# Grower Summary

## PC 302a

Organic tomato: Contingency plans for the control of *Nesidiocoris tenuis*

Final Report 2011

## Disclaimer

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The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

## Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

## Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

## Headline

- A short-term strategy based on natural pyrethrins and spinosad has been developed for the control of *Nesidiocoris tenuis* in organic tomato crops.

### Background And Expected Deliverables

*Nesidiocoris tenuis* originated in tropical regions but is now cosmopolitan in the Mediterranean basin. For many years, it has been known to be a voracious predator capable of attacking a wide range of pest species. During the 1990s and early 2000s, most researchers in the Mediterranean region focused on its potential as a biological agent, particularly against *Bemisia tabaci*. However, it is now known that it can also cause severe damage to tomato plants and, as a consequence, it has become a very controversial species.

In the absence of invertebrate prey, the predator will feed on tomato stems, leaf petioles and flower stalks. This initially shows as brown feeding marks, progressing to chlorotic leaf tissue, lost growing points and premature flower / fruit drop as illustrated in the figures below:

**Brown feeding marks on leaf petiole**

**Chlorotic leaf tissue beyond feeding puncture. Similar damage to a stem near the head of the plant can result in loss of the growing point.**

**Damaged flower stalk leading to premature flower / fruit drop**

Furthermore, broad spectrum insecticides, applied to limit direct damage by the pest, disrupt IPM and lead to secondary problems with other pest species. *Nesidiocoris* has been particularly damaging in organic crops because there has been no effective treatment that is allowed under this growing regime. In some situations, the loss in marketable yield has exceeded £100k per ha.

There is evidence that *Nesidiocoris* is moving further north in Europe. It is known to have become established in one conventional tomato crop in the UK in 2007. The infestation was controlled with acetamiprid (Gazelle); a broad spectrum neonicotinoid insecticide which is neither IPM compatible nor allowed in organic production. Established populations have also

been confirmed in All Year Round (AYR) crops in Finland, where it is proving difficult to eradicate.

Organic tomato crops in the UK are particularly vulnerable to *Nesidiocoris* because growers will not be allowed to use synthetic pesticides and retain their organic status, even under Plant Health and Safety Inspectorate (PHSI) instruction. The objective of this study was to begin to prepare a contingency plan to manage this pest in organic tomato crops in the UK.

## Summary Of The Project And Main Conclusions

### *Preliminary studies*

A preliminary desk study investigated options for the control of *Nesidiocoris tenuis* in organic tomato crops in the UK. The following products were given consideration:

| Trade name | Active ingredient | Approval status |
|---|---|---|
| Savona | fatty acids | This product has on-label approval for this use |
| Eradicoat | glucose polymer | This product has on-label approval for this use |
| Eradicoat T | glucose polymer | This product is not approved |
| Mycotal | *Verticillium lecanii* | This product has on-label approval for this use |
| Naturalis-L | *Beauveria bassiana* | This product has on-label approval for this use |
| BugOil | A mixture of plant oils extracted from thyme, tagetes and wintergreen | This product is not approved |
| Conserve | spinosad | This product has a specific off-label approval (SOLA) for use on this crop |
| Pyrethrum 5EC | natural pyrethrins | This product has on-label approval for this use and has a specific off-label approval (SOLA) for use on this crop |

There was no published data referring to efficacy studies in which this range of products had been tested against *Nesidiocoris*. However, all except BugOil and Conserve had been tested by the authors against the related Mirid bug, *Macrolophus caliginosus*. *Nesidiocoris* and *Macrolophus* are taxonomically similar and have comparable life cycles and life styles. It was therefore reasonable to assume that products that were effective against one species may also have an effect against the other.

Savona, Eradicoat / Eradicoat T, *Verticillium lecanii* and *Beauveria bassiana* were all eliminated based on previous experience of their use against *Macrolophus.* The available evidence suggested that both BugOil and spinosad could have potential and were worthy of evaluation in small scale trials. The most promising option appeared to be natural pyrethrins and their efficacy was investigated in crop-scale trials.

