The Closing Case Report of National Chiayi University Industry-University Cooperation Project

Evaluation of the effect of plant protectant on the control of pests (aphid, mites, spodoptera litura, mealybug)

Project Host: Lin Mingying
assistant professor

National Chiayi University Department of Plant Medicine

December 2016

Evaluation of the effect of plant protectant on the control of pests (aphid, mites, spodoptera litura, mealybug)

National Chiayi University Department of Plant Medicine

Lin Mingying

Foreword

Taiwan is located in a tropical and subtropical location and is suitable for the cultivation and growth of many crops. However, due to the high temperature and humidity of the climate, many crop pests and diseases are often prone to occur, and it is easy to breed and cause serious damage. The use of chemical pesticides at a glance can immediately suppress the occurrence of insects (mites), but the side effects of chemical control are caused by incorrect or excessive use of pesticides. 3R: Resurgence (Rampant again), Resistance (efficacy resistance), Residue (pesticide residues), the problems are endless (He, 1984). How to use pesticides moderately to reduce the problems they are derived has always been an important issue.

Moreover, consumers are paying more and more attention to food safety, and the production side is gradually adjusting. The words of non-pesticide control, non-toxic agriculture, organic cultivation, etc. are filled with the promotion and advertising of agricultural products. Representing the use of non-pesticide materials for pest control is a rapidly developing field (Wang, 2010). The effectiveness of prevention and control of such materials is also in great need of confirmation and mastery.

Agricultural pests such as spider mites, scale insects, aphid and Noctuidae: including pests such as spodoptera litura, beet armyworm, tomato night moth, and looper, have a great impact on crops. Due to the rapid proliferation of their population density, they are often the primary targets for prevention and control. It is easy to find resistance to agricultural pesticides, and it is an urgent task to find non-pesticide prevention materials (Yu and Chen, 2009; Liu et al., 1993).

The purpose of this experiment is to carry out indoor tests on the control effect of plant protectant on pests and mites. The prevention and control of the pests (mites) is clearly controlled, and It will facilitate the future promotion of non-pesticide prevention and control.

Materials and Methods

1. Test materials and insect sources

Explore the effect of pest control on non-toxic and broad-spectrum plant protectants.

The test subjects were Aphis gossypii on the Cucurbitaceae crop, the mealybug on the cassava, the Spodoptera litura larvae and the Tetranychus urticae on the papaya.

1-a) Aphids: The leaves from which a large number of cotton aphids have been collected from the field of flowering courgettes are cut into pieces of about 5 cm x 5 cm and place the leaf back up on a petri dish 9 cm in diameter. About 30 or so aphids per dish.

1-b) Scale insect: Collected from the **mealybug** on the leaves of cassava, cut the leaves to a size of about 5 cm x 5 cm. Place the leaf back up on a petri dish 9 cm in diameter, there are about 20 scale insects per dish.

1-c) Spodoptera litura: Spodoptera litura, which was breed with artificial feed, was placed in a 150 ml plastic box with approximately 3 instar larvae per box for testing.

1-d) Spider Mite: Collected from **Tetranychus urticae** on the papaya garden, cut the leaves into about 5 cm X 5 cm, and placed the leaf back up on a petri dish with a diameter of 9 cm. Each dish has about 30 spider mites for testing purposes.

2. Test Methods

The control of cotton aphid, mealybug, Spodoptera litura larvae and Tetranychus urticae was carried out indoors using a non-toxic and broad-spectrum plant protectant. Dilute 100 times, 200 times and 400 times with pure water, and add 500 times of diatomaceous earth to all dilutions.

The above diluted solution was uniformly sprayed onto the test object by a pressurized atomizer. **After the first spraying, and then spraying again after 24 hours, and observe and record the death after 48 hours. 4 repetitions per treatment. In addition, a dilution of only 500 times of diatomaceous earth was applied as a control group**

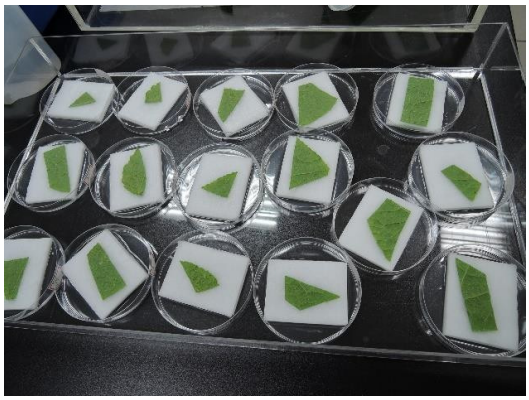
The test results were corrected by the control group, and the formula for calculating the control rate was as follows:

