The growth of *Ginkgo biloba* and *Populus nigra* cuttings by providing distilled water of trees

Iwao UEHARA, Masatoshi KURAMOTO, Hiroe TAKEUCHI, Megumi TANAKA　(Tokyo University of Agriculture)

Abstract: It has been known that the distilled water made from tree leaves, which contain essential oil, sometimes have bacteria resist effects. This research examined the stimulating effects of distilled water of tree leaves for the growth of the cuttings. Experiments used cuttings of *Ginkgo biloba* and *Populus nigra*. Distilled water was made of leaves of *Ginkgo biloba*, *Populus nigra*, *Cinnamomum camphora*, and *Chamaecyparis pisifera*. The experiment results of *Ginkgo bibba* cuttings showed the distilled water of *Cinnamomum camphora* and *Chamaecyparis pisifera* could stimulate the growth, but not for *Populus* cuttings in contrast. In addition, the distilled water of *Cinnamomum camphora* and *Populus nigra* showed some bacteria resistance effect for *Escherichia coli*.

Keywords: cutting, distilled water, *Ginkgo biloba*, *Populus nigra*

要旨：樹木の精油などの成分が溶け込んだ芳香蒸留水には、抗菌作用を持つものがあることが知られている。本研究では、挿し木苗の養成にその芳香蒸留水がどのような効果をもたらすかを考察した。供試材料には、ポプラ、イチョウの挿し木苗を用い、イチョウには、イチョウ、クスノキ、サワラの芳香蒸留水、ポプラには、ポプラ、クスノキ、サワラの芳香蒸留水を定期的に与え、通常の水道水を施した対象区との成長比較を行った。その結果、イチョウの挿し木苗においては、クスノキ、サワラの芳香蒸留水を施した挿し木苗は成長が良好であり、それとは対照的にポプラの挿し木苗では芳香蒸留水を施した方が、成長が劣る結果が得られた。また、クスノキとポプラの芳香蒸留水に大腸菌に対する抗菌作用がやや認められた。

キーワード：挿し木，芳香蒸留水、イチョウ，ポプラ

Ⅰ Introduction

We have showed the bacteria resistant effects of fragrance of tree leaves on other papers (*3*)(*4*). But It has been also known that the volatile fragrance and distilled water made from tree leaves, which contain essential oil, sometimes have bacteria resist effects (*1*)(*2*). However, attempts to research the effects for the growth of the plants have been few. The tree leaves have important meaning as one of the biomass resource and their new utilization is considered, too. Therefore, this research examined the stimulating effects of distilled water of ordinary tree leaves for the growth of the cuttings.

Ⅱ Method

Experiments used cuttings of *Ginkgo biloba* and *Populus nigra*. *Ginkgo biloba* cuttings were made from one year old branches of 12m height and 28cm DBH tree. *Populus nigra* cuttings were made from one year old branches of 18m height and 39cm DBH tree. A planter size was 22cm ×60cm×16cm depth and contained Kanuma soil. 10 cuttings were planted in each planter.

Distilled water was 4 kinds, made from leaves of *Ginkgo biloba*, *Populus nigra*, *Cinnamomum camphora*, and *Chamaecyparis pisifera*. For *Ginkgo biloba* cuttings, 1 litter distilled water of *Ginkgo biloba*, *Cinnamomum camphora*, *Chamaecyparis pisifera* were provided per a week, and for *Populus nigra* cuttings, 1 litter distilled water of *Populus nigra*, *Cinnamomum camphora*, *Chamaecyparis pisifera* were provided per a week. In addition, both each cuttings were provided 2 litter tap water beside the distilled water. Control cuttings were provided 3 litter tap water per a week. Each group was 20 cuttings.

All cuttings were planted in the late April of 2012 and dig up in the early July of 2012. After digging up, we checked the vehicle dry weight (samples were dried by 80℃ for 24hours) of the roots and leaves of each cutting and consider the growth of the cuttings.

