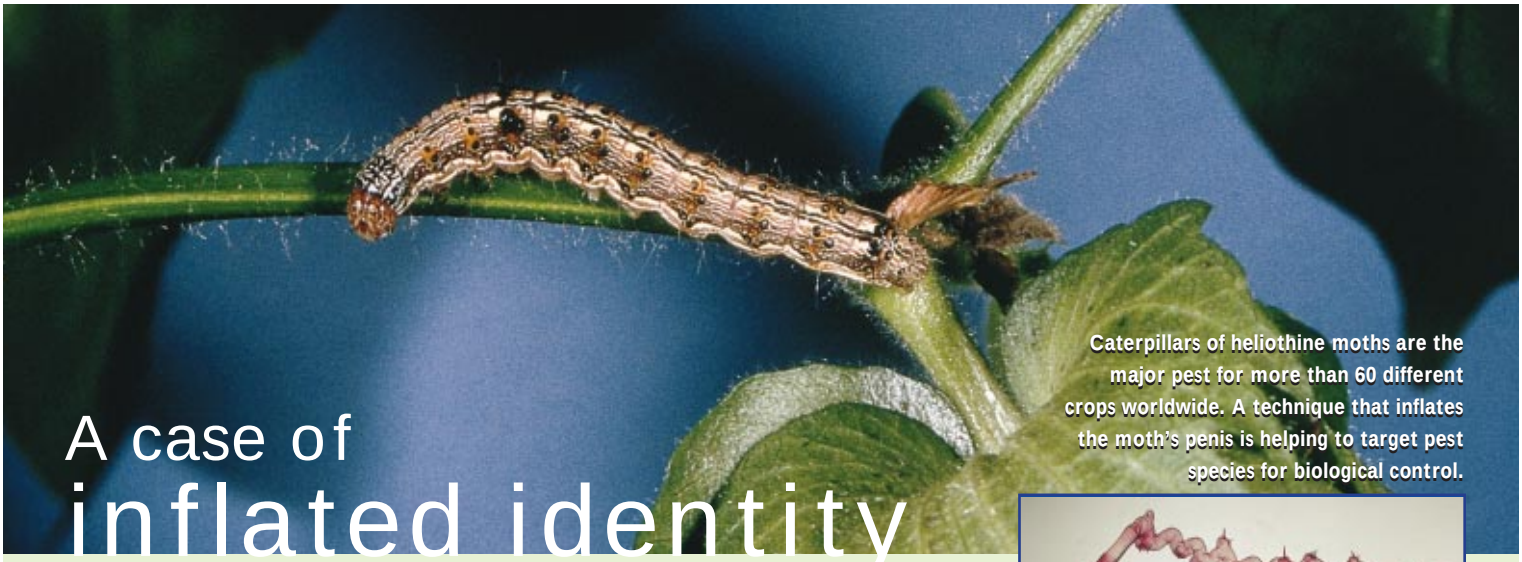

Caterpillars of heliothine moths are the major pest for more than 60 different crops worldwide. A technique that inflates the moth's penis is helping to target pest species for biological control.

A case of inflated identity

A team of CSIRO entomologists has made a breakthrough in the battle to control heliothine moths, one of the world's most devastating agricultural pests. They have developed a way of distinguishing between heliothine species, an essential step towards biological controls.

Caterpillars of heliothine moths are the number one pest for more than 60 different crops throughout the world, and are notorious for their capacity to rapidly develop resistance to chemical pesticides. In India last year, caterpillars of heliothine moths consumed food and fibre crops worth about a billion US dollars, pushing whole communities to the brink of economic collapse, and in some cases, severe hunger.

Biological control of the insects is considered the obvious solution, but there's a catch. Of the 450-member family Heliothinae, fewer than a dozen species are pests. Some of the others are important plant pollinators. The challenge lies in singling out targets for host-specific biocontrol agents.

Complicating matters is the fact that most heliothine species look much the same. The only visible distinction between them is the penis – hardly the easiest organ on such a tiny creature to find and identify. But that organ, with its gnarled contortions and spikes, provides instant identification – so long as it can be seen.

Dr Marcus Matthews of CSIRO Entomology, inventor of the 'phalloblaster'.

Dr Marcus Matthews of CSIRO Entomology has invented a revolutionary device for doing just this. Nicknamed the 'phalloblaster', it pumps a stream of alcohol into the insect's penis, inflating it so that its unique structure can be seen through a microscope. The 'phalloblaster', as well as traditional taxonomy and techniques, such as DNA sequencing, will now help to identify and classify the pests doing the damage. This in turn will help scientists find insects or pathogens – biopesticides – which attack only the pests.

The breakthrough has come at a crucial time. Dr Ebbe Nielsen, who leads the research team, says biopesticides should become the mainstay of a whole new system for controlling India's worst insect pest; saving harvests and reducing the toll on people and the environment of chemical excesses.

'It may seem quaint, but this moth's penis is the vital first step in a chain that leads to safe, effective pest control,' he says. 'That chain means millions of tonnes more food, less hunger, better incomes for the poor and ultimately, the greater regional stability and reduced risk of conflict that stems from prosperity, and a more sustainable environment.'

Professor MS Swaminathan, head of the Madras-based MS Swaminathan Research Foundation, says improving food security is fundamental to political stability in the region. He says the use of pesticides for crop protection in India increased from 2350 tonnes in 1955 to 1.07 million tonnes in 1994, yet up to 30% of potential yields are now being lost.

Swaminathan says that aside from chemical resistance, the accumulation of toxins in the environment has become a serious health problem. DDT in concentrations of 20 parts per million across the Indian population is blamed for rises in the incidence of liver cirrhosis, cancer and nerve damage.

And aside from the health impacts of excessive pesticide use, a reduced food supply drives needy communities to fell forests, plough unstable slopes, and destroy river valleys through over-irrigation as they strive to make up for lost harvests.

This is one of the reasons the International Food Policy Research Institute in Washington says shortages of food, land and water will be the most likely trigger for wars in the 21st Century. Controlling the heliothine moths – in particular *Helicoverpa armigera* (a major pest in Australia as well) – has become the first major biological battle that must be won.

Nielsen's team has been working with scientists at the University of Maryland in the US. A solution to the problem in the Indian subcontinent is being developed with the Indian Agricultural Research Institute (IARI) in New Delhi, and the International Centre for Research into the Semi-Arid Tropics, at Hyderabad in India. IARI is developing a strategy for implementing the research.

Now that the moths can be more easily distinguished, scientists are screening for natural pathogens and parasites. The most likely biological control to come from the research is a virus that, so far, is highly specific to the pest moths. To give the virus enough potency to kill a caterpillar rapidly, the scientists are looking at adding to it the gene responsible for a natural toxin, such as a scorpion's or wasp's venom.

'Otherwise the virus alone acts too slowly and the damage will be done before the caterpillars die,' Nielsen says.

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10.1071_ISSN0311–4546EC97p36