

Control of Lacquer Tree Mompas Disease with Extracts from *Thujopsis dolabrata* (Aomori Hiba)

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Steam-distilled oil and distilled water from *Thujopsis dolabrata* var. *hondae* Makino (Aomori hiba) contains hinokitiol, β -dolablin, and other substances which show strong antibacterial and antifungal effects. Hiba oil was found to inhibit the growth of *Helicobasidium mompa* at the concentration of 1,600 $\mu\text{g/ml}$. Heavy infection by the disease was cured by painting hiba oil at the root of lacquer trees and spraying the distilled water directly onto the soil.

1. INTRODUCTION

Joubouji, of Iwate prefecture is the principal domestic lacquer producing region of Japan. In the recent past, mompa disease has occurred, increasingly becoming a significant problem. Mompa disease affects apple and mulberry trees in the form of a root mold, and as a root mold, this infection can rapidly spread without detection to surrounding trees. In the case of such an infection outbreak, the current remedy includes taking out and burning the infected trees, followed by applying chloropicrin to the infected orchard. However, this procedure is both costly and labor as well as time consuming.

In this paper, with the aim of safely and effectively eradicating of mompa disease, investigation of oil from the Aomori hiba, with characteristic antibacterial and antifungal properties was undertaken.

2. EXPERIMENTAL METHOD

2.1. Antibacterial tests

The antibacterial tests for hiba oil and hinokitiol were conducted in the following manner. For the bacterial matter, the purple mompa fungus (*Helicobasidium mompa*) was used collected from experimental farm.

Hiba oil was extracted from the heartwood of aomori hiba by a steam distillation. Hinokitiol was prepared by separated from hiba oil and purified.

The antibacterial tests were conducted under the Japan Science of Chemotherapy, the minimum inhibitory concentrations (MICs) were determined by the agar dilution method using Sabouraud dextrose agar supplied by Eiken Chemical Co., Ltd. .

2.2. Results from field prevention investigation

The investigation was undertaken from April to June, 1992, at the Umaariba experimental farm, with five infected trees. The five infected trees were clearly

identified by the evidence of mold at the base of the tree (Fig. 1) and subsequently the mold was removed using a wire brush (Fig. 2). Three of the five infected trees were then painted around the base with hiba oil (Fig. 3), after which a 1.5 meter area around the tree was sprayed with 80 liters of steam-distilled water from the Aomori hiba for 8-10 days (Fig. 4). Of the two remaining trees, one was painted with hiba oil around the base, without the spraying of water. For the remaining tree nothing was done. The trees were then left for one year, after which the results of each of these methods were investigated.



Fig.1 The Photo of the trace of lacquer tree mompa fungus appeared at the root of a tree.



Fig.2 The Photo of scraping lacquer tree mompa fungus by using a wire brush.



Fig.3 The Photo of painting hiba oil.



Fig.4 The Photo of sprinkling steam-distilled water from Aomori hiba.

2.3. Steam-distilled spraying investigation

The investigation was undertaken in November, 1993, in Hibarisawa experimental farm, with relatively heavily infected trees. The steam-distilled water was sprayed around the base of the infected trees in a 0.5 meter area, with 10 liters sprayed one time (spraying amount: approximately 1ml/cm²). After 9 months, in August, 1994, the outbreak of mompa disease was measured and the anti-bacterial effectiveness of hiba oil was confirmed.

3. RESULTS AND DISCUSSION

3.1. Antibacterial investigation

In examination of the minimum inhibitory concentrations of various antifungal agents, as shown in Table 1, hinokitiol has a level of 25 µg/ml and hiba oil a level of 1600 µg/ml. With a hiba oil steam distillation process including 60-100 µg/ml of hinokitiol, it can be confirmed that use of hiba oil as an inhibitory agent against mompma disease has potential.

3.2. Investigation of inhibitory effects in the field

Of the five infected trees, with three different treatments, after the one year period to April, 1993, comparative results were investigated. Of the five trees, all were wire brushed to remove the mold found around the base of the tree, and although no cases were found where the mold had regenerated, as compared with untreated tree, of the painted trees, only the lower branches were found to have withered.

