GENETICALLY ENGINEERED INSECTS

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WHAT ARE GENETICALLY ENGINEERED INSECTS

- Insects with newly expressed characteristics.
- New characters as a result of manipulation of DNA in lab.
- Changes passed on the next generation.

INTRODUCTION

- Genetically engineered insects are those insects which has been genetically modified for various reasons like agricultural production, oil production and pest management.
- These insects are made transgenic when one or more DNA sequences from other organisms are inserted into their genome.
- Main purpose of producing the genetically engineered insect is to manage the agricultural pest which are causing severe damage to the yield, quality, environment and human health and reducing the use of synthetic chemical pesticides.
- Genetically engineered insects are being developed with a view to suppress insect populations of the insect species which spread human diseases, such as malaria and Dengue fever.

HISTORY OF GE INSECTS

- In 1937, E.F. Knipling- Concept of genetic control of insect pest Started with sterilization of screw worm flies, a serious pest of livestock
- Experiment on sterile insect technique achieved by using gamma irradiation, UV rays and mutagens like Ethyl methyl sulphonate
- 18 different genera of insects have been manipulated till now.
- First genetically transformed insect- reported when wild type eye color gene was seen in a mutant strain of Drosophila.
- Next transformation was attempted in Mediterranean fruit fly in 1995(Loukeris).

Drosophilla

Screw fly

HOW CAN WE MAKE ?

Direct Genome Modification:

- Direct genome modification is the insertion of desirable gene sequence or DNA into the insect species. This is of two types:
- SIT Non-viable or infertile offspring is the ultimate goal of SIT; the sterile males inseminate the females, producing non-viable eggs, thus reducing the population.
- rDNA technology After selection of a trait, researchers have two options for inserting the gene into the insect's genome.

- One is using transposons or "jumping genes," have the ability to cut and paste themselves into and out of DNA.
- Researchers can put the desired gene within a transposons' molecular machinery and expose it to insect cells.
- Another way is through the use of viral vectors. Similar to transposons, a desired gene can be spliced into a virus construct. Then, viral vectors can be used to integrate into the genome on a random basis.

2)PARATRANSGENESIS

This technique involves altering the flora (or adding completely new flora) in the gut of an insect, but not altering the insect's own genome. This concept is given by Frank Richards in 1996. Researchers can use the interaction between the pathogen and the natural flora of the insect's gut to destroy the disease agent.The kissing bug (Rhodnius prolixus) transmits Chagas' disease (Trypanosoma cruzi). Researchers have been able to alter the bacteria commonly found in the gut of the kissing bug to produce an anti- trypanosome peptide, cecropin. When expressed, this peptide does not harm the insect, but is deadly to the pathogen.

ADVANTAGES OF GENETICALLY ENGINEERED INSECTS

1) **In Public Health GE Mosquitoes**

- Mosquito spread malaria and kill 2.7 million people per year worldwide.
- The transgenic mosquitoes have high survival rate and lay more eggs.
- Those mosquitoes have glowing eyes under UV light due to the presence of Green Fluorescent(GFP) inserted into it.
- Anopheles stephensi is one transgenic mosquito species to resist malaria.

2) Agriculture

a) Pink Boll worm (Sterile InsectTechnique (SIT) program)

- Protects more than 900,000 acres of cotton.
- Million of male pink boll worm moth were sterilized by irradiation

b) Mediterranean fruit fly Males are sterilized by irradiation prior to release so that. female reproduction hinders.

Advantages

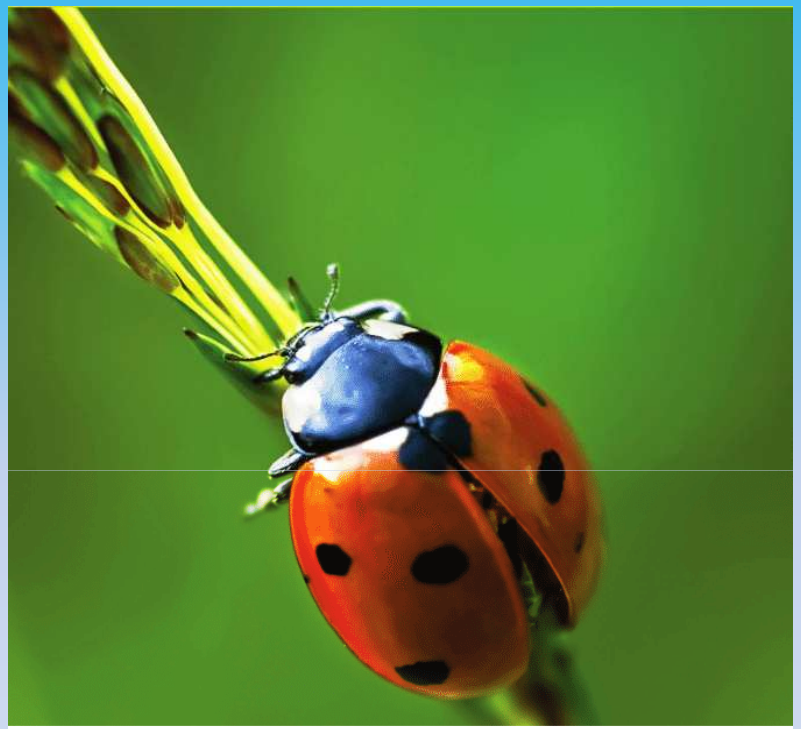
Other associated benefits Recent developments in scientific techniques have allowed researchers to create GM silk worms, harnessing the strong protein production of the worm for production of other proteins. One group recently created a GM strain of silkworms that produce human antibodies.

LIMITATIONS

1) Instability of the induced genes Transgenes were reported to get rapidly lost under field conditions.
2) Horizontal gene transfer Genes are vertically transmitted to progenies and move between individuals of different species in a process known as horizontal gene transfer.
3) Poor fitness : It is due to the result of introducing transgene there by making the recipient weaker. Laboratory rearing is not compatible with competitive behavior of insect.
4) Environmental risks are also associated with the use of genetically modified insects over the open environment. Once they released, they can’t be taken back so lots of investigation and regulation should be done for this research.

COMMERCIALLY RELEASED GENETICALLY ENGINEERED INSECTS

- Predatory mites- in 1997 in USA
- Pink bollworm- in 2001 in Mexico
- Anopheles mosquito- In 2002 in India
- Screw worm fly- Kenya and Central America



Predatory mite

PINK BULL WORM

ANOPHELES MOSQUITO

SCREW FLY

CONCLUSION

- On the midst of millions of people are suffering from the hunger and diseases, expanding this novel approach can be the panacea with appropriate social policies.
- It is difficult to predict all of the broader ecological impacts of these changes. It is possible that the elimination or vast reduction in numbers of this organism could have dire consequences for other non-targeted organisms.
- In my view, the advantages of Genetically modified insects outnumbers the disadvantages of this technology but sound research on the public safety and sustainable ecological balance is necessary so that technology might not overestimate the right of future generation in the matter of preservation of our ecology and self-sustained nature.

THANKYOU