



Background

Aphids are a major pest of many crops in Fiji, including fruit, vegetables, root crops and kava.

They can damage crops directly and spread diseases like the Cucumber Mosaic Virus that causes Kava Dieback Disease.

Fiji's climate provides a suitable environment for aphids to thrive. Chemical pesticides are commonly used to control aphids and other insect pests, but they don't always work, they can be expensive, and they harm the environment, human health, and affect long-term pest management. Research was needed to find controls that were more cost-effective and safe.

Biopesticides

Biopesticides are pest control products made from naturally occurring biochemicals, minerals (e.g., clays), and microbes (e.g., some bacteria and fungi).

Plant extracts from Indian lilac (neem) and ginger have been known to offer sustainable control and scalability. These products generally have very low toxicity to humans, are more environmentally friendly, and can be more cost-effective.

Ginger is an important export commodity for Fiji, with approximately 1,400t of a range of processed and some fresh products exported to a range of countries annually. Processing of ginger generates 15 to 25% waste product. Transforming this waste into a value-added product, such as a biopesticide, could not only reduce waste streams but also generate economic and environmental benefits while supporting climate-smart agriculture.

Biochemicals, such as gingerols, are naturally present in ginger. While they have been found to control some insects in trials done in other countries, this had not previously been tested on aphid species in Fiji.

Biopesticide research by Fiji National University

In 2025, PHAMA Plus commissioned research with Fiji National University to look into the use of ginger waste in biopesticides, to control aphids. The project utilised ginger waste from PHAMA Plus partner, Kaiming Agro Processing.

- Fresh ginger waste from Kaiming's factory was collected and used to prepare a biopesticide solution. The waste was kept at room temperature and used for the biopesticide trials over a period of five days.
- The ginger waste was blended with water and made as 5, 15, 25 or 50% concentration.



Formulation of ginger biopesticide from ginger waste.

The solution was tested under laboratory and greenhouse conditions to determine if it was possible to control aphids on cabbage plants. The leaves of the plant were sprayed with the solution or dipped in it.

The aphids were checked 24 hours later to see if they were still alive.

The solutions were also tested by the Institute for Applied Science at the University of South Pacific to measure the amount of gingerol. Gingerol is one of the recognised biochemicals in ginger that can control insects.



An aphid colony on the underside of a leaf.

The results

The biopesticide solutions at 15, 25, and 50% reduced the survival of aphids. The gingerol levels of the 15 and 25% solutions were similar and were higher than the 5% solution. The mortality rate was the highest with the 50% solution, but its gingerol level was not tested. FNU plans to test gingerol levels for the 50% solution as part of future work.

When the solution was mixed using ginger waste that had been stored for a number of days, the efficacy was reduced. The solution needs to be freshly prepared.

The unfiltered solution was observed to have greater adhesive properties and may be more effective in sticking to insects and leaves. But this would be difficult to apply under field conditions without further refinement (e.g. the solid ginger waste block spray nozzles).

Key findings

The research has confirmed that ginger waste can be used as a biopesticide to control aphids under greenhouse conditions.

Biopesticide solution made with ginger concentrations higher than 15% were effective against aphids. Solution containing 50% of ginger extract applied to aphids showed 100% mortality rate. However, the potency of these solutions appears to decline over time.

With further development, this biopesticide could help to reduce Fiji's use of synthetic pesticides, make use of this readily available waste product from ginger processing, and support sustainable agricultural practices.

Recommendations

1. The Masters research project is being finalised and data will be available in late 2026.
2. Initial results warrant further testing and product development:
 - a. More controlled testing of the ginger waste and biopesticide solution to confirm what the key biochemicals are, including but not limited to gingerol levels.
 - b. Further testing to refine the optimal solution to balance efficacy with commercial viability.
3. Trials to develop a shelf-stable biopesticide solution that can be applied using standard equipment such as knapsack sprayers.
4. Trials at the field scale to confirm the promising results from the laboratory and greenhouse scale.

Acknowledgements

PHAMA Plus appreciates the research conducted by Mr. Waisea Sewabu from the Fiji National University and the support provided by Mr. Calvin Qiu of Kaiming Agro Processors Ltd.

