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Sterile Insect Technique

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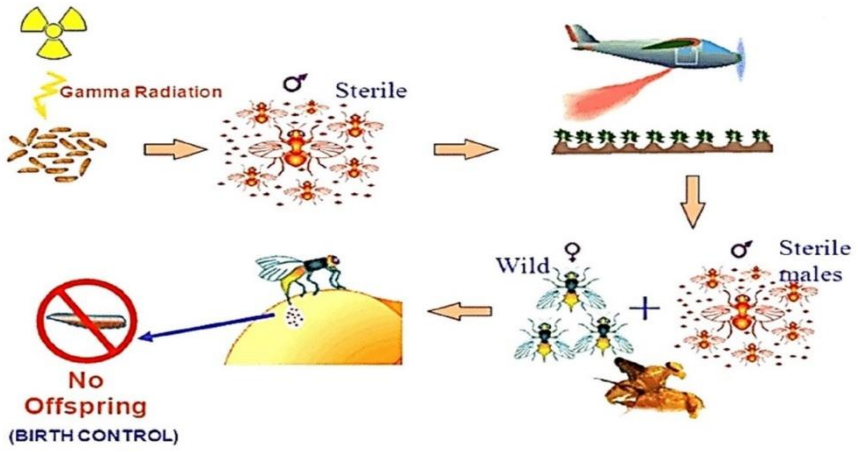
INTRODUCTION

The sterile insect technique is an environmentally friendly method of controlling insect pests that involves mass-rearing and sterilising a target pest using radiation, then dispersing the sterile males over a large area by air over predetermined areas, where they mate with wild females and produce no offspring but a declining pest population. One of the most eco-friendly insect pest management techniques ever created is the sterile insect technique, or SIT for short. Mass-raised insects are sterilised by irradiation, such as with gamma rays and X-rays, such that they may still compete sexually but cannot reproduce. Transgenic (genetic engineering) procedures are not used in SIT.

The most evolutionary successful animal group on Earth is represented by insects. Almost everywhere on our world, they have adapted to the various ecological situations. The majority of bug species contribute significantly and favourably to ecosystems. Even so, some of them pose a serious risk to both human and animal health as well as agricultural production. Broad-spectrum insecticides have been used as the major method for managing insect pest populations and disease vectors for many years. Insecticide resistance has been widely propagated as a result of the unrelenting and reckless use of these chemicals, whose detrimental effects on the environment, food chains, and human health have all been conclusively demonstrated.

Environmentally friendly, species-specific, and sustainable methods, like the sterile insect technique, are urgently needed.

The most evolutionary successful animal group on Earth is represented by insects. Almost everywhere on our world, they have adapted to the various ecological situations. The majority of bug species contribute significantly and favourably to ecosystems. However, some of them pose a serious risk to both animal and human health as well as agricultural output. Broad-spectrum insecticides have been used as the major method for managing insect pest populations and disease vectors for many years. It is possible to use the sterile insect technique (SIT) in the area-wide integrated pest management (AW-IPM) of insect pests of the medical, agricultural and veterinary significance. Sterile insects are non-invasive agents rather than intrusive poisonous, pathogenic, or other harmful organisms, in contrast to chemical and biological goods. Pre-release population suppression using traditional control methods is necessary for the SIT. These include both straightforward tools like sticky traps and extensive pesticide aerial treatments. Therefore, depending on the precise type and combination of control agents and strategies, environmental dangers might range from insignificant to substantial.



The SIT varies from traditional biological control, which includes introducing biological control agents that are not native to the area, in a number of ways-

- Since sterile insects cannot reproduce on their own, they cannot establish themselves in a given habitat.
- Autocidal control, often known as breaking the pest's reproductive cycle, is by definition species-specific.
- Non-native species are not introduced into an environment by the SIT.

