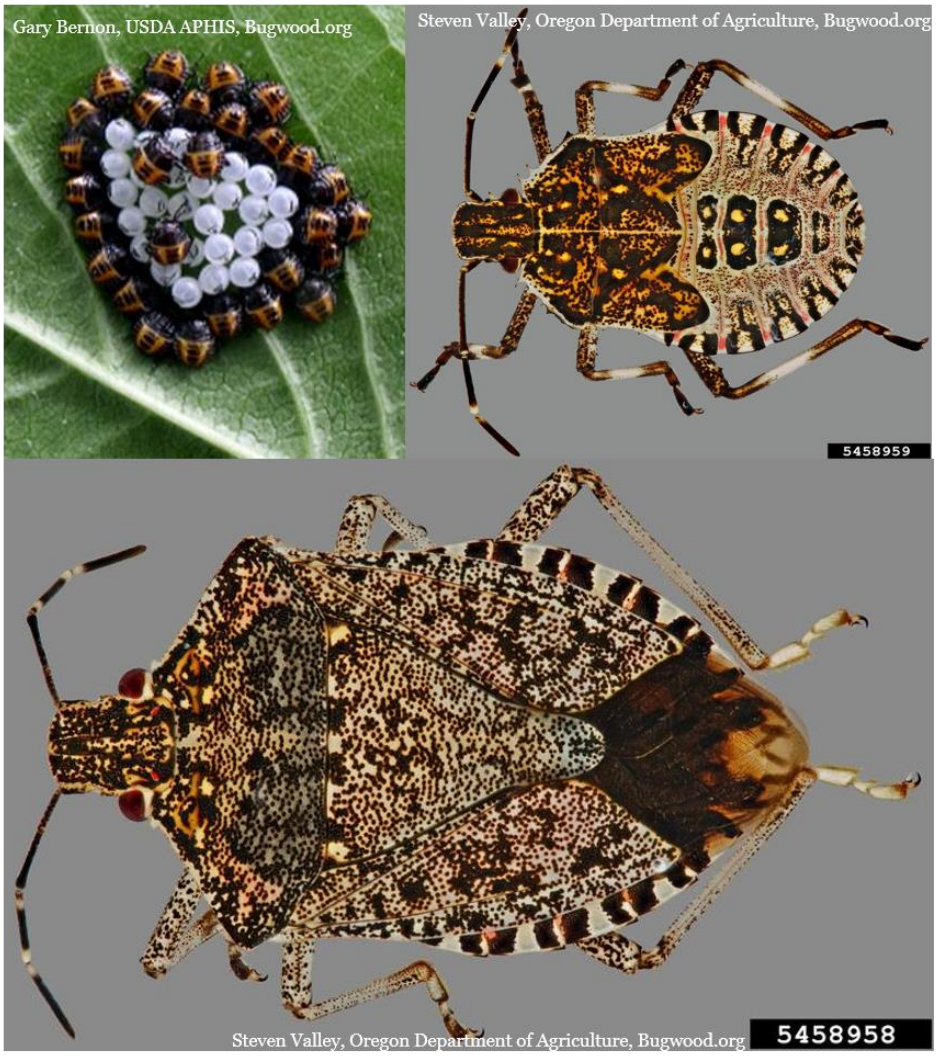
PHC2019/01 Monitoring for the Brown Marmorated Stink Bug (BMSB) *Halyomorpha halys* in Scotland

Policy Summary



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1 Policy Summary

1.1 Background

The increase in global trade brings with it the risk of spread of new pests and diseases into Scotland. *Halyomorpha halys*, Brown Marmorated Stinkbug (BMSB) belongs to a group of insects called shield bugs and is an invasive pest that has already become established in North America and several European countries. The insect aggregates inside houses over winter and can cause problems as an urban nuisance pest in homes as well as being a pest of agriculture. Preventing introduction of this species is particularly difficult as overwintering adults aggregate in sheltered spots and buildings and may be moved from infested areas on numerous commodities. BMSB has been intercepted entering the UK on several occasions in recent years, located on passenger luggage or imported goods. However, establishment of populations has not been reported.

Detection is difficult until damage is noticed. The BMSB attacks a wide range of hosts including *Rubus idaeus* (raspberry) and *Prunus avium* (sweet cherry). The potential for economic impact in Scotland is not yet fully understood. In order to meet trade requirements, the Scottish soft fruit industry requires pest freedom status, with countries setting strict biosecurity measures for BMSB.

1.2 Key Research Questions

The aim of this project was to gain a better understanding of the future threat of *Halyomorha halys* the Brown Marmorated Stink Bug (BMSB) and to determine the likely outcomes for any potential outbreak in Scotland. The possibility that BMSB presents a significant threat to Scotland's soft and tree fruit industries, and the likelihood of the pest becoming established in Scotland under current and future climate conditions and growing practices, was investigated.

1.3 Research Undertaken

- Co-ordinated monitoring for the presence of *Halyomorpha halys* in Scotland at 10 trapping sites selected based on their proximity to locations considered to be 'risk points' for introduction and 'at risk' for potential damage to industry.
- Modelling to predict future scenarios and areas for likely establishment of *Halyomorpha halys* under current and future climatic conditions in Scotland.
- Modelling to assess the risk of *Halyomorpha halys* becoming established within protected cropping environments.
- Establishment of a reference voucher specimen collection and barcode library of common UK stink bug species.