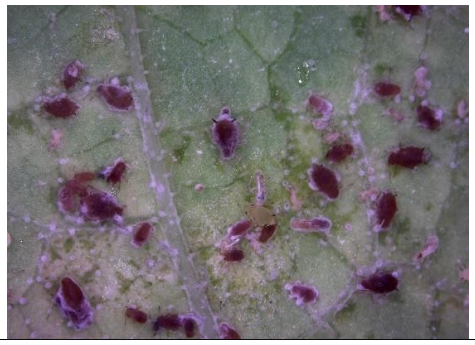
$$\text{control rate}\,(\%) = \frac{\text{treatment group mortality} - \text{control group mortality}}{1 - \text{control group mortality}} \times 100$$

Results and Discussion

The control effect of non-toxic and broad-spectrum plant protectant on aphids, scale insects, Spodoptera litura and spider mites.
The test results are described as follows:

2-a) Aphids: The aphids tested in this experiment are cotton aphids on the flowering courgettes, and the non-toxic and broad-spectrum insecticide protectant are sprayed 100 times, 200 times and 400 times respectively, the test procedure is detailed as shown in the attached photo**. After the mites are sprayed with the diluent, they are obviously covered with the pest protectant during the microscopic examination.** The death of the mites is recorded at intervals of 24 hours, and then sprayed with the same dilution for 48 hours (2 days) and 96 hours (Day 4) record the death. Draw with the corrected rate of prevention, as shown in Figure 1.
When the indoor test is carried out, 100 times of the protective agent sprayed once for 24 hours, the control rate reached 94.3%, and after spraying twice, it reached 97.6%; under the condition of 200 times, the control rate of the first day and the second day the control rates were 92.9% and 87.3%, respectively. **The prevention and treatment rates on the 1st and 2nd day of the 400-times results were 66.3% and 76.2%,** respectively. On the whole, the protective agent can control the aphids under three kinds of concentrations, and the control effect can reach more than 70%.

	
Aphids test situation	**The control group that just sprayed the dose**

	
Spraying pest protectant 100 times situation	Spraying pest protectant 200 times situation
	
Spraying pest protectant 400 times situation.	The death situation of two days later after spraying pest protectant 400-times.

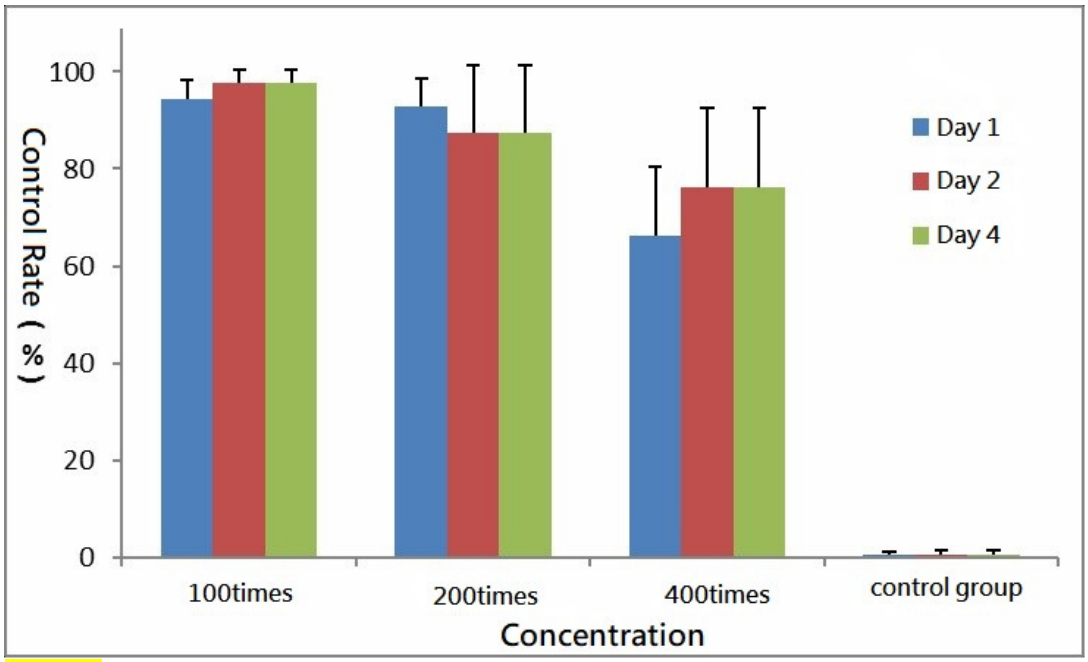
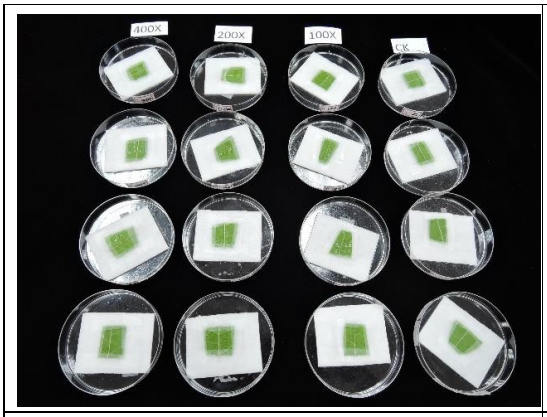