Thus, hiba oil applied to the base of the tree was confirmed as a treatment, therefore for low levels of infection, wire brushing and painted applications of hiba oil can be confirmed as sufficient treatment.

3.3. Investigation of steam-distilled spraying of hiba oil

As shown in Fig. 5, in the Hibarisawa experimental farm case, with relatively serious infections of mompma disease, the zones of withered trees can be seen. In this withered area, where the mompma infected trees were left totally untreated, the wither and death rate was 100%.

In the areas where steam-distilled hiba oil was sprayed, following the 9 month waiting period, in June, 1994, the condition of the infected trees is shown in Table 2. On the one hand of the 26 trees treated by spraying, suppression of the disease could be seen in 40% (10 trees). Of the remaining 60%, the mold

Table 1 Minimum inhibitory concentrations of various antifungal agents, hiba oil and hinokitiol against *Helicobasidium mompma*.

Agents	MIC(µg/ml)
Benlate wettable powder	3,200
Polyoxin AL wettable powder	> 6,400
Lobral wettable powder	> 6,400
Hiba Oil	1,600
Hinokitiol	25

Table 2 The results of the prevention test against mompma disease.

State	Tree No.
Cure	1, 5, 12, 13, 17, 18, 19, 20, 21, 23
Relapse	3, 4, 7, 8, 9, 10, 11, 14, 15, 22, 24, 25, 26
Withered	2, 6, 16

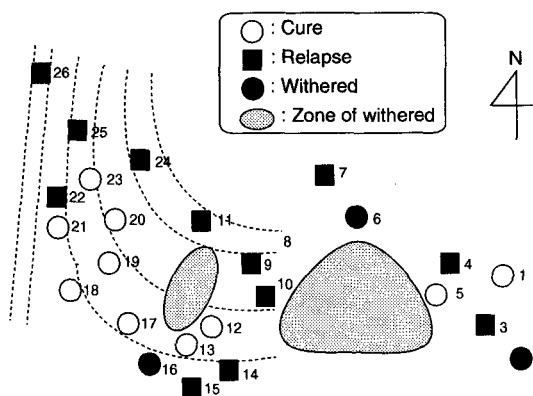


Fig.5 The map of Hibarisawa experimental farm.

returned in 13 of the trees, however, upon investigation of the circumstances of the area, it is apparent that water movement accounts for both the cases near the withered area (Nos. 3, 4, 8, 9, 10, 14) as well as cases located some distance from the withered areas (Nos. 22, 25, 26). From this it can be seen that it is possible to control mompa disease with a hiba spraying strategy together with applications of hiba oil to tree bases.

Further, regarding the three withered trees, two of the trees were infected with cockroaches and the cause of withering could be attributed to this, against which the effectiveness of hiba spraying was not investigated. As for actual cases of mompa causes withering and death, out of the 26 trees, only one case can be reported.

4. CONCLUSION

With the objective of safely and effectively inhibiting mompa disease from trees in the Joubouji experimental farm, hiba oil extracted from aomori hiba tree and steam-distilled water from aomori hiba was investigated and the results were found as follows;

- 1) Hinokitiol, at 25 $\mu\text{g}/\text{ml}$, and hiba oil, at 1600 $\mu\text{g}/\text{ml}$, were found to be the minimum inhibitory concentrations and an antifungal agent against mompa disease.
- 2) Investigation of three methods of controlling infection, wire brushing the mold from the tree base, applying hiba oil to the base of the tree, and spraying steam-distilled water from aomori hiba were undertaken, with the applications of hiba oil and spraying of hiba distilled water being most effective.
- 3) In the Hibarisawa experimental farm investigation, with relatively heavy infection of 26 trees, using the spraying method with examination of reoccurrence after a 9 month waiting period, approximately 40% of the infected trees were cured.

Hiba oil and steam-distilled water from the hiba tree, depending on specific disinfectant application schedules, times and amounts, can be seen as a potentially effective inhibitor against mompa disease.

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