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# Sterilizing Effects of Three Chemosterilants on *Tetranychus viennensis* (Zacher)*

# 三种不育剂对山楂叶螨的不育效应

Tang Hua 唐 桦 Xu Rong** 徐 荣 Zheng Zhemin 郑哲民 Jang Wensheng** 姜文胜 Kong Zhong** 康 忠

(Institute of Zoology, Shaanxi Normal University, Xi'an, Shaanxi, 710062, China)
(陕西师范大学动物研究所 陕西西安 710062)

**Abstract** In order to control the leaf mite, *Tetranychus viennensis* (Zacher), three kinds of chemosterilants(MSA, CSⅡ and MSC) are prepared and their effects are tested in the laboratory. The tested concentrations are 0.2%, 0.5%, 1.0 for MSA; 0.4%, 0.8%, 1.2% for CSⅡ; the liquid of original, and that of being diluted 1 or 2 times for MSC. It is the control that spraying distilled water on the leaf mite. After spraying of the chemosterilants on the adult mites, the oviposition, hatching, mating and life-span are recorded every day. The observation lasts for 3 months. The results show that spraying with 0.8% wettable powder chemosterilant CSⅡ gains the best sterilizing effect. The number of oviposited eggs per female adult, hatching-rate(%), and the number of female and male adults of the 2nd generation are 7.17, 3.66, 1.00 and 0.50, respectively, while that of the control are 73.33, 84.06, 32.00 and 70.67, respectively.

**Key words** *Tetranychus viennensis*, chemosterilant, sterilizing effects

摘要 为了有效防治山楂叶螨(*Tetranychus viennensis*),以喷蒸馏水为对照,配制3种不育剂(MSA、CSⅡ、MSC)对山楂叶螨进行不育效应的室内试验。MSA、CSⅡ、MSC的试验浓度(3个重复)分别是0.2%, 0.5%, 1.0%; 0.4%, 0.8%, 1.2%; 1倍原液, 2倍原液,原液。喷不育剂后,每天对产卵、卵的孵化、交尾、寿命等观察和记载,持续3个月。结果表明,以0.8%的CSⅡ可湿性粉剂喷雾使用为最好。与对照相比,此浓度可将该叶螨的每雌产卵量(粒)、孵化率(%)及第2代雌、雄成螨数量(头)降低,分别为7.17, 3.66, 1.00和0.50;对照分别为73.33, 84.06, 32.00和70.67

关键词 山楂叶螨 不育剂 不育效应
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The researches of chemosterilants on leaf mite, *Tetranychus viennensis* (Zacher), have not been found from the previous reports, except for that on other mites[1~5]. In recent years, the leaf mite has made heavy harmful to the economic forest, particularly in mulberry fields and orchards, in Ningxia province, western China. The mites concentrate on the leaves, and make the attacked leaves curl, yellow and drop, and even cause the trees to die. The application of ordinarily control methods could obtain certain efficiency, but the resistances to chemical control such using pesticides often come along. On the other hand, the artificial control costs a lot, and the constantly increasing cost blocks the control efficiency rise. It is significant to do some researches on the leaf mite with chemosterilants in order to find a new way to control the leaf mite. Some reports on chemosterilants in other mites, artificial rearing[6,7], ecology[8~10], resistance to pesticides[11] and control[12,13] are referenced.

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** Ningxia Forest Research Institute (limited company), Yinchuan, Ningxia, 750004, China.

## 1 Methods

The detached mulberry leaf Petri dish was prepared as follows. A full grown tender mulberry leaf was put into distilled water in a dish, and the double sides of the leaf was constantly scrubbed using a small brush in order to remove all other insects or mites such as the natural enemies from it. Then the leaf was cut into round pieces about 5 cm in diameter, and its petiole was cut away. The round pieces without petiole was spread with surface up on a piece of filter paper on a wet sponge of 0.8 cm in thickness and 6 cm in square, which was in a Petri dish of 7 cm in diameter. There was no interspace between the margin of the leaf piece and the filter paper in order to prevent mites to move to the undersurface of the leaf and to escape observation. After leaves in Petri dishes were prepared sufficient, they were put on a super cleaned work table and disinfected for 3 hours with ultraviolet lamp.