Figure 1. The control effect of different concentrations of non-toxic and broad-spectrum plant protectant on the control of cotton aphid.

2-b) Spider Mite: The spider mite tested in this experiment is Tetranychus urticae group collected from papaya and cultivated in large quantities indoors. **The Tetranychus urticae were sprayed 100 times, 200 times and 400 times respectively with non-toxic and broad-spectrum pest protectants. The test procedure is detailed as attached photo. After spraying the diluent, the spider mite was similar to the case of the aphids in the microscopic examination. It was also covered with a protectant. However, after the coated diluent was slowly dried, most of the spider mites began to move and appeared to be unaffected.**

Therefore, the prevention rate at the first day of the three-time dilution ratio was 100 times the highest, only 63.3%. 200 times and 400 times, respectively, only 36.7% and 13.3%.
The result of spraying once again was 93.3% for 100 times and 80% for 200 times. However, under 400 times, the control rate was only 46.7% until the 4th day of the end of the test.

<table>
<tr><td> 
</td><td>  </td></tr>
<tr><td>get on testing of the Tetranychus urticae</td><td>Tetranychus urticae on the leaf before spraying</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Spraying pest protectant 400 times the situation</td><td>Spraying pest protectant 100 times the situation</td></tr>
</table>

	
Spraying pest protectant 200 times the situation	**Situation of the control group**

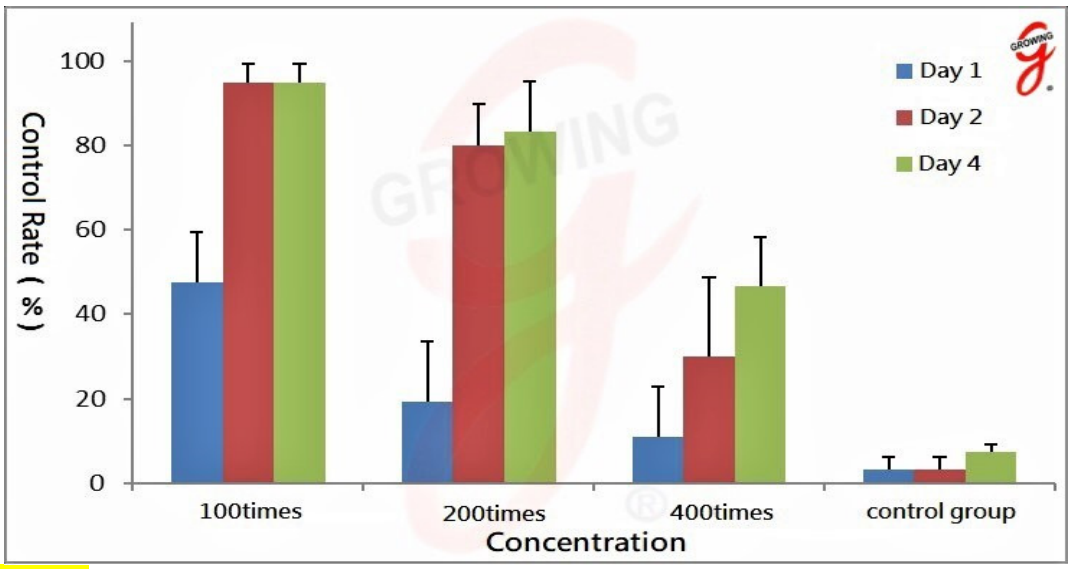
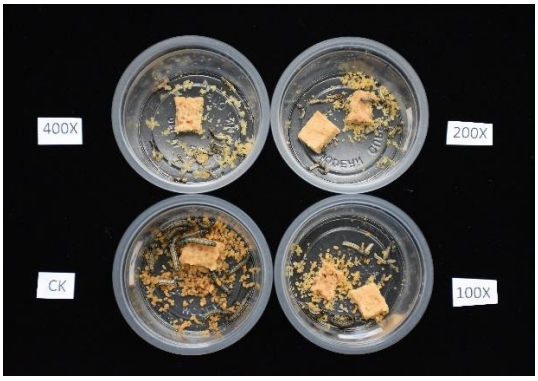


