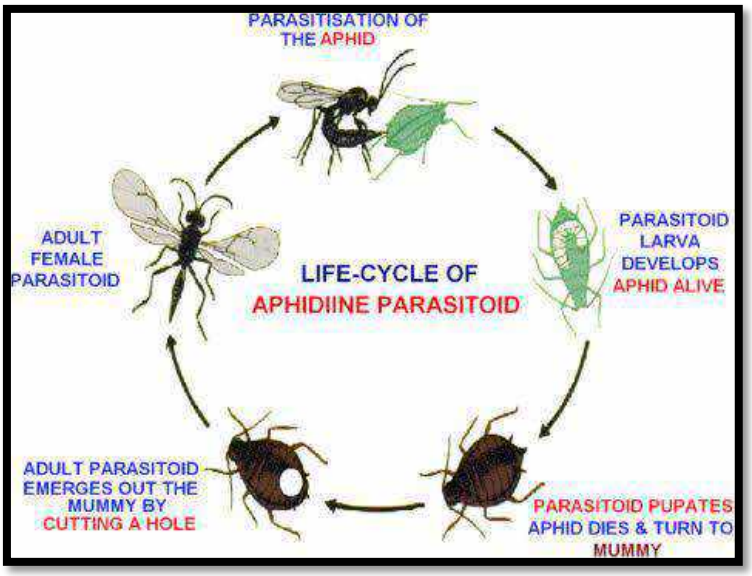


Figure2. Life cycle of Aphis craccivora (Source:ScienceDirect.com)

In the former USSR, Aphiscraccivora overwinters as eggs, often at the base of young alfalfa plants, but is also reported to overwinter on Acacia, camelthorn and perennial weeds. The eggs hatch in early spring and the first larvae are known as fundtrix (stem mothers) and feed at first on alfalfa. These aphids are all female and reproduce by parthenogenesis, producing nymphs which moult four times over the course of eight to twelve days. By and of April, winged females have migrated to other host plants, often Acacia, and later to cotton, on which crop this pest does much damage. It may move back to alfalfa later in the year in delarus, lupine is an important host plant and in Ukraine, Acacia is most affected. A female aphid lives for 9 to 25 days and can produce from 25 to 125 young during its life. There may bi up to Twenty generations in the year.

BY November winged forms have developed and eggs are laid before winter sets in. In warmer climates, parthenogenetic reproduction takes place throughout the year. The winged male insects are seldom encountered but have been observed in Germany, India and Argentina. The aphids tend to concentrate on the growing tips of plants, Young leaves, shoots, flowers and developing seed pods. They are often tended by ants which feed on the secretions they produce and deter predatros. Natural enemies include parasitic wasps, ladybirds, lacewing larvae and hoverfly larvae.

Control measures

Aphis craccivora Koch, is an important pest of cowpea Vigna unguiculata (L. Walp.) in most tropical regions where cowpea is grown. We used life table and population parameters of the cowpea aphids reared on five cowpea varieties to assess the degree of host plant resistance. The five varieties were Blackeye, B005-C, INIA-37, IT835-720-20 and TVX3671-14C-OID. The parameters measured were fecundity, survival, intrinsic rate of natural increase, pre-reproductive period and relative growth rate of cowpea aphids. Our hypothesis was that cowpea varieties resistant to *A. craccivora* would have significant effects on life table parameters of the aphid when compared to a susceptible variety. Mean fecundity, age-specific fecundity, and survival rates, intrinsic rate of natural increase (r m), pre-reproductive period and relative growth rate differed significantly among varieties (Sharma *et al.*, 2017). Fecundity, survival, intrinsic rate of natural increase and mean relative growth rate were significantly lower on variety IT835-720-20 compared to susceptible variety Blackeye. The pre-reproductive period was significantly delayed on variety IT835-720-20 compared to other varieties. The adverse effects of variety IT835-720-20 on life table parameters of *A. craccivora* indicate the presence of host plant resistance. Prolonged pre-reproductive period and reduction in reproductive performance of *A. craccivora* on variety IT835-720-20 may suggest that antibiosis is the modality of resistance. However, further detailed studies that include determination of biochemical and morphological characteristics that mediate resistance need to be carried out. IT835-720-20 is, therefore, a promising variety with useful genetic resource for cowpea breeding programs aimed at developing resistant varieties against A. craccivora.

Pyrilla perpusilla

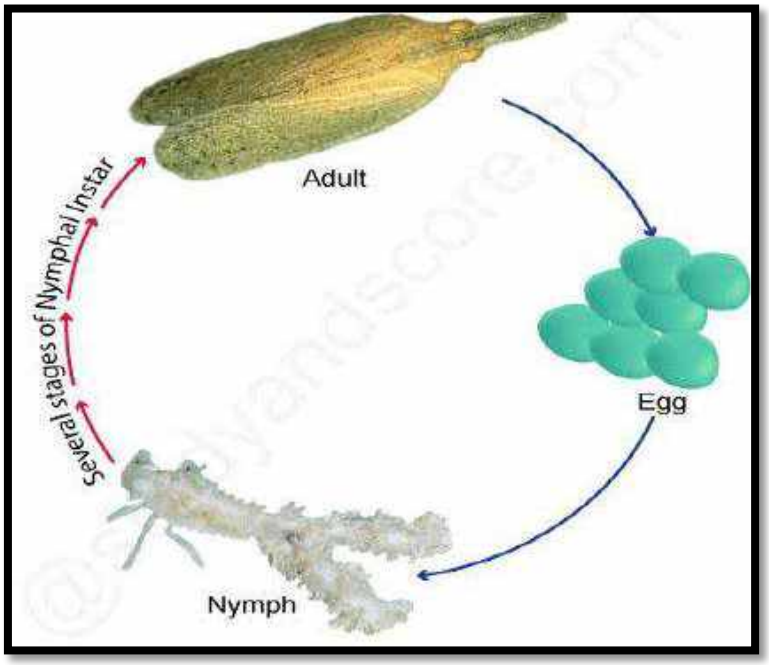
Classification

Kingdom	Animalia
Phylum	Arthropoda
Order	Hemiptera
Family	Fulgoridae
Genus	Pyrilla
Species	Perpusilla

Major host is sugarcane but it also attacks on wheat maze sorghum Bajra etc.

