Eco-friendly technology to replace chemical pesticides

In the early 19th century, synthetic chemical pesticides were used in large quantities causing harm to the crops as well as to human health. After World War II, Rachel Carson, (writer, scientist, and ecologist, from Springdale, Pennsylvania, USA) developed new policies to protect environment and human health and brought awareness on the long term use of chemical pesticides. Her book 'Silent Spring' in 1962 recorded the detrimental effects on the environment and particularly on the random use of pesticides. This book led to the ban on DDT (dichlorodiphenyltrichloroethane – disadvantage is that it causes oxidative stress and damage to brains neural pathways).

Later in the 20th century, the organic movement took over due to serious side effects caused by the organic and non-organic (bio material vs. chemicals) methods. During this era, the biochemistry and engineering techniques introduced a new concept of machinery and pesticides that changed the farming concepts extraordinarily.

In CSIR-NCL, Dr Mukund Deshpande and his team developed a biopesticide with the use of fungal spores of *Metarhizium anisopliae*[1]*. An insect called the *Helicoverpa armigera* is found mainly on pigeonpea (tur dal), chickpea (chana dal), tomatoes etc. This insect *Helicoverpa* causes 50 % loss in pigeon pea production which has an annual yield of 29,00,000 tonnes in India. Earlier this insect showed resistance to pyrethroid containing pesticide. But, on trials from Dr Deshpande's team, its existence reduced when sprayed by using the fungal spores, thus, biopesticide proved to be more effective.

The spores from the fungus are produced in the lab and these are then tested and taken in the fields for spraying. The spores are spread on the leaves, flowers and fruits where the insects are likely to eat. It was found that the insects which came in contact with the spores were affected and killed. The fungal spores penetrate the protective cover to infect and kill the worm. These spores were also effective in controlling mealybug infestation in

grapes, woolly aphids[2]* in sugarcane and mosquitoes too. These same spores remained unharmed when in contact with birds and humans.

The farmers who used these spores were trained to allow the spraying during the flowering season and at intervals so that the insect would not reproduce. Thus the fungal spore technology worked not only for the farmers but also for the birds and humans too.

Notes:
1) Metarhizium anisopliae* - formerly known as *Entomophthora anisopliae* (basionym)
2*) woolly aphids - are sucking insects that live on plant fluids and produce a filamentous waxy white covering which resembles cotton or wool

References:

1. https://en.wikipedia.org/wiki/History_of_organic_farming
2. https://en.wikipedia.org/wiki/Metarhizium_anisopliae
3. https://en.wikipedia.org/wiki/Eriosomatinae
4. Kulkarni S. A., Ghormade V., Kulkarni G., Kapoor M, Chavan S. B., Rajendran A., Patil S. K., Shouche Y., and Deshpande M. V. (2008) Comparison of *Metarhizium* isolates for biocontrol of *Helicoverpa armigera* (Lepidoptera: Noctuidae) in chickpea. Biocontrol Science Technology **18**: 809-828.

Further reading:

Novel Biopesticides.pdf