Briefing note

Protected Edibles

Potential controls for Southern Green Shieldbug in UK glasshouses

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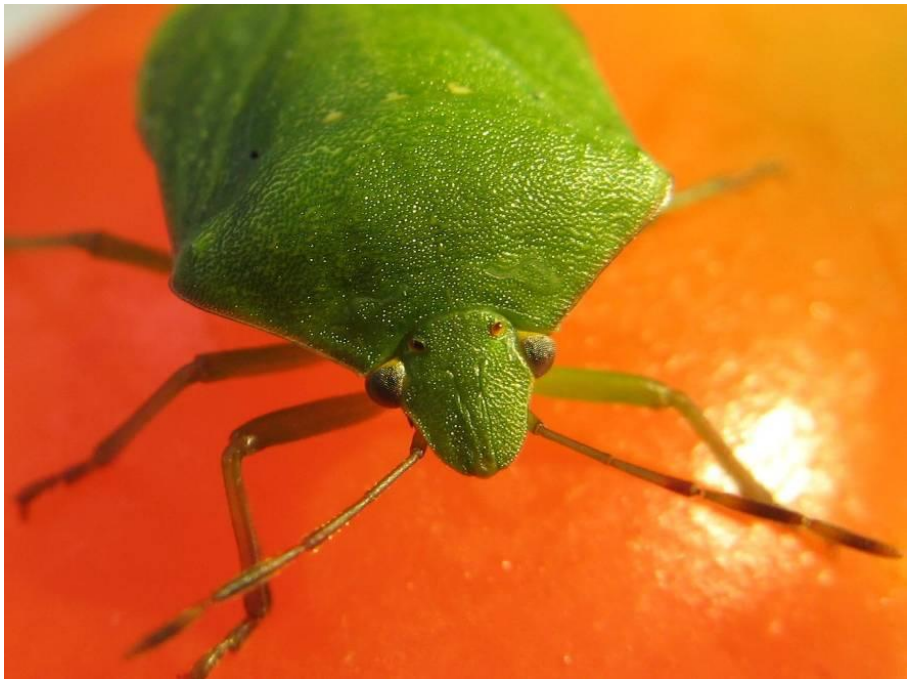


Updated December 2014

Background

This briefing note updates progress in Horticultural Development Company (HDC) project PE 014, a desk study to explore IPM compatible options for control of southern green shieldbug, *Nezara viridula,* a new pest of pepper and aubergines, and project PE 016 which has begun to test potential control measures.

Nezara viridula is widely distributed across tropical and subtropical regions of the world where it is a serious pest of many important food crops. It has been imported into the UK on fruit and vegetable products for many years and is now considered to be established in London and the surrounding area. Breeding populations have most commonly been found in man-made habitats such as parks, gardens and allotments, where the pest seems particularly fond of leguminous plants. *Nezara viridula* has recently found a niche in heated glasshouses growing sweet peppers and aubergines in the Lea Valley.

In 2012, HDC commissioned a factsheet which provides an introduction to the biology and recognition of *N. viridula* and helps growers to distinguish it from less damaging native species of plant bugs (Factsheet 36/12). That factsheet will help to prevent unnecessary treatments due to misidentification of the target organism.

HDC has obtained an EAMU (Number 1994/12) enabling growers to use lambda-cyhalothrin (Hallmark with Zeon Technology) against *N. viridula* on pepper and aubergine crops. While effective, this product is extremely harmful to the biological control agents used against other pests in IPM programmes. Most notably, applications of lambda-cyhalothrin could lead to secondary problems with western flower thrips (*Frankliniella occidentalis*) and associated infection with tomato spotted wilt virus. It is vitally important that UK growers have access to IPM compatible control measures against *N. viridula* as soon as possible.

In January 2013, HDC commissioned a desk study to look at control measures being used in other parts of the world with particular emphasis on solutions that could be incorporated into existing IPM programmes in the UK. Between July 2013 and December 2014, HDC sought to make a preliminary evaluation of some of the control measures identified in that desk study. However, opportunities were severely limited because the pest did not reappear in UK glasshouses until the end of the 2014 season. A limited amount of work has been done overseas and these results are incorporated below.

