Series 7: Programme 3 (of 8) - 'From Plague to Plenty'

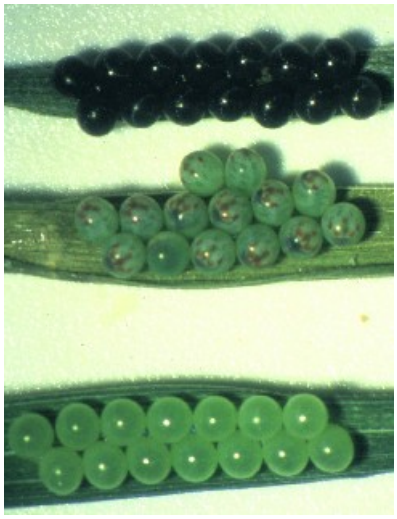
Bread Bugs – Turkey and Syria

Bread is a staple food for millions of people around the world, especially in West and Central Asia. But the wheat, from which most bread is made, can be affected by insects known as the Sunn Pest. Even a small infestation can render a harvest worthless and ruin farmers. Now research is examining the insect's natural weaknesses to give the farmers a chance to fight back.

Sunn Pest

Large outbreaks of Sunn Pest generally occur every six to eight years and can reduce yields by up to 90 per cent, causing damage costing tens of millions of dollars. As they eat the grain they inject an enzyme which destroys the natural gluten and makes the flour useless for making bread. If even a small proportion, 2 to 5 per cent, of the harvest is infected, the whole crop is useless. The baking process is also affected, producing misshapen and poor quality bread. With over 15 million hectares of wheat worldwide being affected by Sunn Pest every year, it is a major problem.

Bread from healthy grain (left) and infected grain (right). Credit: ICARDA



Different Sunn Pest eggs - the black ones indicate that these eggs have been parasitised. Credit: ICARDA

The Sunn Pest is a group of insects which include the 'shield bug' (Scutelleridae) and 'stink bug' (Pentatomidae) families. They are found in parts of North Africa, throughout West Asia and in much of Central Asia.

Only 1 cm long, the dun-coloured insect damages cereal crops, especially wheat, by feeding on all parts of the plant. The greatest impact occurs when it feeds on the developing grains.

Sunn Pest adults spend about nine months in over-wintering sites where they stay from the summer through the winter. They bury themselves deep in leaf litter beneath trees until the following spring. Then they migrate back to the cereal fields to mate and lay their eggs.

The effects of infestation can be devastating for poor countries trying to become self-sufficient in cereal production – they can lose a valuable export crop, and may have to import costly grain and pay for expensive chemical pesticides. Worldwide over US$150 million is spent for control of this pest, but a decrease in insecticide efficacy has been reported in recent years, and is suspected to be a sign of resistance.

The effect of Sunn Pest damage on seed
Credit: ICARDA

Pesticides also have a detrimental impact on the environment: they disrupt native parasite and predator populations, and pollute water courses. Regulation of pesticide use is becoming more stringent, so farmers are looking for natural ways to control this serious pest. Researchers believe that biological controls can be developed which are easy and cheap to mass-produce, and environmentally friendly as they do not accumulate in food chains or cause harm to other animals.

Farmer Field Schools (FFS)

Farmers in Turkey learning how to release Sunn pest egg parastoids. Credit: ICARDA

In a project by the International Centre for Agricultural Research in Dry Areas (ICARDA), supported by the UK Department for International Development (DFID), farmers from all over West Asia meet at Farmer Field Schools to learn natural ways of controlling the threat from Sunn Pest. The FFS is a new approach which aims to promote interaction between researchers, extension workers and farmers, leading to a greater awareness and acceptance of Integrated Pest Management (IPM). There are several methods that can be used to help limit the damage caused by Sunn Pest:

1. *Monitor pest populations*

Sunn Pest populations vary from year to year in response to climatic conditions. Pest populations should be monitored annually to check if it is necessary to spray for the insect. As large outbreaks occur periodically, it may be advisable to plant alternative crops when an outbreak is expected.

2. Collect from over-wintering sites

Sunn Pest can easily be collected in sites where they over-winter under the litter at the base of pine or oak trees, bushes and in the grass along the river banks. Later, sweep nets can capture them when they are in the wheat fields. The pests may be fed to poultry.

3. *Plant early-maturing wheat varieties and harvest early*
Damage is less if wheat is harvested before Sunn Pest reaches adulthood. Growing early-maturing varieties and establishing a uniform planting date in a region minimises damage. Early harvesting methods can be developed to suit local production methods and weather conditions.

4. *Maintain shelter belts around wheat fields*
Natural enemies reduce Sunn Pest populations and should be encouraged. Areas around the cereal crops should remain as uncultivated habitats where flowers can grow undisturbed, providing shelter and alternative food sources, which improve survival of these beneficial insects.

5. *Use chemical insecticides only if needed*
Selective insecticides should only be used when pest populations reach economically damaging levels. Farmers involved in with the school test their fields for Sunn Pest infestation. Using 50 cm square frames, they sample random areas and count the number of pests in each frame. If the average is less than ten nymphs per square metre, they are advised not to use chemical pesticides but to instead to use natural controls.

Biological Pest Control Methods
ICARDA, in collaboration with its partners NARS (National Agricultural Research Systems) in West Asia, the University of Vermont in the USA and CABI Bioscience in the UK, has developed several ways to control the threat using the Sunn Pest's natural enemies.

Parasites: In cardboard incubators ICARDA breeds thousands of Hymenopteran egg parasites, which develop inside Sunn Pest eggs and destroy them. The incubators are hung on the wheat stems, and after hatching they fly out to seek the Sunn Pest eggs in the field.

A cardboard incubator with parasitized Sunn pest eggs hung in a wheat field in Turkey. Credit: ICARDA

Partridge: Flocks of partridge inhabit wooded areas where the Sunn Pest spends the winter months. Here they can eat the insects. These predator birds are being mass reared and released at the moment in Turkey for Sunn pest management.

A Turkish farmer about to release a partridge in order to control Sunn pests. Credit: ICARDA

Fungus: Fungal infections are particularly effective against the Sunn Pest – in recent trials the mortality rate is about 90 per cent. The treatment is prepared by injecting a measured dose of a fungus, known to cause Sunn Pest mortality, onto partially cooked wheat grains. These are left to incubate for two weeks to produce spores. These are then dried, leaving a granular residue. The grains are sprinkled around trees that the Sunn Pest inhabits, and as the insects come into contact with the fungus it kills them.

Dr Bruce Parker, University of Vermont, applying a granular fungal formula to the base of a tree. Credit: ICARDA

Mr S Edgington, CABI Bioscience, applying an oil fungal formula against Sunn pest nymphs. Credit: ICARDA

Soon the product will be ready as a granular or oil-based formula for the mass market to clear infestations at over-wintering sites. Further research has been carried out to find a product to control juvenile infestations. Initial trials have produced a spray that can be applied on the wheat fields if the juveniles have hatched.

Further Work

ICARDA have been searching for wheat varieties with confirmed resistance to Sunn Pest that will be used in the breeding programmes to develop wheat-resistant varieties for West and Central Asia. Several strains have been identified and further trials are continuing.

The Farmer Field Schools have demonstrated to the farmers that biological control agents and beneficial environments can help in the fight to control Sunn Pest. If these are effective the farmers can get good prices for their wheat.

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