In addition, we examined the bacteria resistance effects of the distilled water. *Eschewrichia coli* and *Staphylococcus aureus subsp.aureus* were selected as examined bacterium, because they were ordinary existed in daily life. Each 10μl bacterium was put on the center of the culture dish. 10ml distilled water was absorbed by a syringe and put into each culture dish through 0.2μm disk filter. Distilled water was made of 30g leaves from each 4 kind trees and 1 litter boiled water. Culture dishes were cultivated for a month (average temperature was 30℃). Growing bacterium area of 10 repeat culture dishes and 5 control ones were periodically measured. Method of measuring growing rate of bacterium was to measure the growing rate of the bacterium, tracing the bacterium area on the paper, and scanning the area by measuring software. This resistance effect experiments were attempted on 11th of August.

Ⅲ Results and discussion

Table 1 shows the percentage of rootage of each cutting group. All cutting's rootage percentage was more than 90%.

上原　巌，倉本真峻、竹内啓恵、田中　恵　(Tokyo University of Agriculture, 1-1-1 Sakuragaoka Setagaya-ku Tokyo 156-8502)　芳香蒸留水を施用した挿し木苗の成長

Table 1. The percentage of rootage of each cutting group (%)
表－1．各挿し木苗の活着率（%）

	Control	Same species	*Cinnamomum camphora*,	*Chamaecyparis pisifera*
Ginkgo biloba	100	100	100	95
Populus Nigra	100	100	90	90

1. *Ginkgo biloba*

Fig.1 shows the difference of average vehicle dry weight of *Ginkgo biloba* cuttings. The vehicle dry weight of the roots of cuttings provided *Cinnamomum camphora* and *Chamaecyparis pisifera* distilled water were statistically heavier than control cuttings ($p<0.01$). But the weight of cuttings provided *Ginkgo biloba* was no difference with control cuttings.

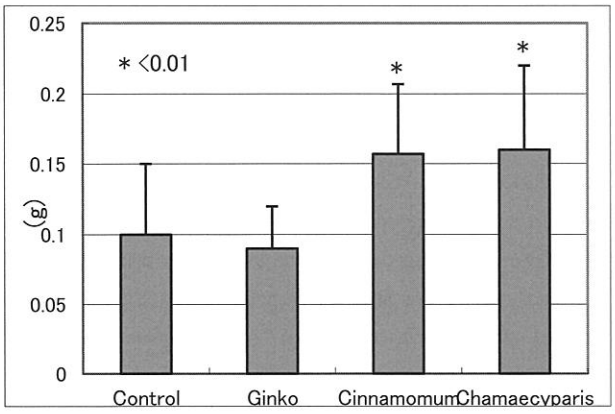

Fig.1 Difference of the vehicle dry weight of *Ginkgo biloba* cuttings
図－１．イチョウの挿し木苗の根の乾重の違い

Next, the differences of the average length of the longest root of *Ginkgo biloba* cuttings were shown on Fig.2.

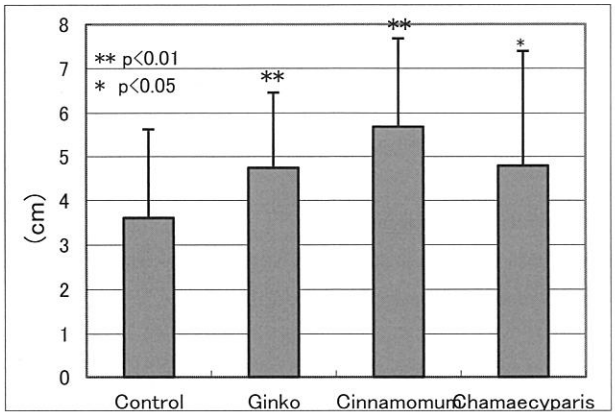

Fig.2 Differences of the length of the longest root of *Ginkgo biloba* cuttings
図－２．イチョウの挿し木苗の最長根の長さの違い

Average longest roots of cuttings which were provided three kinds of distilled water were statistilcally longer than control cuttings.

Also, 20% of control cuttings had no roots and all of the other cuttings had roots.

Fig. 3 shows the conditions of cullus making. 45% of cuttings provided *Ginko* distilled water and 50% of ones of *Cinnamomum* distilled water had cullus on the cutting surface. These results showed some sistilled water might stimulate cullus making. However, no culls on the cutting provided *Chamaecyparis* distilled water.

