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Pest management strategy to manage the major pests of Banana (*Musa spp.*)

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Pest management strategy to manage the major pests of *Banana (Musa spp.)*. Banana (*Musa spp.*) is one of the important fruits of India and South East Asia. Altogether 19 insects have been associated with banana and causing significant losses to this crop. The banana pseudo stem weevil (*Odoiporus longicollis* Oliver), banana scarring beetle (*Basilepta subcostatum* Jacoby), banana rhizome weevil (*Cosmopolite sordidus* Germar) and the banana aphid (*Pentalonia nigronervosa* Coquerel) have been recognized as major pests of banana in India and abroad. These noxious pests can be effectively managed by adopting bio-rational pest management approaches incorporating cultural, behavioral, host resistance, mechanical as well as need based application of certain safer pesticides based on ecological considerations.

Abstract :-

Banana (*Musa spp.*) is one of the important fruits of India and South East Asia. Altogether 19 insects have been associated with banana and causing significant losses to this crop. The banana pseudo stem weevil (*Odoiporus longicollis* Oliver), banana scarring beetle (*Basilepta subcostatum* Jacoby), banana rhizome weevil (*Cosmopolite sordidus* Germar) and the banana aphid (*Pentalonia nigronervosa* Coquerel) have been recognized as major pests of banana in India and abroad. These noxious pests can be effectively managed by adopting bio-rational pest management approaches incorporating cultural, behavioral, host resistance, mechanical as well as need based application of certain safer pesticides based on ecological considerations.

Key Words :-

Pests, Banana weevils, Scarring beetle, Banana aphid, Pest management.

Introduction :-

Banana is the herbaceous flowering plant of the genus *Musa*, which is genetically originated from two wild species *Musa acuminata* and *Musa balbisiana*. It is native to tropical regions of south East Asia and grows well in humid warmer climatic conditions. It is cultivated over 130 countries while India led the world in banana production with 28 per cent of the world's production producing 29.80 million tones followed by the

China producing 11.20 million tones ^[1]. In India, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Assam, Orissa, Bihar and West Bengal are the main banana producing states on an area of 830.50 thousand hectares with the total production of 29,779.91 thousand tones ^[2].

The nutritive value of banana fruit is very high having plenty amount of carbohydrates (22 %), fats (0.3 %), proteins (1.1 %), fibers (2.6 %) and the essential minerals like potassium, phosphorus and the vitamin A, B₁, B₂, B₆ and Vitamin C. Therefore, bananas are good for the heart, digestive system, and other muscle movements. That is why bananas are recommended to be eaten before and after exercise ^[3].

Although there are 19 insect pests are known to be associated with banana plant throughout its crop cycle but only the Banana rhizome weevil, *Cosmopolites sordidus*, Banana pseudostem weevil, *Odoiporus longicollis*, Banana scarring beetle, *Basilepta subcostatum* and the banana aphid, *Pentalonia nigronervosa* are considered as major and serious insect pests of banana in India causing significant damage to the plant either directly or indirectly ^[4, 5].

Major pests of banana :-

(i) Banana rhizome weevil, *Cosmopolites sordidus* Germar, (Coleoptera: Curculionidae) :-

The banana rhizome weevil is a serious pest of banana and its incidence has been reported from all banana growing countries of the world. It has also been recorded from various parts of India viz., Kerala, Karnataka, Tamil Nadu, Assam, Maharashtra, Gujarat and Delhi ^[6, 7].

The adult weevils are more active in night and the female weevils lay eggs at the base of the banana plant and after emergence of grubs they enters into the corms by making tunnels. The damaged rhizome can be easily detected with the presence of several holes along with grubs and adults. At the initial stage of infestation growth and the flowering of the plant is badly affected, leaf size, bunch size, number of fingers and finger size are reduced. Secondly the damaged portion of the plant is exposed to attack of bacteria and fungi that leads to rotting and weakening of plant that leads to broke down under the influence of strong wind and in case of its severe incidence yield loss is reduced up to 85 per cent ^[8].

The adult rhizome weevils are black in colour sized 10-15 mm with long snout with short elytra. It is free living, though most commonly found between leaf sheaths and lay eggs in the corm inside the soil. The banana weevil has long life span (2years) and low fecundity (10-15 eggs). It can survive for 6 months without food. The incubation period of egg is 5 - 7 days and after emergence of larva (grub) it starts damaging the corms passing through 5 - 8 instars in two to six weeks and after getting maturity it pupates within the soil. Its pupation period lasts for a week. In general its total life cycle is completed in 5 – 7 weeks.



