



BMSB biocontrol in kiwifruit

Research update: August 2020



This is an update on the research programme that has been commissioned by KVH and Zespri to help improve our understanding and optimise the use of biocontrol for managing Brown Marmorated Stink Bug (BMSB) in kiwifruit.

Background

The BMSB is considered one of the most significant biosecurity threats to the New Zealand kiwifruit industry, especially as pressures at our borders continue to increase. The risk of this pest entering New Zealand is considered high and if it were to establish eradication would be a significant challenge. One of the promising tools, both for eradication and possible long-term management is the biocontrol agent, *Trissolcus japonicus*, commonly known as the Samurai Wasp.

In 2018 the Environment Protection Authority (EPA) approved with controls the release of this biocontrol should BMSB establish in New Zealand. However, this was only the beginning of a large BMSB preparedness work programme, and there is still ongoing research that will help to optimise how we would use the wasp in a response most effectively. This work is undertaken through the BMSB Council, of which KVH is an active member and is still ongoing. Outside this national programme, KVH and Zespri, through the Biosecurity Innovation portfolio have commissioned work specific to kiwifruit to better understand how the parasitoid would perform in kiwifruit orchards.

Why the Samurai Wasp?

The Samurai Wasp is a natural parasitoid of BMSB that is thought to be one reason for suppressing BMSB populations in Asia - BMSB's native range. While there are other parasitoids attacking BMSB in Asia, the Samurai Wasp is reported to have the highest egg parasitising rates. You may have heard reports of it parasitising 60-90% of BMSB egg masses, and while this is true for some habitats, such as fruit trees (i.e. cherries) it is unknown how it will perform across a range of habitats, such as kiwifruit.

Because the Samurai Wasp has co-evolved with BMSB in its native range, it has adapted to BMSB so it will respond to the cues and chemical signatures that the stink bug leaves on trees and crops, and can locate BMSB in many different habitat types. While the wasp can also parasitise other stink bug species, it shows a preference for BMSB and it is mostly restricted to the Pentatomidae (stink bug) and Scutellaridae (shield bug) families (in New Zealand we only have representatives in the Pentatomidae). This host preference was a strong criterion for gaining EPA approval as it is unlikely to swap to parasitise native stink bugs should BMSB be eradicated.

While native to Asia, like BMSB, the Samurai Wasp has slowly made its way around the globe, now being found in North America and Europe. This provides a great opportunity for research to now be conducted in invasive habitats where the interactions between the parasitoid and BMSB may differ from the relationship in its native range.



Photo credit: Gonzalo Avila - Plant and Food Research.

Research

While there is a large programme of work on biocontrol for BMSB at a national level, much of this research has a more generalised scope and is not industry specific. To ensure that we understand the parasitoid interactions in kiwifruit specifically, KVH and Zespri have undertaken a specific program of work to address this gap.

Research in Italy

KVH/Zespri commissioned a two-year trial in Italy where one of the main objectives was to investigate if there are any potential predators or parasitoids found in kiwifruit that could be useful for biological control of BMSB. The identification of potential predators and parasitoids was consistent across both years, but unfortunately did not show a high level of promise for control. Spiders, earwigs, ants, tachinid flies and *Anastatus bifasciatus* (an egg parasitoid) were those found. The Samurai Wasp is not native to Italy and is only present in small numbers currently, however a rearing and release programme was started earlier this year in northern Italy.

Anastatus bifasciatus was the most promising find in Italy as this parasitoid was observed emerging from collected egg masses, highlighting that it can develop on BMSB eggs. *Anastatus bifasciatus* is native to Europe (not present in New Zealand) and is a proven BMSB egg parasitoid but parasitism rates are significantly lower than its Asian counterparts (i.e. the Samurai Wasp) with around 20% parasitism reported. Early research in Switzerland (not KVH commissioned) was undertaken to investigate host preference of this species, and it was found to be highly polyphagous (i.e. parasitises a number insects in different orders) which would make it an unlikely option for approval in New Zealand.



Image above: From left: Parasitised BMSB egg mass; eggs from which parasitoids have emerged; an adult of *Anastatus* spp (Ref: Francati, S., Dindo, ML. (2020). BS1821: The interaction between kiwifruit and BMSB lifecycle and potential parasitoid and predator control).

Research in China

As part of a bigger project, KVH and Zespri have commissioned trials to be undertaken in China to better understand parasitoid abundance and diversity in kiwifruit as well as optimising our knowledge around release numbers, timing and frequency of the Samurai Wasp in kiwifruit. The parasitoid surveys are expected to be conducted across three years, and we have just finished the second year of trials as reported below.

New knowledge on parasitoid abundance/diversity within kiwifruit orchards will help improve biological control options for BMSB in New Zealand. Also, developing optimum release strategies (i.e. parasitoid numbers to release, timing and frequency) is essential for the success of a biocontrol programme. Therefore, it is key to conduct research to develop optimum release strategies of Samurai Wasp in kiwifruit orchards, as this will help to maximise biological control effects in the field. These parasitoid surveys are expected to be conducted over three years, and we have just finished the second year of trials.

Results from the trial highlight that there were four different egg parasitoids emerging from sentinel BMSB egg masses in China. This included the Samurai Wasp, which was the dominant species, but closely followed by a similar wasp, *Trissolcus cultratus* and then significantly smaller numbers of *Anastatus* sp and *Acroclisoides* sp. Another interesting result was that parasitism rates in-field using sentinel egg masses was much lower than has been reported previously. The report highlights that parasitism rates vary across seasons and regions. Conventional orchards had lower parasitism than organic orchards which is possibly due to the different orchard management systems, where the conventional spray programme could also be impacting parasitoid abundance.

Biocontrol research in China continued...

While up to 80% is often quoted as the parasitism rate of Samurai Wasp on BMSB, these results highlight that there is a fair degree of variability and that while the wasp remains a valuable tool in our toolbox, on its own, it's not likely to effectively manage BMSB populations and it will need to be used in combination with other strategies for effective control. [kiwifruit industry with](#)



Image: Picture of BMSB egg masses in the field used to determine the rates of parasitism and abundance of parasitoids (Ref: BS1913: Optimising biocontrol for BMSB in kiwifruit: Preliminary results - year 2 update).

BMSB Council biocontrol work

On the back of the 2018 EPA decision to approve the release of the Samurai wasp in a response, a large programme of work was initiated to ensure that we are in the best position to use this tool, should the need arise.

This work programme consists of:

- ✓ Developing and refining a mass-rearing protocol so that we have the numbers required for a successful release in a response.
- ✓ Host searching research which is looking into ability to spread naturally and host location success rates at different densities.
- ✓ A Samurai Wasp release plan that will bring all this research together and outline how and when we would release the biocontrol to give us the best chance of success.

What's next?

- ✓ Research through the BMSB Council will continue and KVH will continue to be actively involved.
- ✓ The KVH/Zespri project in China (outlined above) has another year of trials to complete after which we will look to refine our biological control knowledge around parasitism rates and release plans.
- ✓ Italian researchers have begun Samurai Wasp release programmes. KVH/BMSB Council will be taking a keen interest in these trials and will stay informed of the results.

By proactively working together, we can protect your investment and manage risk