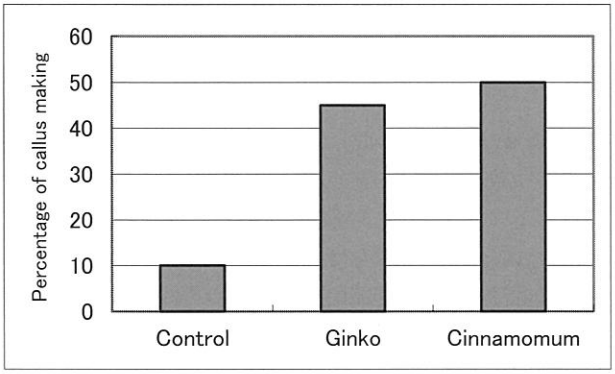

Fig.3 The conditions of cullus making
図－３．カルス形成の状況

Fig.4 shows the differences of the average vehicle dry leaves weight of *Ginkgo biloba* cuttings. The results was as same as the vehicle dry weight of the roots, the cuttings which were provided *Cinnamomum camphora* and *Chamaecyparis pisifera* distilled water were statistically heavier than control cuttings. The average weight of cuttings which were provided *Ginkgo biloba* was higher than control, but it was not statistically.

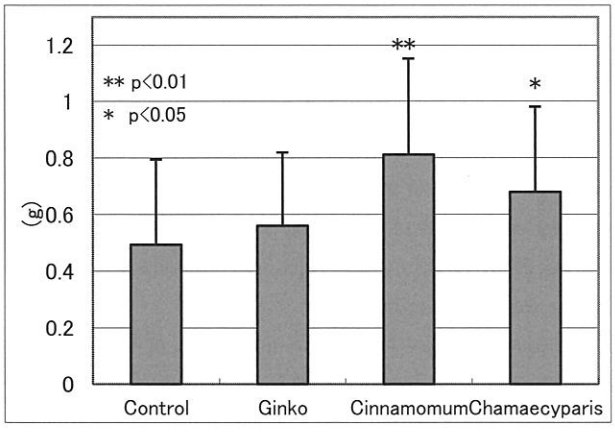

Fig.4 Difference of the vehicle dry weight of leaves of *Ginkgo biloba* cuttings
図－４．イチョウの挿し木苗の葉の乾重の違い

Totally, the distilled water of *Cinnamomum camphora* and *Chamaecyparis pisifera* leaves showed the developing growth effects on *Ginkgo biloba* cuttings. But the distilled water of *Ginkgo biloba* leaves did not show the effect like *Cinnamomum camphora* and *Chamaecyparis pisifera* leaves.

2. *Populus nigra*

Fig.5 shows the difference of average vehicle dry weight of *Populus nigra* cuttings. The roots of control cuttings were heaviest and other cuttings which were privided distilled water was approximately half of control cuttings as same as the results of *Ginkgo biloba* cutting.

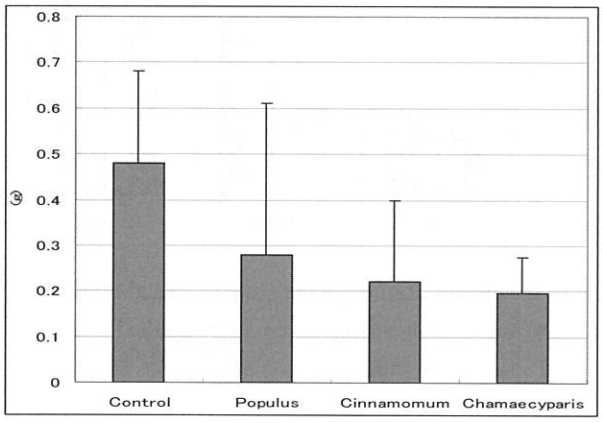

Fig.5 Difference of the vehicle dry weight of *Populus nigra* cuttings

図－５．ポプラの挿し木苗の根の乾重の違い

Next, the differences of average length of the longest root of *Populus nigra* cuttings were shown on Fig.6.

Average lengh of the longest roots of cuttings which were provided *Populus nigra* and *Cinnamomum camphora* distilled water were shorter than control cuttings, but there was no difference between control cuttings and *Chamaecyparis pisifera* distilled water providing cuttings.