Life cycle

Life cycle consists of egg nymph and adult. Female lays about 300 to 500 eggs in clusters on the lower surface of leavesEgg hatch into nymphs after 7 to 22 days, creamy white in color bearing anal filaments. They suck the cells sap of leaves and moult 5 times in 6 to 8 weeks after moulting, nymphs' transfers into adults



Control Measures

1. Ratoon crops should be avoided since they may have infestation

2. Spraying of 0.25% endosufano or 0.25% fenitrothion, 0.12% to .025% of wetable powder of agrocide are used to kill the pest

3. Mixture of 0.25ltr to 035ltr of endrine of BHC and 10 ltr of kerosene oil is spread on the infected crop

4. Sugarcane stubble should be removed after harvesting the crops. It helps in killing the hibernating larvae.

PEST MANAGEMENT

1. **Insecticides**

- They are substances which kill and repel insects. Dried leaves of Margosa are added to drive away insects from store grains and clothes. Crushed leaves of Boeninghausenia albifora are used for protection against fleas and mosquitoes. Pyrethrum and nicotine are two natural insecticides which were in use before 1940. Afterwards four types of synthetic insecticides were discovered. They are organophosphates, carbamates and pyrethroids.

- Most of insecticides acts on nervous system or enzymes connected with transmission of impulses from one nerve to another or nerve to muscles. A few are also respiratory poisons (Soni *et al.*, 2019).
- Synthetic insecticides- A large number of synthetic insecticides are under use. They belong to different chemical groups. Major synthetic insecticides are divided into six groups organochlorines, organophosphates, carbamateas, pyrethroids, triazines and auxins derivatives.
- **Organochlorines:**
  - ✓ They are organic compounds or hydrocarbons to which are added several atoms of chlorines through the process called chlorination.
  - ✓ Common organochlorines are DDT, BHC, DDE, endosulphan, aldrine ect.
  - ✓ Aldrine is added to building foundations to prevent attack of termites.
  - ✓ Dieldrin is 5 times more potent than DDT.
  - ✓ Endrin is the most toxic of all the organochlorines.
- **Organophosphates:**
  - ✓ They are organic esters of phosphoric acid, and its derivatives.
  - ✓ The important organophosphates used as pesticides includes malathion, parathion, triothion, ethion, tetraethyl pyrophosphates and fenithrotion**.**
- **Carbamates**:
  - ✓ The pesticides are organic esters of hypothetical compounds, cabonic acids.
  - ✓ Being poisonous, they influence workers handling them.
  - ✓ Common carbamates used as insecticides are carbaryl, carbofuran, aldicarb, propoxur.
- **Pyrethroids**:
  - ✓ Pyrethrum is the safest insecticide.
  - ✓ Its synthetic derivatives are termed as Pyrethroids.
  - ✓ They are equally safe, quick acting and broad spectrum.
  - ✓ They are costlier; therefore, they are not much used in India.

2. **Bioinsecticides**

   These are organisms or their products which are used to kill or repel the specific insects. They are of different types via Predators, Parasites and pathogens, sterile male, insect hormones and natural insecticides (Srinivasan *et al.*, 2019).

- **Predators:**

  These are specific natural organisms that are introduced to control plant pests without harming useful insects. Lady bug and praying mantis can control scale insects or aphids of vegetables, cotton and apple.

- **Parasites**:

  These are organisms that feed on other living organisms without devouring them.

- **Parasitoid:**

  These are the organisms that live a parasitic life in younger stages (egg and larva) but lead a free life later on.

- **Pathogens:**

  These are disease producing microorganisms. Egg parasitoids of *Trichogramma* are able to control a number of pests of cotton, sugarcane and pulses**.** Sporeine developed in Germany is the first commercial bio insecticide obtained from *Bacillus thuringiensis.*

Natural insecticides are insecticides and related pesticides which are obtained from microbes and plants, some examples are as follows

a. Azadirachtin: obtained from neem.
b. Rotenones: obtained from roots of *Derris elliptica* and *Lonchocarpus nicou*
c. Squill: obtained from red Squill
d. Nicotine: obtained from *Nicotina* species.
e. Pyrethrum: it is obtained from inflorescence of *Chrysanthemum cinerarifolium, C. coccineum, C. Marshallii*
f. Thuriocide: is a toxin produced by *B. thuringiesnsis.*

Different types of hormones used for controlling pests, like

a. Juvenile hormone: doesn't allow insect to reach the maturity.
b. Pheromone: Biochemicals used to disrupt mating behavour of insects.
c. Moulting hormone: it causes premature moulting of larvae resulting in death.

CONCLUSION

It was a wonderful experience to study about 'Crop Damaging Insects' there because in class rooms, we can only imagine. Going for this project, we were able to know about different types of crop damaging insects. It is a great combination of theoretical and practical knowledge with live examples in agricultural fields. It helped us to understand and grasp the concepts clearly and extend our thinking capacity and knowledge.

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