Some adult mites in high vigor on outdoor fresh leaves were picked up with a pointed end of a small brush under microscope and put on the sterilized leaves in Petri dishes (3♀ 2♂ in each Petri dish). Distilled water was added into the Petri dishes along dish side with burette until the water surface reached to 5 mm high. Three kinds of chemosterilants prepared by our research group were used. They were regarded as MSA, CSⅡ [14] and MSC. The first two were wettable powder, and the last one was a kind of Chinese traditional medicine made up by decocting. Three tested concentrations were designed for each chemosterilant. They were 0.2%, 0.5% and 1.0% for MSA; 0.4%, 0.88% and 1.2% for CSⅡ; and the liquid of original, and that of being diluted 1 or 2 times for MSC. It was the control that spraying distilled water on the leaf mite. Each concentration had three repetitions, and was sprayed on the leaves in each Petri dish. After sprayed, the Petri dishes were marked and put into a constant-temperature cultivation chamber under 28℃. In order to keep humidity, a beaker filled with distilled water was put in the bottom shelf inside the chamber. To simulate natural situation, natural light was complimented by a closed glass door of the chamber with external gate open. The mating, eggs laying, hatching and life-span of the mite were observed under microscope every day until the 2nd generation had developed. Distilled water was added into the Petri dishes when observing so as to prevent the leaf pieces from losing water. The observation was done on the super cleaned work table to avoid contamination and moldy of the leaf pieces.

About 7 days, the leaves would lose green, or get moldy, and need to be renewed. In this case, a fresh leaf was cut into the same size as filter paper which was on a sponge wad, and a big round hole that was the same as the old leaf was cut in the center of the leaf. The shaped fresh leaf was directly put on the filter paper. Coming day, the overwhelming majority mites would move on the new leaf, especially the female adults, and started to lay eggs on the new leaf. In this time, the old leaf was replaced by another fresh leaf which was the same as the old leaf in size.

## 2 Results

The test data are shown in table 1. A double sample $F$-test with the data is conducted under 95% reliability. The results are shown in table 2.

It can be seen that under the reliability of 95%, only the $P(F \leqslant f)$, single tail probability value, of CSⅡ 2 is smaller than 0.05. There is a significant difference between CSⅡ 2 and control, and no significant different between others and control. The results show that CSⅡ 2 has the best efficiency, and is worthy to do more tests in the field.

**Table 1 Averages of the data from the control and three repetitions on each treatment**

| Treatment | Eggs per female (Egg) | Hatching rate (%) | No. of female adults of the 2nd generation | No. of male adults of the 2nd generation |
|---|---|---|---|---|
| MSA1 | 36.22 | 73.91 | 12.00 | 27.33 |
| MSA2 | 45.00 | 86.47 | 11.00 | 50.67 |
| MSA3 | 5.22 | 35.19 | 0.00 | |
| CSⅡ 1 | 41.44 | 82.93 | 0.33 | 0.33 |
| CSⅡ 2 | 7.17 | 3.66 | 1.00 | 0.50 |
| CSⅡ 3 | 3.22 | 33.33 | 0.00 | 0.00 |
| MSC1 | 53.78 | 84.18 | 8.67 | 87.67 |
| MSC2 | 21.56 | 34.78 | 0.00 | 13.33 |
| MSC2 | 11.50 | 55.91 | 12.50 | 25.50 |
| Control | 73.33 | 84.06 | 32.00 | 70.67 |

**Table 2 Results of the double sample *F*-test between each treatment and control**

| Treatment | No. of data | Single tail probability $P(F \leqslant f)$ |
|---|---|---|
| MSA1 | 4 | 0.408 |
| MSA2 | 4 | 0.314 |
| MSA3 | 4 | 0.317 |
| CSⅡ 1 | 4 | 0.194 |
| CSⅡ 2 | 4 | 0.004 |
| CSⅡ 3 | 4 | 0.295 |
| MSC1 | 4 | 0.228 |
| MSC2 | 4 | 0.242 |
| MSC3 | 4 | 0.440 |
| Control | 4 | |

## 3 Discussions

The leaf mite distributes extensively in Asia, Europe and Oceania. Its distributions in China are recorded chiefly in Ningxia, Beijing, Liaoning, Mongolia, Hebei, Shandong, Shanxi, Henan, Shaanxi, Gansu, Jiangsu and Jiangxi Provinces[13]. Economic forests such as white mulberry and fruits and many kinds of Rosaceae ornamental plants and flowers are seriously injured by mites. Because the leaf mite is easy to produce resistance to pesticides, many agricultural chemical researchers and companies had to renew the medicaments constantly, which costs huge. Hence, it is a great significance to find an alternative method to control mites.

This method can sterilize the wild race by directly spraying of chemosterilants, and this sterilization could be passed on the normal mites by mating with the sterilized mites. In this way, the sterilizing effects could be enlarged and kept for a long time. Because this method can produce a large number of the sterililized mites to mate with normal ones, there is a very small possibility for the mites to produce resistance. In several years of the spraying of the chemosterilant CSⅡ, the mite population could be controlled in the economically permitted level.


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