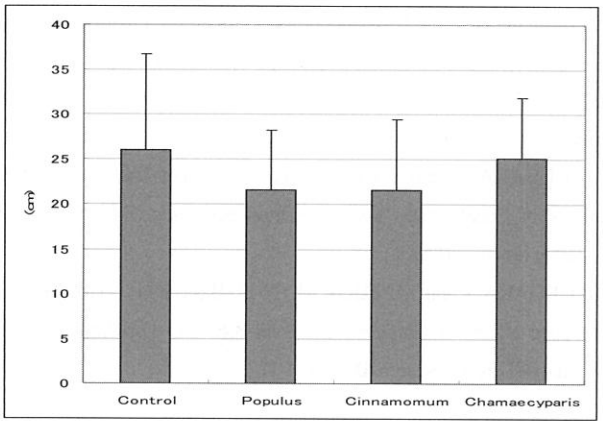

Fig.6 Difference of thelength of the longest root of *Populus nigra* cuttings

図－６．ポプラの挿し木苗の最長根の長さの違い

Fig.7 shows the differences of the average vehicle dry leaves weight of *Populus nigra* cuttings.

The leaves weight of control cuttings were heavier than other cuttings which were privided distilled water.

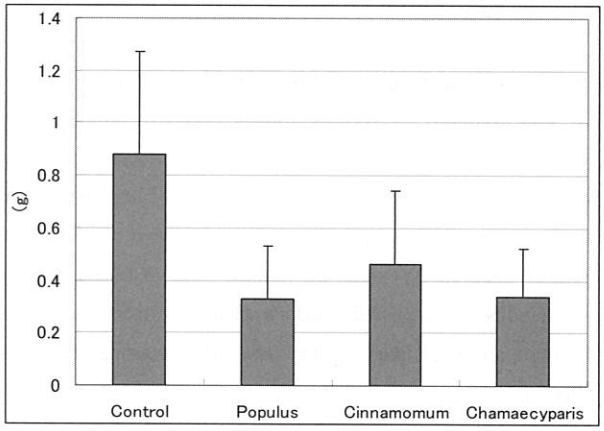

Fig.7 Difference of the vehicle dry leaves weight of *Populus nigra* cuttings

図－７．ポプラの挿し木苗の葉の乾重の違い

Fig.8 shows the average numbers of new shoots which grew after planting. There were no difference between control and distilled water providing cuttings.

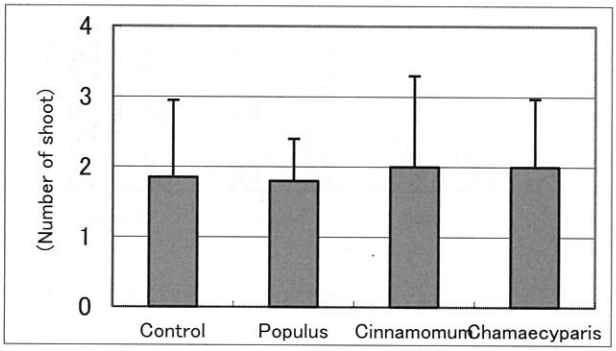

Fig.8　Average new shoots number of *Populus nigra* cuttings

図－８．ポプラの挿し木苗の平均新枝数

Fig. 9 shows the average length of new branches of cuttings. The branches of control cuttings were longer than other cuttings which were privided distilled water.

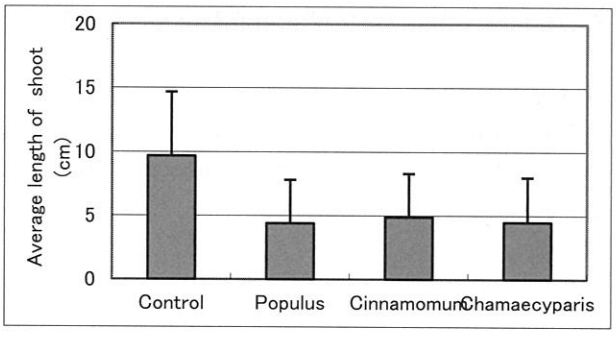

Fig.9. Average length of new branches of *Populus nigra* cuttings

図－９．ポプラの挿し木苗の新枝の平均長

No cullus making on Pupulus cuttings like Ginko ones.