***Evaluation of BugOil and spinosad***

BugOil and spinosad (as Spintor 480SC) were evaluated against adults and nymphs of *Nesidiocoris* at normal and double the application rates recommended for other pests. All treatments were compared to untreated controls.

Adults and nymphs were collected from a natural population of *Nesidiocoris* which had become established in a mature tomato crop. They were sorted into batches of twenty and each batch was placed on a filter paper in a ventilated dish. Treatments were applied with a hand-held sprayer fitted with a fine nozzle which gave a light covering of the target equivalent to spraying foliage the 'point of run off'. After treatment, the insects were moved from the wet filter papers to dry filter papers in similar ventilated dishes. They were provided with crumpled tissue paper for refuge, a damp pad for moisture and then kept in the dark at approximately 20$^{o}$C for five days. The numbers of live insects were recorded daily.

Survival of adults following treatment with BugOil was similar to the untreated control. In comparison, numbers of adults in the spinosad treatments were reduced by 56%. The results were less consistent for nymphs but BugOil and spinosad reduced numbers by 50% and 61% respectively compared to the untreated controls at day 3. Overall, the level of control provided by both products was considered to be insufficient to warrant further evaluation under the less ideal conditions in commercial crops.

***Practical evaluation of natural pyrethrins***.

The label rate for Pyrethrum 5EC is 20ml product per 5 litres of water (*i.e.* equivalent to 400ml product per 100 litres water). However, the lower rate of 100ml product [5g active ingredient] per 100 litres of water had been shown to be effective against *Macrolophus*. Our preliminary practical studies with natural pyrethrins used an alternative product, Serv-Crisant (this product is

not approved in the UK), because Pyrethrum 5EC was not available in Portugal at that time. We tested Serv-Crisant at standard, double and quadruple rates, which spanned the rates for Pyrethrum 5EC in the UK. Each product was applied high volume, to the point of run off, to approximately 350m$^2$ of a mature organic tomato crop (cv Piccolo). Numbers of *Nesidiocoris* adults and nymphs were recorded immediately pre-treatment and 24 hours post-treatment. Numbers of adult *Nesidiocoris* were reduced by 39%, 91% and 95% following the standard, double and quadruple rate treatments respectively. Numbers of nymphs were reduced by 6%, 27% and 48% respectively. Numbers did not decline in the untreated control.

The maximum overall reduction of 56% at 28.4g active ingredient per 100 litres water was disappointing compared to previous results with natural pyrethrins against *Macrolophus*. This may have been at least in part due to different histories of exposure to insecticides. The *Macrolophus* populations in UK greenhouses originate from biological products that were raised in insecticide-free cultures for many generations and have since had little selection pressure from synthetic insecticides in tomato crops. In contrast, the *Nesidiocoris* were a natural Portuguese population that invaded from local agro-ecosystems where previous generations had been subjected to a wide range of synthetic insecticides over many years. The preliminary practical studies indicated that natural pyrethrins were unlikely to provide adequate control of *Nesidiocoris* with quarantine status in the UK. However, a chance observation suggested that their performance may be enhanced when applied in a tank mix with spinosad and this was followed up with a crop-scale trial.

The tank mix study was done in two mature organic tomato crops; cvs Roturno and Piccolo. The treatment comprised a tank mix of natural pyrethrins as Pyrethrum 5EC (80ml per 100 litres) and spinosad as Spintor 480SC (25ml per 100 litres) (this product is not approved in the UK). The spray was applied with the nursery's robotic sprayer calibrated to provide cover to the point of run off, which was equivalent to 2,991 litres per hectare. Assessments were done immediately pre-treatment and one day post-treatment. There were 10 sample stations in each of 10 plots within the treated area (*i.e.* 100 in total) and 10 sample stations in each of 4 plots within the untreated area (*i.e.* 40 in total). Two leaves, positioned 1-2 and 3-4 leaves down from the top of the plant, were chosen at random at each sample station. Each leaf was tapped 4 times over a white plastic tray to dislodge adults and large nymphs. The leaf was then scanned for remaining individuals. The numbers of adult and nymphs found on the two leaves were recorded separately for each sample station.

