PIP – SUMMARY OF TRIALS

October 2014

Field trials of biological products to reduce fruit fly damage on mango in Senegal

Introduction

These notes summarise the results of field trials carried out in Senegal during 2012 by *Université Cheikh Anta Diop, Facultés des Science et Techniques*. The work was supported by COLEACP PIP and the full report is available on request.

The invasive fruit fly *Bactrocera invadens* has become the scourge of many fruit growers in Africa since it moved through the continent. In 2005 it became a problem in West Africa. There were already some conventional pesticides registered which can be used against fruit flies, but the possibility of using biologically-based pesticides as an alternative to, or alongside conventional products, is attractive as they convey minimal risks in terms of residues and are safer to users of the products.

1. Trial protocol

Four biological control products were tested in the pilot trials to determine which might be worthy of further work and eventual registration. They were applied as sprays in mango (variety Kent) in orchards in the region of Thies. Other tests took place in the laboratory to assess the potential repellency in comparison with untreated fruit, and insecticidal effect when products were sprayed directly on to flies.

The four products (coded at the request of the manufacturers) tested were:

- ✓ P1 - (0.03% solution being used) which consists of orange and *Trichoderma harzianum* extracts,
- ✓ P2 - A product (60g/l being used) based on kaolin,
- ✓ P3 - A product (0.3% solution being used) based on plant extracts,
- ✓ P4 - A product (0.3% solution being used) based on propylene glycol alginate.

There was also an untreated control.

Each treatment was applied using a 1 litre sprayer to mango fruits on the tree, with treated fruits being distinguished by coloured labels. There was also a control treatment in which no product was applied.

All treatments were replicated 3 times and applied each week during an 8 week period. Fruits showing oviposition marks were picked and incubated in the laboratory. At the same time, the level of infestation of two species of fruit flies (*B invadens* and *Ceratitis*) was monitored using traps baited with terpinol, methyl eugenol or TrimedLure.

In another test, aimed at assessing the repellency of treated fruits versus untreated fruits, mangoes from each treatment were placed in cages, each containing untreated fruit and fruit treated with one of the four products. Gravid (about to lay eggs) female flies were placed in the cages to see which fruits were preferred for oviposition.

The third test was to spray adult flies directly with the products to assess mortality from direct contact.

The box below summarises the findings which are explained in more detail later in the text.

- P2 was the best product for reducing oviposition in the field, and hence showed potential for further testing
- P1, P3 and P4 did not prevent oviposition when there were many *Bactrocera* present. The authors considered that these products may have performed better if they had not been washed off by rain soon after being applied.
- P3 seemed to attract both sexes of *Bactrocera* and *Ceratitis* flies and may have a role in 'Lure and Kill' techniques.
- In laboratory tests, paradoxically (in the light of the point above) P2, P3 and P4 had an insecticidal effect when sprayed on flies. This insecticidal effect was even more pronounced for P2 and P4.

2. Results and conclusion

Many problems were encountered with test fruits being picked or damaged by bats and birds, and the fruit fly source (bananas and pawpaw) did not consistently provide sufficient flies for the tests. Moreover rains washed away some of the spray treatments on fruits. Notwithstanding these challenges, some interesting findings were observed.

2.1. Field oviposition

Early in the trial, before the rains increased the number of *B invadens*, the level of oviposition was low, but from 6 weeks onwards, oviposition increased greatly. Mangoes treated in the field with P2 had least oviposition puncture holes, but all the other treatments had more puncture holes than the untreated control, with P3 being the worst at around 85% affected (versus control having 45% affected). Only 4% of fruits treated with P2 had oviposition puncture marks.

2.2. Laboratory egg-laying preference comparisons

In contrast to the field results, fruit in cages that had been treated with P1 showed no attack (oviposition) whereas untreated control fruits showed damage. P2 was the worst treatment with 25% of fruits being punctured by females laying eggs. P3 actually killed flies (90% mortality after 4 hours) although before they died, the females had already caused some puncture holes indicating that they had laid eggs.

2.3. Mortality when flies were sprayed with the products directly

When the products were sprayed directly on to flies under test conditions, all gave at least 40% mortality after 5 days (compared with 14% in the control) and flies sprayed with P2 had a very high mortality (94%) indicating that the kaolin may have blocked the breathing spiracles.

The table below summarises these findings:

Product	Mode of action		Efficacy	
	In the field	In the laboratory	In the field	In the laboratory
P1	Does not prevent oviposition on fruits	Some repellency and slight insecticide effect when sprayed directly on flies	Some efficacy	Some efficacy
P2	Apparent deterrent effect	Apparent deterrent effect Insecticide effect when sprayed directly on flies	Some efficacy	Less efficacy
P3	Does not prevent oviposition on fruits Appears to attract flies	Appears to attract flies Slight insecticide effect when sprayed directly on flies	Some efficacy	Some efficacy
P4	Does not prevent oviposition on fruits	Slight deterrent effect Some insecticide effect when sprayed directly on flies	Some efficacy	Some efficacy

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