From above results, totally, distilled water could not show the stimulating roots developing effect, or it might obstruct the developing

on *Populus nigra* cuttings.

3. Bacteria resistance effects of distilled water

We also examined the bacteria resistant effects of distilled water. Fig.10 shows the difference of expanding rate of bacteria bed growth of *Escherichia coli* by distilled waters. The distilled water of *Cinnamomum camphora* and *Populus nigra* showed some bacteria resistance effect ($p<0.1$). But the distilled water of *Chamaecyparis pisifera* did not show the effect and it's standard deviation was bigger than other species. It might rather show the stimulating effects for bacteria growth.

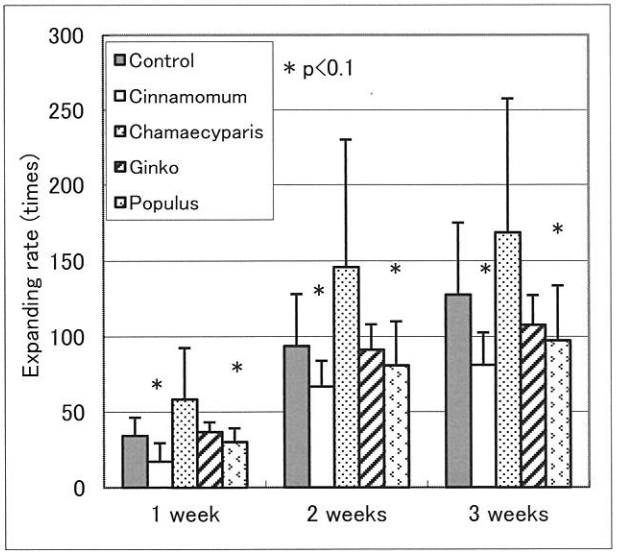

Fig.10 The difference of expanding rate of bacteria bed growth of *Escherichia coli*

図－10. 大腸菌に対する各芳香蒸留水の抗菌作用

Fig.11 shows the difference of expanding rate of bacteria bed growth of *Staphylococcus aureus subsp aureus* by distilled waters .All distilled water did not show the bacteria resistance effects on contrast as against *Escherichia coli* results. It showed rather stimulating bacteria growth.

From above results, distilled water might sometimes show the bacteria resistance effects and sometimes rather stimulate bacteria growth.

Ⅳ Conclusion

This basic study showed the distilled water of tree leaves sometimes have stimulating effects and no effect in the other time. They might have some bacteria resistance effects, too.

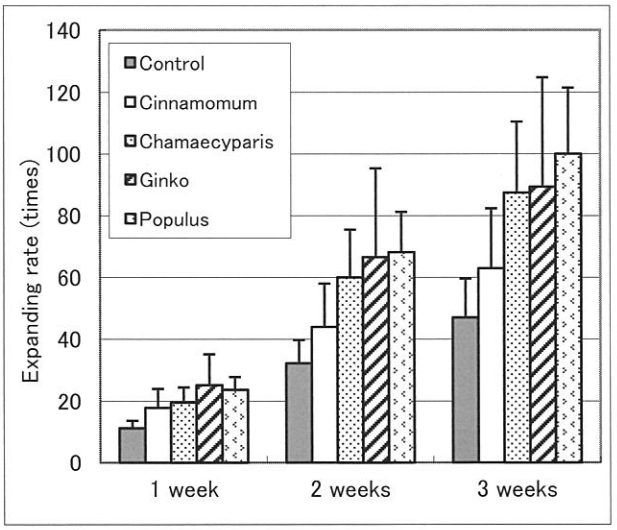

Fig.11 The difference of expanding rate of bacteria bed growth of *Staphylococcus aureus subsp aureus* by distilled waters

図－11. ブドウ球菌に対する各芳香蒸留水の抗菌作用

It has known that *Cinnamomum camphora* includes monoterpene (conphor) and diterpene (α-comphoren) (*3*). *Chamaecyparis* also has monoterpene and diterpene (*3*). However, it has not been exactly made clear what caused stimulating or disturbing plant growth and bacteria resistant effects by those tree contents yet.

Further researches are necessary to make clear the contents and mechanism of distilled water of tree leaves. In addition, enhancing the experiment accuracy and researching the effects of other parts of the trees and species should be investigated.

Ⅴ References

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