Fig 01 : Banana Rhizome weevil infestation

(ii) Banana Pseudostem weevil, *Odoiporus longicollis* Oliver (Coleoptera: Curculionidae) :-

This weevil is another serious pest of banana and found damaging banana plant in all over the world where banana crop is grown. It has been reported from India, China, Malaysia, Indonesia and Thailand as serious insect pest of banana ^[9]. It has been reported from all the banana growing states of India viz., Assam, West Bengal, Delhi, Bihar, Uttar Pradesh, Karnataka, Kerala, and North East Hill States ^[10].

The pest incidence starts mainly by grubs when crop become five months older and continued till maturity. Initially grubs feeding on leaf sheath and again entered into the pseudostem by making holes and feed internally. The early stage symptoms include yellowing of leaves, exudation of sap from pseudostem, whereas the advanced stage of infestation shows several holes on the pseudostem, apical stem tapering, reduction in leaf size and bunch size.

The infested plants get riddled with several holes. These holes are further exposed to attack of several bacteria and fungi which leads to rotting of stem. As a result of severe infestation, translocation of nutrients and water is disrupted that affect the growth and development and the badly infested plants are lodged down easily. The loss is estimated up to 90 per cent incase of severe infestation ^[11].

The adults are dark-brown coloured measured 23-39 mm having short and curved snout and are active fliers. The pest is primarily active in night hours but some times also in day hours when temperature and lights are lowers and during the unfavorable conditions it remains hides within the pseudostem. The female lay eggs by making air chambers in the pseudostem and eggs are yellowish white in colour, cylindrical in shape. The incubation period lasts for up to one week, larval period up to three to four weeks, pupal period up to three weeks and thereby the total life cycle for one generation of the insect completes within seven to eight weeks. The longevity of life span of weevil adults is up to one year ^[12].



Fig 02 : Pseudo stem weevil infested Banana plant

(iii) Banana scarring beetle, *Basilepta subcostatum* Jacoby (Coleoptera: Chrysomelidae) :-

The banana scarring beetle, *Basilepta subcostatum* has been acknowledged as one of the serious pests of banana causing severe damage to banana leaves as well as banana fruits during summer and rainy seasons resulting in heavy economic losses. It is the serious pest of banana in Bihar, Assam, West Bengal, Uttar Pradesh and North-eastern region of India. The extent of damage has been reported to be 30 per cent but in case of its severe infestation, losses may be reached up to 80 per cent ^[13]. The adults are reddish brown coloured with black head and bluish black elytra. They are active in night. The female lays very tiny eggs in the cavities gnawed on leaves or on the dry scales of young suckers in cluster of 50 to 60 eggs. The incubation period ranged between 5 to 7 days. Newly emerged grubs feed on leaf sheath

or flower bud and after 15 to 21 days, it forms cocoons to pupate within the soil. The total life cycle completes in 21-29 days. The males are more active than the females. The damage is caused by both, grubs and adults. They live inside the central leaves, flower brackets. They feed on leaves and fruits by scrapping the chlorophyll producing several scars on affected parts. As a result of infestation fruits have to lose its market value greatly.



Fig 03 : Banana Scarring beetle infestation

(iv) The Banana aphid, *Pentalonia nigronervosa* Coquerel (Hemiptera: Aphididae) :-

This aphid species was first reported from South East Asia but now it is present about everywhere the banana is grown throughout the world. It is a true bug and sucks the cell sap from the flower bud, leaf axils and from the other tender parts of the banana plants. The banana aphid is the efficient vector of a virus which causes the serious banana bunchy top disease.

It feed on the plant tissues by piercing its stylet and sucks the cell sap. As a result of its feeding leaves become deformed, curled and shriveled and the top of the plant appears like a bunch that is why this disease is named as banana bunchy top disease. Secondly the aphids excrete honey dew and which serves as a medium for the growth of sooty moulds and fungus.

Aphids are of dark brown to black coloured, sized up to 2mm and it completes its life cycle in 12-15 days with a nymphal period of 8 to 10 days. The life span lasts for 27-37 days with the fecundity of producing 35 to 50 nymphs. They have 30 to 40 generations in a year.



Fig 04 : Banana Aphid infestation

Pest Management :-

Several attempts have been made earlier to tackle the pest menace by several workers ^[13, 14, 15, 16 and 17] in India and abroad. Although those tactics are seems to be effective even today but many of them rely on broad spectrum insecticides which are either banned or restricted. The

world has already witnessed the harmful effects of the use of the pesticides and chemicals to tackle the pest menace. Chemical pesticides have long term detrimental effects, leading to environmental degradation and elimination of natural parasitoids and predators and development of resistance against the chemical insecticides. The entire world today, is seemingly very health conscious and looking up to organic products that are considered to be free from any toxic residues of chemicals. The banana fruits are mostly consumed in raw conditions, they are more vulnerable to contamination with plant protection chemicals. Thus, there is a need to develop pest management strategy keeping in view of the consideration of the food safety with environmental conservation. Though, the use of agrochemical seems to be inevitable but the bio-rational crop protection strategy has a very good prospect along with need based application of safer pesticides.