A possible IPM programme

The desk study has identified several monitoring and control measures that could be exploited by UK growers in the short, medium and longer term. It should be possible to develop monitoring methods that can be used to accurately time IPM compatible treatments based on biological, physical and chemical techniques. However, it must be stressed that all these measures should be studied in greater depth before they can be recommended with any degree of confidence for use in UK crops.

Monitoring systems

Sexually mature males of *N. viridula* have been shown to release a pheromone which is attractive in the field to females, males and late-stage larvae of the same species. The project team sourced a formulation of the pheromone which was claimed to be highly attractive to *N. viridula* in Japan. This was tested around previously infested UK glasshouses and in infested parkland in and around Lisbon, Portugal. The formulated pheromone was not attractive to *N. viridula* in these trials which indicated that European populations of *N. viridula* are of a different genotype to those found in Japan. However, there

was an exciting development at the trial sites in Portugal where the pheromone was shown to be attractive to a parasitic fly, *Trichopoda pennipes*. This parasitoid is known to attack *N. viridula,* and if it were present in the local ecosystem, then the pheromone could be used to draw it into crops infested by *N. viridula*.

Mercury vapour light traps have been used for monitoring adult *N. viridula* in Australian pecan crops. This technique could have potential as an alternative to pheromone traps and should be evaluated in UK glasshouses. If effective, the study could be extended to investigate alternative sources of light.

Trap plants

Plants which are more attractive to *N. viridula* than the crop have been used as traps in and around valuable broad acre crops in the USA, Australia and New Zealand. Sorghum and soybean appear to be particularly attractive to *N. viridula*. It is difficult to predict from the published work whether the plant species which have been shown to be more attractive than, say, cotton crops would also be more attractive than peppers or aubergines.

Unpublished reports from allotments in the London area suggest that podding beans could be a useful alternative to soybean and sorghum in UK glasshouses. The size and growth habit of dwarf French beans could make them ideal candidates for use under the main crop canopy. Ideally, trap plants should be tested with and without effective insecticides to control the spread of any offspring hatching from egg masses. Even synthetic pyrethroids could be used in this situation without impacting upon natural enemies operating within the main crop canopy.

Parasites and predators

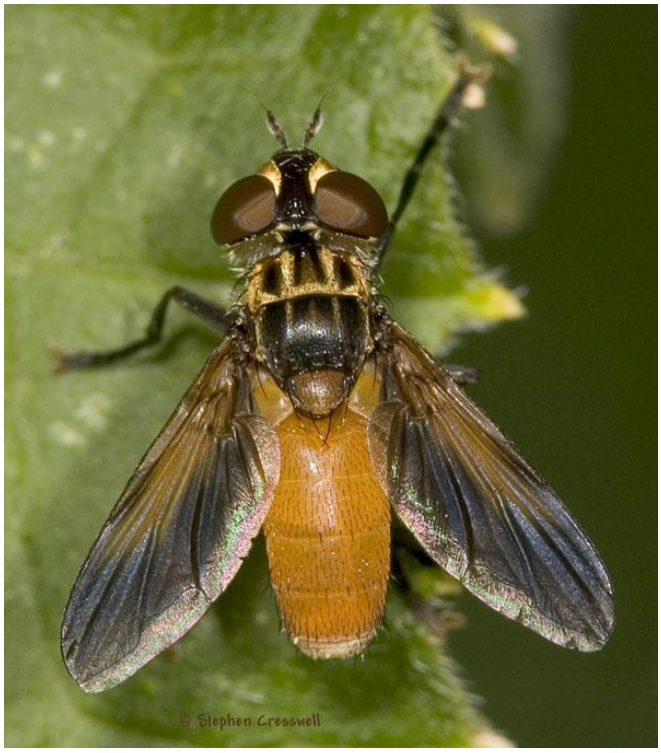
Over 60 species of parasitoids have been reported attacking *N. viridula*, with egg parasitoids the most important. The scelionid wasp, *Trissolcus basalis*, is the dominant egg parasitoid in the Americas, the Mediterranean Basin, the Middle East and Pakistan, and has been established in Hawaii, Australia, New Zealand, and other Pacific islands as part of biological control programmes. However, it is not specific to this pest and it is unlikely that it could be introduced to the UK.