Mass-Rearing

If maintained in accordance with best practises and standard operating procedures and developed utilising current biosafety concepts, insect-rearing facilities represent a minimal environmental risk. In contrast, when so many insects are raised at one location, they might unintentionally release fertile insects into the environment. If the facilities are near where the native species naturally occurs, there may be some damage, but if the habitat is conducive to the introduction of exotic species, there may be major risks. As a result, when putting up facilities inside the prospective habitats of the target insect, rigorous quarantine and security regulations must be followed throughout every stage of insect production and export. To lessen this danger, the United States only permits the

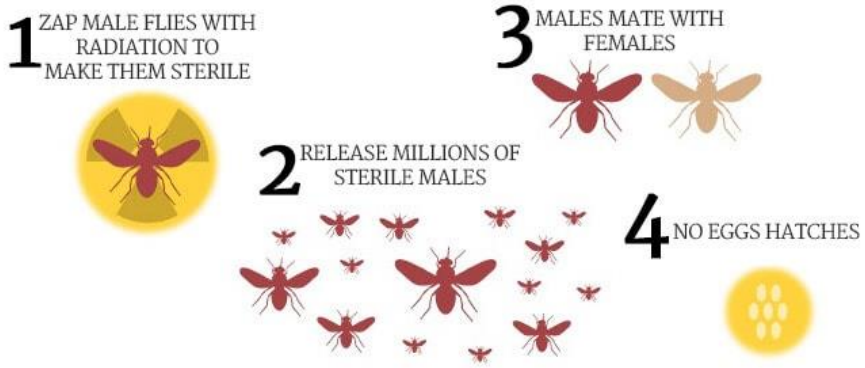
generation of sterile fruit flies in places where the relevant species is already present or where the environmental circumstances are unfavourable for establishment. Facilities for mass-raising insects may be hazardous to workers' health. Humans may have allergic reactions after being exposed to frass, hairs, or scales. The risk of being exposed to microbes is another (fungi, bacteria).

In order to reduce the airborne concentration of allergenic particles and possible infections, raising facilities must have efficient air filtration systems, and employees who are regularly exposed to these agents should wear protective clothes and masks.

In nations with limited occupational health norms and resources, this might be an issue.

For the SIT, insects are raised on either natural or synthetic diets. These methods pose no issues for the majority of species. However, when tsetse flies were first being mass-produced, real animals were utilised as hosts to provide food for the insects. This method was neither feasible nor sympathetic to the welfare of animals. It was subsequently replaced with a silicone-membrane feeding system that mimicked a host's skin and used blood that was taken from slaughterhouses**.**

Irradiation-



Target insect pupae or adults are sterilised using radioactive isotopes like Co^{60}. The International Atomic Energy Agency (IAEA), which is participating in the majority of AW-IPM programmes that employ the SIT, provides further instructions. As a result, a danger related to the routine use of irradiation sources is not anticipated in nations with a track record of safe usage and proper disposal of hazardous materials. IAEA standards prohibit the construction of irradiation facilities in nations with insufficient nuclear safety legislation and infrastructure. Contingency plans must consider how to acquire irradiators and related technologies in the event of political unrest.

Advantages of the method-

Sterilized insects are used as a part of area-wide integrated pest control in four different ways: suppression, eradication, containment, and prevention.

The SIT package is transferred to Member States through field projects so that these can benefit from improved plant, animal, and human health; cleaner environments; increased crop and animal production in agricultural systems; and accelerated economic development. It involves both applied researches to improve the technique and develop it for new pest insects.

The SIT has been effective in eradicating a number of well-known insect pests, including fruit flies (Mediterranean fruit fly, Mexican fruit fly, Oriental fruit fly, and melon fly), tsetse fly, screwworm, and moths (codling moth, pink bollworm, false codling moth, cactus moth, and the Australian painted apple moth). Retrospective economic

evaluation studies in numerous nations where the technology has been used have demonstrated a very high return on investment. The technology's advantages include a significant decrease in crop and livestock production losses, protection of the horticultural and livestock industries through the prevention of pest introductions, the ability to export commodities without being subject to quarantine restrictions to high value markets, the preservation and creation of jobs, and a significant decrease in production and human health costs.