Pheromone Identification for Environmentally Responsible Control of Thrips

Berichterstattung

Projektinformationen

PERFECT

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Projekt abgeschlossen

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Final Report Summary - PERFECT (Pheromone identification for environmentally responsible control of thrips)

The aim of the project was to make aggregation pheromones of thrips easily available for the monitoring and control of a range of current and future pest species of thrips. Our first objective was to synthesise a

library of potential pheromone compounds of thrips (Thysanoptera). The candidate compounds are esters consisting of a monoterpene alcohol combined with a 5-carbon fatty acid. The approach was to synthesise the esters using all the possible isomers of 5-carbon acids and various monoterpene alcohols. The second objective was to analyse the library of compounds by coupled gas chromatography mass spectrometry (GC / MS) with chromatographic separation of all these compounds on non-polar (DB5 MS), polar (DB WAX) and chiral (Cyclosil-B) columns. The third objective was to collect a bulk sample of pheromone of Thrips palmi by developing techniques for holding live male thrips and entraining the pheromone they produce. The aim of the fourth objective was to identify the collected pheromone by matching it to the library and then synthesise and test it. Finally, the aim of the fifth objective is to collect a pheromone of another thrips species, use the library to identify it and then synthesise and test it.

All of the tasks for years 1 and 2 were completed successfully. The library was completed by synthesising over 200 compounds and analysed by GC / MS. We made two visits to Japan and collected a large quantity of the pheromone required for identification. This pheromone has now been identified.

We have demonstrated clearly that the adult males of Thrips palmi produce a compound that is analogous to the aggregation pheromone of other thrips species. We have identified this compound unambiguously by subjecting it to GC / MS analysis, using various non-polar, polar and chiral columns and matching it to our library of synthesised esters. We have followed extensive synthetic and analytical methodologies for further confirmation of the exact form of the Thrips palmi compound. We have produced a library of terpene esters by using all the possible isomers of 5-carbon acids and various monoterpene alcohols. Some of the 5-carbon acids and isomers of monoterpene alcohols were not commercially available and we synthesised these from their corresponding alcohols and racemic mixtures. Furthermore, we have carried out GC/MS analysis for all these compounds on DB5 MS, DB WAX and Cyclosil-B columns under different conditions and generated retention time-locked libraries for all these compounds with naphthalene D8 as an internal standard. Kovats indices were calculated for all these compounds.

We have also developed a portable entrainment method for collecting bulk samples (> 1 microgram) of thrips pheromone. Large numbers of thrips collected from a crop can now be kept alive in a small chamber for 4 days and this allowed the collection of nearly 2.5 microgram of pheromone. This is the first time such a large quantity of pheromone has been collected from any thrips species. With this methodology we have collected nearly 2.1 microgram of Thrips palmi pheromone in Japan.

On return from Japan, the Thrips palmi pheromone sample was analysed by GC / MS and compared with the library of synthesised esters. A direct match was not observed immediately from the library. More esters were synthesised with the appropriate molecular weight based on evidence from the new sample. These esters were analysed and added to the library of compounds. One compound was found to match the Thrips palmi sample on all three different columns consistently. Advanced synthesis was then necessary to identify and match the correct form of the pheromone.

We have identified the pheromone of Thrips palmi by various analytical and synthetic methodologies. We expect that the identified compound will attract thrips in planned future field trials and we are optimistic that the use of the pheromone as part of an environmentally responsible control strategy will play a role in reducing the impact of damage from this pest thrips in agriculture and horticulture. The methods we have

developed, together with the library, will also allow rapid identification of the pheromones of other thrips species and thus provide new control strategies that reduce the need for pesticides in many crops.

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