Figure 2. The control effect of different concentrations of non-toxic and broad-spectrum plant protectant on the control of Tetranychus urticae.

2-c) Spodoptera litura: The larvae of Spodoptera litura in this experiment are bred by artificial feed. **The larvae tested are mainly larvae of 3~4 years old.** The test was carried out as shown in the photograph taken during the test period, and the larvae continued to provide artificial feed as a source of food after spraying.

When the larvae of Spodoptera litura were sprayed on the first day, their control rates were low, only 57.5% at 100 times and lower at 400 times, only 8.8% (Fig. 3). After the second spraying, the prevention rate of 100 times was 86.3%; that of 200 times was also 83.8%, and 400 times was more than 63.8%. **However, the mortality of the control group in this trial significantly increased significantly after the second day, exceeding 21.3%, which was less common**. **Because all the diluted liquids have 500 times of diatomaceous earth except for different concentrations of pest protective agents, it is speculated that the larvae of Spodoptera litura are affected by the diatomaceous earth, resulting in death.**

	
Tested Spodoptera litura situation	**Spraying different concentrations of Spodoptera litura**
	
The death larva of spraying pest protectant.	**The case of experimenting with artificial feed breeding.**

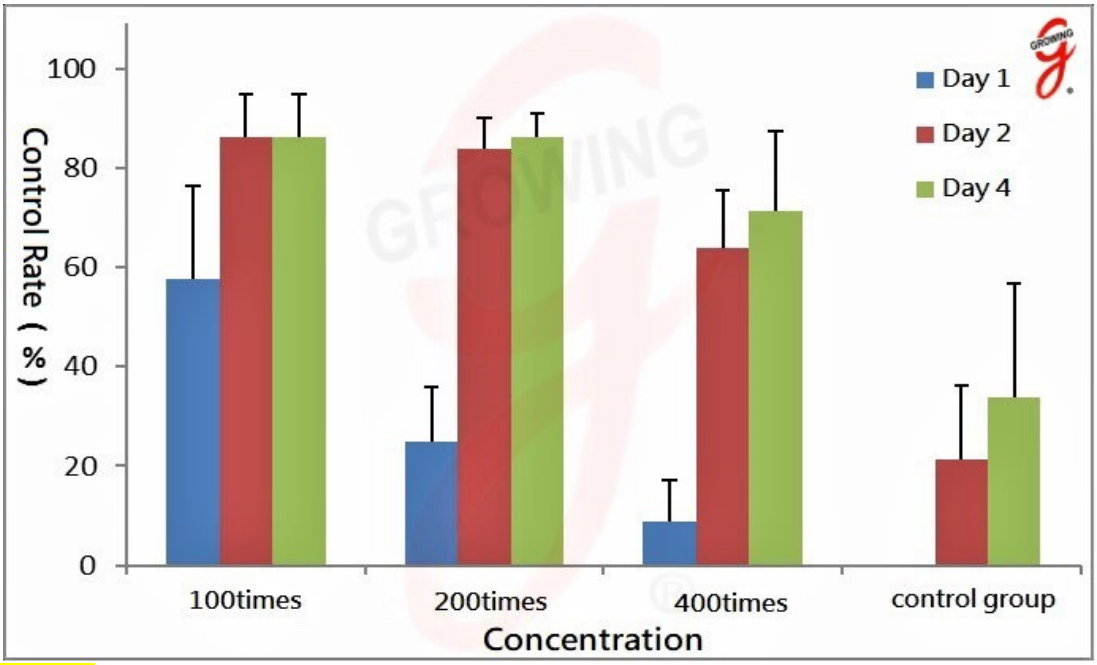
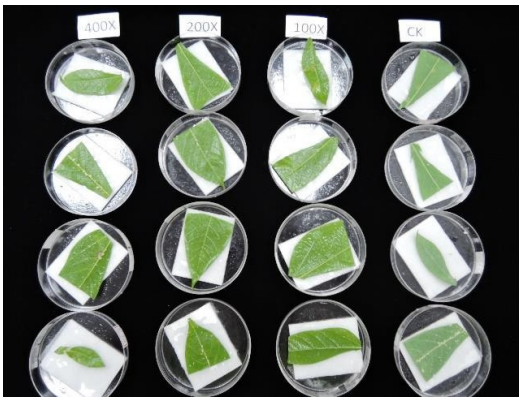
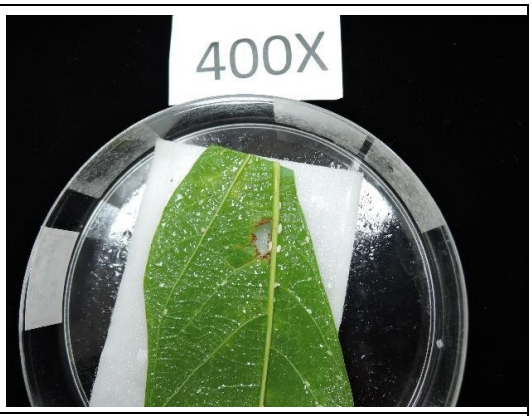
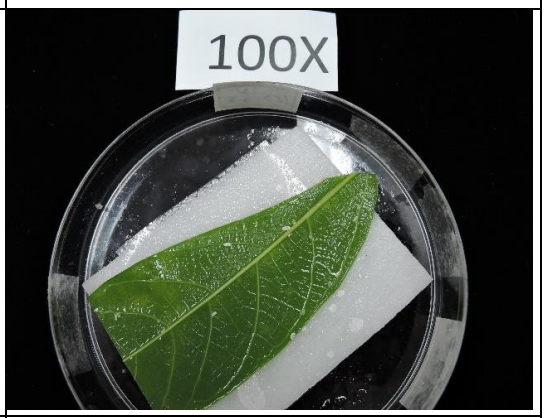


Figure 3. The control effect of different concentrations of non-toxic and broad-spectrum plant protectant on the control of Spodoptera litura.

2-d) Mealybug: The mealybug in this experiment were collected from cassava. **The main test subjects were mealybug on the leaves that had not yet started spawning**. The photo of the mealybug body after being sprayed by the pest protectant is as follows, **most of the mealybug will be covered by the protectant, and the wax powder on the surface of the mealybug will obviously disappear**. **If the body of the mealybug dies, the body surface will no longer secrete the wax powder, and even some dead insects will have a yellow-brown to brown appearance**.

Under the condition of 100 times, the rate of prevention and control of this material can reach 100%, while at 200 times, there is a control rate of 76.1% on the first day, but the control rate is only 15.3% when sprayed at 400 times. **Overall, after 200 times the end of the test, there is more than 85% control rate**, **but if sprayed at 400 times, the best control effect is only 57.1%**