Six species of tachinid flies are known to parasitise adult *N. viridula* and one, *Trichopoda giacomellii*, is reported to be specific for the pest. On that basis, it was introduced to control the pest at sites in western New South Wales and south-eastern Queensland. *Trichopoda giacomellii* is not indigenous to the UK but could be considered as a licensed biological control agent if further studies proved it to be specific to *N. viridula*. However, the cost of mass rearing the host bug in sufficient numbers to make the production system economically viable could be a limiting factor.

Our practical work has identified a pheromone that is attractive to another tachinid fly, *Trichopoda pennipes*. This species is not specific to *N. viridula* and this would probably eliminate it as a released biocontrol agent unless it is already in the UK. It has not yet been recorded as indigenous to the UK but this may be because no one has specifically looked for it or stumbled across it by chance. We know that it is present in Europe and information from North America indicates that it is capable of surviving at least as far north as Ontario and Massachusetts where winter conditions are far more severe than in southern England. The pheromone tested in this project could provide an opportunity to accelerate a search for *T. pennipes* in the UK.

There are relatively few publications which specifically refer to predators of *N. viridula*. Several generalist predators feed on *N. viridula* egg masses but take relatively small numbers. The ability of *Orius* spp. and *Macrolophus pygmaeus* to feed on *N. viridula* eggs/nymphs could be evaluated as both of these

predators are already released in many UK pepper and aubergine crops and may make a contribution to the overall control of the pest.



Trichopoda pennipes **(Courtesy of Stephen Cresswell, 'AmericanInsects.net')**

Entomopathogenic fungi

Published information indicates that the entomopathogenic fungi, *Metarhizium anisopliae*, *Beauveria bassiana* and *Paecilomyces* spp., could all have the potential to contribute to an IPM programme against *N. viridula* and could be evaluated in greater depth. In the short term, crop-scale trials would be restricted to the only available product in the UK market. In the longer term, it would be sensible to screen a wider range of isolates from all three genera. Entomopathogenic fungi may be of particular interest to organic growers who have limited options for the use of conventional insecticides.

Chemical insecticides

Chemical insecticides have been used against *N. viridula* for over 50 years. The earliest reports described the efficacy of organochlorine, carbamate and organophosphate insecticides but the emphasis has gradually changed to the newer generations of synthetic pyrethroids. The latter are now the most commonly used products throughout the world. Although the majority of these chemicals have been reasonably effective against *N. viridula*, they are incompatible with IPM programmes in UK glasshouse crops.

Of the chemical insecticides recently available to UK growers of protected edible crops, potentially useful products include:

- Pymetrozine could be properly evaluated both as a high volume spray and via the irrigation in a commercial crop situation.
- The neonicotinoids, acetamiprid and thiacloprid, may have a role in the IPM programme. However, UK approvals for application methods to minimise their impacts on biological control agents and pollination would need to be secured.
- The insect growth regulators, diflubenzuron and teflubenzuron could be considered for evaluation against *N. viridula* in laboratory bioassays prior to being tested on a crop scale.

Spirotetramat is registered for use on tomato crops in other parts of the world (*eg* Canada) and is said to be harmless to most beneficials. Unpublished information from Australia indicates that it may have had an incidental effect on *N. viridula* when applied against other pests. Spirotetramat has a unique two-way systemic mode of action which could allow it to be applied via the irrigation system. Although not currently available to UK pepper and aubergine growers, this active could be considered in future trials, given its compatibility in IPM systems.

'Alternative' insecticides

Argentinian researchers have shown that plant essential oils (PEOs) from *Aloysia polystachya*, *Aloysia citriodora*, *Origanum vulgare*, *Thymus vulgaris* and *Schinus molle* var. *areira,* as well as N, N-diethyl-*m*-toluamide, have activity against various life stages of *N. viridula*. These PEOs may be worthy of further evaluation.

Summary

The full reports from HDC projects PE 014 and PE 016 are available. Information compiled to date should help to develop an IPM compatible control programme based on a monitoring method to accurately time treatments of an anti-feedant against adults and possibly an insect growth regulator against nymphs. Other control options identified may support the strategy in the longer term. Development of this programme requires some preliminary small-scale practical tests to pave the way for a full-scale project.