

# Pest outbreak, insecticidal resistance in agricultural pests

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**Introduction:** - Pest outbreak means, any organism which is economically harmful to human being and increases its population more than the ETL value (economic threshold level). Or a sudden increase in the population of the harmful organism is called pest outbreak. On another hand, insecticidal resistance is an ability of an insect to survive against the continuous use of pesticides and agrochemical. This resistance may be temporary (environmental resistance) or may be permanent (develop by genes) both the term pest outbreak and resistance is directly proportional to each other, pest outbreak depends on the availability of many resources which are responsible for the growth and development of insect such as availability of food, favorable temperature, relative humidity etc. and for resistance it can be easily said that that is a habit developed by insects for their survival

**Pest outbreak:** - It is an increment in the population of any insect pest more than the ETL value (economic threshold level) or sudden increasing in the population of any individual sp. of an insect is called pest outbreak

**Reasons for pest outbreak:** - Pest outbreak is a sudden increment in a population but it takes a long time to happen in any ecosystem. It can occur when the condition is favorable for the individual insect

**An introduction of exotic insect species:** - When any new species introduced to the area where it is not found normally, it increases its population due to the absence of natural enemies and proper availability of resources for their development, due to these condition their mortality is sufficiently reduced, causing population outbreak occur.

**An introduction of exotic plant species:** - When any new plant species introduced to a new biological community, there are many insect pests which will feed on it and it will favor for pest outbreak to occur.

**High yielding varieties/cultivars:** - After the development of high yielding varieties of food crop there is sufficient amount of food for insect pest which results in the quick multiplication of the insects and pest outbreak occur.

**High amount of fertilizers:** - Use of the high amount of fertilizers leads to vigorous growth of crop, standing crop releases some volatile compounds by which insect attracted to crop and start multiplication due to availability of food

**Destruction of natural enemies:** - Indiscriminate use of the high amount of pesticide leads to killing the natural enemies with the pest. And in the absence of natural enemies, pest increase their population.

**Temperature:** - It is an environmental factor and it is the most important factor that favors the rate of growth and development of insect pest if the temperature increases the population of insect pest increases, and if the temperature decreases the population of insect pest decreases.

**Mono-culture:** - It is an old method of farming which is not in use nowadays but somewhere it is being used in mono-cropping, we provide food to insect pest continuously season to season, which results in pest outbreak to occur.

**Weather pattern:** - Sometimes weather also favor for the insect to outbreak

For e.g. such as locusts, the wind with higher velocity is important to determine where they will fly

Grasshopper lays eggs more in the temperature in 32°C than 22°C.

**Migration:** - Some insects migrates from one area to another for better favorable conditions, which allows them to escape from control measures and leads to their multiplication

**Management or control measures for pest outbreak:** - Nowadays pest outbreak is a major problem in the agriculture and it is needed to manage it, it can be managed by following some measures such as

**Cultural measures:** - Crop rotation leads to check their life cycle due to unavailability of food, trap cropping also helps to manage them, by soil solarization larvae and pupae of insects pest can be killed easily

**Mechanical measures:** - By using of some trap such as light trap for nocturnal insects pheromone trap for moths and yellow sticky trap for flying insects helps us to monitor their population and prepare the controlling models for them

**Biological measures:** - In this measure, we use living organism to kill the insect pest such as parasites and predators for insect pest and their control.

**Chemical measures:** -Uses of chemical can reduce the population of pest, but continuous use of chemical can make insect resistant against chemical which can cause again pest outbreak so it should we use safely and with proper knowledge

**Pesticidal resistance:** -

According to the insect resistance management committee (IRAC):-

Insecticidal resistance is a heritable change in the sensitivity of a pest population that shows the continuous failure of a product to achieve the expected control.

(Insecticidal resistance action committee. 2007. Retrieved December 2014)

Insecticidal resistance describes the increasing ability of an insect to survive against the application of a specific insecticide.

### **Types of insecticidal resistance**

**Temporary resistance:** - This type of resistance induced by the environmental factors such as temperature humidity light etc. and it is for some time, it is not permanent

**Permanent resistance:** - This type of resistance is developed by the heritable changes or due to gene manipulation. it is of three types

**Monogenic:** - The resistance for an insecticidal chemical is developed by only one gene.

**Oligogenic:** - The resistance for an insecticidal chemical is developed by few genes.

**Polygenic:** - The resistance for an insecticidal chemical is developed by many genes.

**Vertical resistance:** - When the insect is resistant to only one insecticide.

**Horizontal resistance:** - When the insect is resistant to more than one or two insecticides.

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**Insecticidal resistance mechanism:** -Insect can be resistant by the numbers of ways

**Metabolic resistance mechanism:** - Sometimes resistant insect may use their internal enzymes for breaking down of pesticides; they break down the pesticides particle faster than susceptible once. The resistant insect may pose the higher concentration of enzymes than the susceptible insects. Sometimes these enzymes are broad spectrum in nature they can degrade many types of chemicals.

**Target-site resistance mechanism:** - Target sites are those parts of insect body with which insect body reacts to kill them, but many insects modified or manipulate the target site to prevent insecticide to interact with that target site and become resistant

**Penetration resistance mechanism:** - Susceptible insect absorbs chemical more than the resistant insect, resistant insect modified their cuticle to be resistant sometimes extra growth found in the insect cuticle which makes them resistant to insecticide

**Behavioral resistance mechanism:** - Many insects changes their behavior if there is an application of pesticide occurred they may stop feeding or leave the area where the pesticide has applied this type of insect resistance reported for many classes including organochlorine, organophosphate, carbamates, and pyrethroids.

**Break or manage the Pesticidal resistance:** - To break or manage the resistance, IRM (integrated resistance management) measures should be followed, it is most effective method to break resistance

Combine as many management strategies such as possible as the use of synthetic insecticides, biological insecticides, and biological agents (parasite and predators) cultural practices, transgenic plants chemical attractants and deterrents etc.

The Lifecycle of insect and correct time of application of insecticide should be known for proper management of population and maintain the susceptibility, use of spray rates and timing of spray recommended by the manufacturer or by the local agricultural extension regulation. It is important to mix two or more insecticides as resistance increases, an important element in effective management of resistance is the use of alternation rotation and sequenced use of many insecticides on the basis of their classes, and user should avoid repeated use of same pesticides in a same crop cycle, insecticides must be used when there is numerous of insecticide that causes economic losses, or where there is a threat of public health farmer should consult their local advisor about economic threshold level of target pest in their area for proper management.

**Conclusion:** -pesticides resistance and pest outbreak both are harmful to environment and human being as well, there are many times found that pest outbreak in India and other countries that was severe, and did high economic loss to mankind. To control their population many scientist developed new and effective method, and we use chemical method much more, because it is highly efficient method and it gives quick result. But continuous use of pesticides make insects resistant to the chemical thus we go to IRM (integrated resistance management) by which we are trying to break the resistance it is an effective method developed by IRAC (insecticidal resistance action committee) this method is a combine approach of all available method of managing pesticidal resistance, like cultural control, mechanical control, biological control, chemical control etc.

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