	
The tests carried out mealybugs	**Spraying 400 times the mealybugs**
	
Spraying 200 times the mealybugs	**Spraying 100 times the mealybugs**
	
Spraying 100 times mealybugs death	**Just spray 400 times the mealybugs**

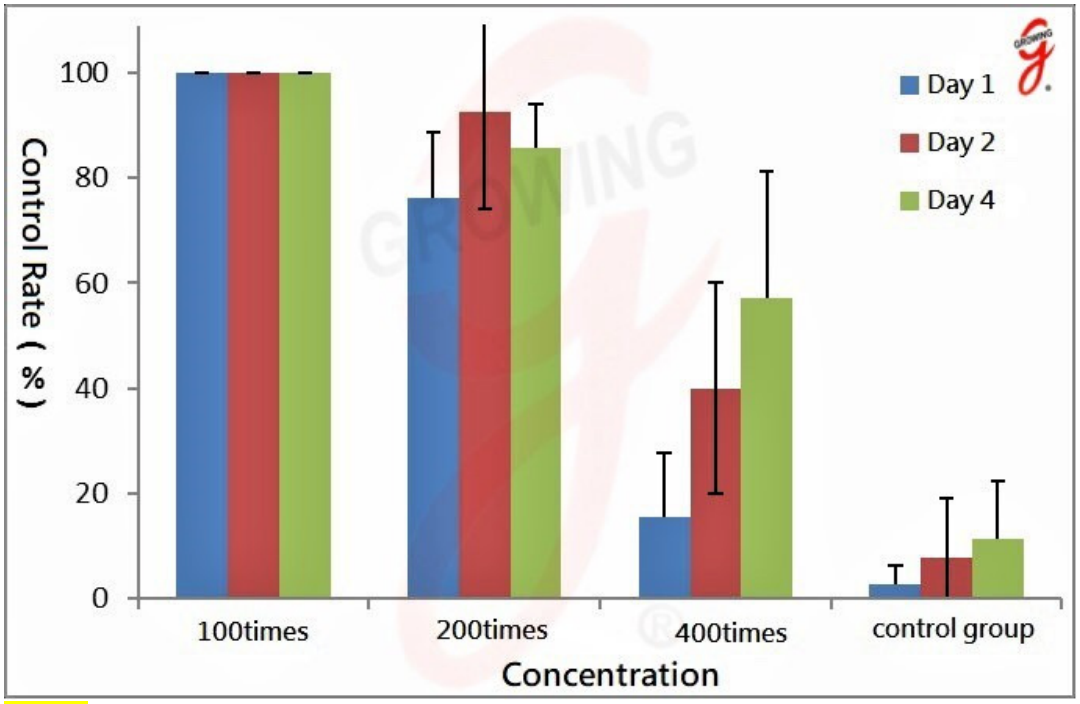


Figure 4. The control effect of different concentrations of non-toxic and broad-spectrum plant protectant on the control of Mealybug.

Conclusion

The non-toxic and broad-spectrum plant protectant is used in indoor and outdoor control tests against aphids, spider mites, Spodoptera litura and mealybug. According to the preliminary results, it has a certain degree of effect and can effectively control pests on crops; **However, the concentration seems to be one of the key factors determining the success or failure of prevention and control. If the concentration of 400 times is not effective for the management of spider mites and mealybug, the control rate is only about 50%. However, if the aphids or mealybug are applied twice in a row, the concentration of 400 times after 4 days is also more than 70%. When applied at a concentration of 100 times, the control rate of the four pests tested can reach more than 80%.**

The laboratory test can make a preliminary assessment of the control effect of the materials, and it is also the first priority for the first-time mastery of the effects. In the future, the materials of such plant protectants to field control effects should be carried out again. **First, to evaluate the control effect of different pests on different crops,** and **secondly to explore whether the test concentration has obstacles to the growth of crop plants. If we can find a suitable mode of operation, under the premise of the production of safe agriculture today, the use of such non-pesticide materials will have unlimited possibilities and development.**

In addition, the Agriculture Committee of the Executive Yuan (Taiwan's highest government administrative unit) shouted the policy of "half the use of chemical pesticides in 10 years". It is expected to introduce low-toxic and effective chemical pesticides and Non-chemical pesticides prevention and control materials to replace high-risk pesticides.

This trend will soon pervade the global agricultural market, and "chemical pesticides" will soon be replaced by "The plant protection material of non-chemical pesticides". The early bird has insects to eat, and the first mover will be the winner of a highly competitive agricultural market operator.

References Literature:

Wang Qingling. 2010. Crop pests and non-pesticide prevention materials. Special Edition of the Agricultural Research Institute of the Executive Yuan, No. 142. 183 pages.

Yu Zhiru, Chen Binghui. 2009. The lethal effect of three vegetable oils on the two-leaf clover. Taiwan Agricultural Research 58: 136–145.

He Kunyao. 1984. The observation of pesticides causing the re-emergence of citrus spider mites. Plant Protection Journal 26: 99-108**.**

Liu Daxiu, Wang Wenzhe, Chen Qiji. 1993. The application of several non-pesticide substances in the control of spider mites. Taichung District Agricultural Improvement Field Research Report 39: 61-71**.**