In the untreated control, the mean numbers of *Nesidiocoris* adults and nymphs increased by 6% and 29% respectively. The increase in numbers of adults was probably due to nymphs maturing

while the much larger increase in numbers of nymphs was no doubt due to continuous egg hatch. Overall, there was a 17% increase in numbers in the untreated plots between assessments. In contrast, numbers of *Nesidiocoris* adults and nymphs decreased in the treated plots by 89% and 94% respectively.

This treatment can form the basis of a short-term strategy for the control of *Nesidiocoris* in UK tomato crops and as such satisfies the main objective of this project. A single application of the tank mix would be adequate if we were following a 'culling' strategy similar to that employed against populations of *Macrolophus* in the UK. However, as a non-indigenous pest, it is more likely that growers will be instructed to eradicate *Nesidiocoris*. In that case, it is highly likely that at least one further application will be required 7-10 days after the first. Multiple applications to the whole plant will inevitably harm biological control agents used against other pest species.

## Financial Benefits

The damage caused by *Nesidiocoris* is similar to that caused by *Macrolophus* but more severe. Prior to HDC project PC 240 (Organic tomato: Development and implementation of a robust IPM programme), it was estimated that the cost of *Macrolophus* infestations in speciality organic tomato crops was over £100k per ha per season (Starkey, Grotek, unpublished data, 2004). Based on this information, the cost of uncontrolled infestations of *Nesidiocoris* in 10ha of organic tomato crops would exceed £1m per season. Effective control measures for organic crops will minimise such losses and allow growers to retain their organic production status. Furthermore, the new control measures will have knock-on benefits to conventional tomato production (particularly those growers attempting 'synthetic pesticide free' production) and will therefore be advantageous to the whole UK tomato industry.

## Action Points For Growers

- Seek specialist help immediately if you suspect that *Nesidiocoris* is present in your crop.
- Any action must be taken under the instruction / guidance of the PHSI.
- Acetamiprid (Gazelle) has provided control of a population of *Nesidiocoris* in a conventional tomato crop in the UK but it must be used with care within an IPM programme.
- This HDC project has developed a control measure based on a tank mix of natural pyrethrins and spinosad which can be used in organic and conventional crops. The precise rates of use may require some further fine tuning to take into account the discrepancies between recommended dilution rates, the amount of active ingredient allowed per hectare and the quantity of diluted spray required to provide cover of tomato foliage to the point of run off. This issue has previously been addressed for the application of Pyrethrum 5EC against *Macrolophus* on mature tomato crops (SOLA 3026 / 2006) but not, as yet, for products containing spinosad.

## GUIDELINES FOR GROWERS

### Background:

- *Nesidiocoris tenuis* is related to *Macrolophus caliginosus* and has a broadly similar life cycle and life style.
- It is slightly larger than *Macrolophus* and the adult has distinct black markings on its wings and 'knees'.
- Both adults and nymphs predate upon a wide range of insect hosts and can make a significant contribution to an IPM programme.
- In the absence of insect prey, they feed on the plants and are capable of causing very serious damage:
    - Feeding causes characteristic brown markings on stems, leaf petioles and flower stalks.
    - The plant tissue beyond the feeding mark often dies resulting in yellow leaves, lost growing points and premature flower / fruit drop.
    - In some circumstances, localised swelling develops on stems around the feeding mark.