(i) Cultural management :- Primarily it is the manipulation of cultural practices for reducing or avoiding pest damage to crops but now the term “ecological engineering” is employed that rely on the habitat manipulation through cultural practices to enhance the activities of beneficial biota on ecological knowledge about both the components i.e. host and the pest. The following practices are employed to keep the banana crop safe from the harmful effect of pest activities:

- Ploughing of the field during the summer season to expose the resting stages of insects in the soil to sun light and predators.
- Destruction of the virus affected plants, weeds, dried leaves and plant residues through burning to promote clean cultivation.
- Tissue cultured plantlets are widely used in commercial banana plantations for pest and disease control. Where tissue culture is not available, farmers should pare suckers to remove weevil larvae and eggs.
- Application of balanced dose of nutrients (300 g Nitrogen, 50 g Phosphorus and 300 g Potash per plant) and soil application of neem cake @ 1 kg per pit.
- Application of plant growth promoting rhizobacteria (*P. fluorescens*) to make the plant vigour.
- Application of *Trichoderma* spp. and *P. fluorescens* for sucker treatment @ 2.5 ml per litre of water before planting and for drenching of soil.
- Crop rotation with leguminous plants to manipulate the habitat to break the generations.
- Growing of flowering plants (Sunflower, Fennel, Coriander, Cowpea, Carrot, French bean etc.) on the bunds as the trap crop to attract natural enemies (spiders, ladybird beetles, *chrysoperia*, earwigs and others) of the noxious pests.

(ii) Biological management :- It is the exploitation of natural enemies such as parasites, predators and pathogen to reduce the damage caused by the noxious pests to tolerable levels either by promoting the natural populations available in the field or by augmenting through artificial release.

- Spraying of commercial formulations of *Beauveria bassiana* and *Metarhizium anisopliae* @ 2 ml per litre of water against as preventive measures Rhizome weevils and pseudo stem weevils just after two months.
- Ants feed on aphids attracted through due to secretion of honey dew by aphids.

- Release and promote the braconid, *Lysiphlebius testaceipes* in the banana field which is the efficient parasite of banana aphid.

(iii) Behavioral management :- Certain chemicals have been evolved or tested which are able to modify the behavioral activities of perceiving insects at sub micro levels. These chemicals affect the insect behavior, growth and reproduction for suppression of insect population in the field. Several traps are used to keep the population of insect below economic thresh hold levels :-

- Application of longitudinal cut stem trap of 30 cm size @ 10-15 per acre with bio bio pesticides.
- Application of pheromone (cosmolure) traps @ 5 traps / ha is effective against the monitoring of banana rhizome weevil.
- Incidence of banana scarring beetle can be minimized through bagging of bunch of banana at the time of its initiation with white gunny bag with some pores for aeration.

(iv) Varietal screening :- Host plant resistance is one of the effective tools to the pest management but at the same time it should also taken into consideration that the every variety has their own fruit quality characters like uses, number of fingers, numbers of hands, taste, fragrance etc. The banana genome, *Musa balbisiana* (AAB or ABB) mostly used for cooking / roasting purposes, such as Kothia, Bhimkol, Kachkel, Bankel and Batisha are better options as they have shown resistance against the incidence of both the major weevils, rhizome weevil and pseudo stem weevil and also against banana scarring beetle, while the banana genome group, *acuminata* or Cavendish group (AAA) used for edible purpose such as Robusta, Malbhog, Kanthali, Nendran, Champa and Karpoorvally are more affected by these weevils. The banana cultivars Nepali Chinia, Motta poovan, Bhos, Sucker chinia, Manik champa and the hybrid banana FHIA-3 are resistant to banana scarring beetle, *Basilepta subcostatum*.

(V) Chemical management :- Since the pests are highly sensitive to pesticides and they are capable of developing resistance against the pesticides it is essential to use these chemicals efficiently to avoid harmful effects to the humans and the environment:

- NSKE (10%) spray at one month interval to the whole plant provide better protection from all the pests.
- Whorl application of Neem oil @ 20 ml/whorl to the banana heart provides effective protection from the incidence of banana scarring beetle.
- In case of higher infestations of weevils spraying and drenching the soil around the base of the plant with Chlopyriphos 20 EC @ 2.5 ml per litre of water is suggested.
- Spray imidacloprid 17.8 SL @ 0.5 ml/litre of water when the heavy infestation of banana aphid is noticed.

Conclusion :-

The article has been prepared with updated information regarding the pest activities of major pests of banana and their distribution pattern in Bihar particularly with reference to recent climate change. The most important thing is to develop an approach, which can be gainfully employed by farmers/ researchers to analyze the field situations with regards to sustainable and bio-rational pest management strategy for the major pests of banana, so that pest population can be kept under control on the one hand and the natural ecological balance be restored to the others.

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