1.4 Main Findings

- No examples of *Halyomorpha halys* were caught on any of the monitoring traps or by sweep netting.

- SASA now hold eight native species, one European species and BMSB (from the USA) within their voucher specimen collection and reference barcoding library, allowing them to provide more robust ID's on suspected cases of BMSB reported by inspectors and members of the public.
- Two DNA extraction and amplification methods have been evaluated and a method has been developed for barcoding of degraded fragments of insect material trapped on the Pherocon BMSB STKY sticky traps. This method would allow body parts of the insect to be preserved for taxonomic identification and reference.
- Climate change projections show that in outdoor environments in Scotland BMSB populations would be unlikely to become established until the end of the century, where the environment may well be able to support the development of a generation of BMSB, particularly along the northeast and east coastline of Scotland - areas where soft fruit cropping is currently focused.
- Temperature data from protected environments suggest that there is the potential for 2 or even 3 generations per year in Scotland, depending on the timing of the introduction. However, with limited outdoor annual reproductive success there is consequently a very low risk of establishment (overwintering adult congregations are an expected part of the life cycle and are taken into account within the model).
- Establishment in Scotland is expected to be slower than in England and there is therefore the potential to attempt eradication rather than management or to manage individual outbreaks carefully to prevent spread.

1.5 Recommendations (and next steps if appropriate)

Surveillance and best practice for detection

- Future surveillance should be encouraged, especially focused on soft fruit production under protective cropping as this may provide key areas for establishment. If BMSB was found to be established in England, then targeting surveillance to this new route of entry should be considered.
- If routes of entry are too diverse for a targeted approach and establishment under normal Scottish conditions is unlikely under our current climate (see below), then targeting sites where a full life cycle could occur and known hosts are present may be the most successful strategy. For early detection, we would therefore recommend continuing to monitor at sites of soft fruit production under protection. Additional publicity events to raise public awareness and an easy reporting structure would aid detection of new introductions into non-cropping areas.
- Current best practice for detection is to use commercially available pheromone lures with sticky traps. These are non-bulky and easy to use and monitor. Pheromone lure traps can be used to both monitor and reduce populations, the latter by targeting late season congregating behaviour of adults. Pyramid traps baited with commercial lures containing BMSB aggregation pheromone and methyl decatrienoate are effective at capturing BMSB even at low densities. However, they are bulky and more difficult to maintain. Blue light traps (plus pheromone lure) are also in development in the USA.
- There are many similar species of shield bug in Scotland! Experts are required to identify potential BMSB by good quality photographs or specimens but molecular tools

developed in this project allow potential BMSB to be identified from poor specimens (on sticky traps) or identification by non-experts.

Eradication and control

- In all cases outside Scotland so far eradication has not been successful at the point of detection. It is anticipated, therefore, that eradication attempts may quickly be replaced by control. An IPM strategy is possible for BMSB, utilising trapping, biotechnical methods, biocontrol and pesticides where necessary. Control options include: Pheromone lure and pyramid traps (see above); Biotechnical methods have been explored by USDA scientists – focussing control at the edge of growing crops through the removal of individuals or egg masses as well as and the bagging of the growing fruit to reduce damage to the main crop; Asian biocontrol species (samurai wasps and microsporidial pathogens) have naturally established alongside BMSB populations in the USA and may arrive with the pest, expediting their potential use as biocontrol agents. Similar North American/European species are not considered to be good biocontrol agents but native predators such as ladybirds, beetles and lacewings may provide a level of control; No insecticide resistance has been reported but the choice of product suitable for use during fruit production and ripening may be limited in Scottish crops.

Knowledge transfer and intelligence gathering

- Knowledge transfer is critical to the success of controlling establishment and spread of BMSB, and novel findings and control advice should continue to be highlighted and reported to stakeholders at appropriate KE events and information platforms.
- Continuing to monitor impact and progress in other countries as the pest establishes is essential, as this will further inform crops at risk, alternate hosts and suitable control measures. A key network of scientists from other countries, e.g. as part of International Pest Risk Research Group (IPGR)'s 'Project Stinky', should be maintained to inform risk assessments. Therefore, opportunities to develop links with pest practitioners and form working groups should be encouraged to aid the development of risk analysis and control strategies.
- A central reporting site should be set up, potentially through the PHC website, to increase the possibility of early detection of BMSB.

Potential impact on Scotland potential hosts

- Impact is difficult to predict as most regions where BMSB has been introduced are still measuring impact as the pest establishes. The insect is a potential pest of many crops and wild hosts, with impact being across a wide range of fruit and vegetable production, as well as a potential impact on the environment. We consider soft fruit production is currently the most at risk due to the potential of the insect to successfully complete its life cycle in Scotland under a protected environment.
- Moderate damage (particularly quality) has been observed in blueberry in the USA and Canada. Highest levels of damage were observed at 17°C. Fruit damage and necrosis are also likely on cane fruits including raspberry and blackcurrant.

- Orchard fruits are also at risk of damage if BMSB were to establish outdoors. Apple and pear are of greatest concern in Scotland, where feeding site necrosis may render fruit unmarketable. Cherry and plum are also hosts but suffer less physical damage.

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