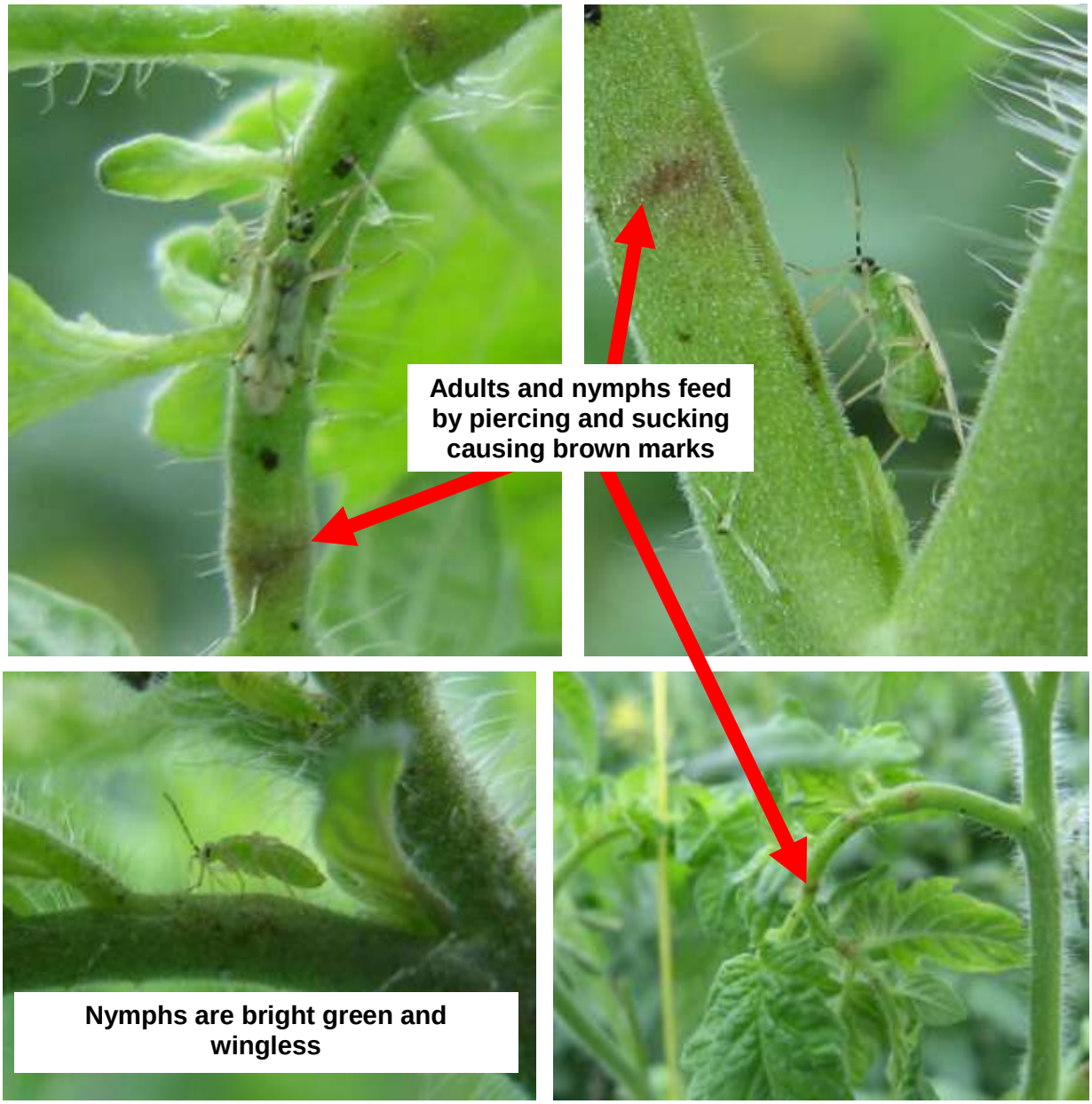
### Previous incidence in the UK:

- *Nesidiocoris* is common throughout the Mediterranean basin but not in northern Europe.
- It was found on a nursery in the UK in 2007 where it produced a large and damaging population. It was eradicated with a broad spectrum insecticide.
- It has become established in Finland where it is proving difficult to control.
- *Nesisdiocoris* remains a very real threat to UK growers and it is important that growers are aware of the damage symptoms.

### Action:

- Seek specialist help immediately if you suspect that *Nesidiocoris* is present in your crop.
- Any action must be taken under the instruction / guidance of the Fera Plant Health and Seed Inspectorate.
- Acetamiprid (Gazelle) has provided control of a population of *Nesidiocoris* in a conventional tomato crop in the UK but it must be used with care within an IPM programme.
- An HDC project has developed a short-term control measure based on a tank mix of natural pyrethrins and spinosad which can be used in organic and conventional crops.

**Adults are slightly larger than Macrolophus and have more distinct black markings on wings**



**Note that the leaf is yellowing beyond the feeding marks**

**Damaged flower stalks become yellow and swollen before fruit drop prematurely**

**Some tomato varieties react to feeding with localised swellings**