



Potential of coniferous terpenoids: Utilization of their functionality as defensive components

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Research fields: Wood extract, Terpenoid chemistry, Chemical ecology

Main research themes:

- Effects of terpenoid oxidation on chemical defense of conifers
- Enhancement of the bioactivity of coniferous essential oils using environmental factors
- Selective extraction of highly volatile essential oil components



Fig.1 Resin exuded from *Abies sachalinensis* cones.

Research interests:

I am most interested in the chemical defense mechanisms of conifers that involve terpenoids, components that have been present in conifers since ancient times. Terpenoids are abundant in coniferous trees, and many of them function as defensive components against pests and/or pathogens. Terpenoids, constituting essential oils and rosins, have volatilization and oxidative properties and are exploited by conifers in chemical defense. My research is aimed at investigating the role of terpenoids as defensive components using analytical instruments and to examine their potential as products to enrich our lives.

Part of the research results:

“Antifungal properties of terpenoid components in *Picea abies* against *Heterobasidion parviporum*”



Fig.2 *H. parviporum* infected log. Fig.3 Exuded resin from *P. abies* bark.

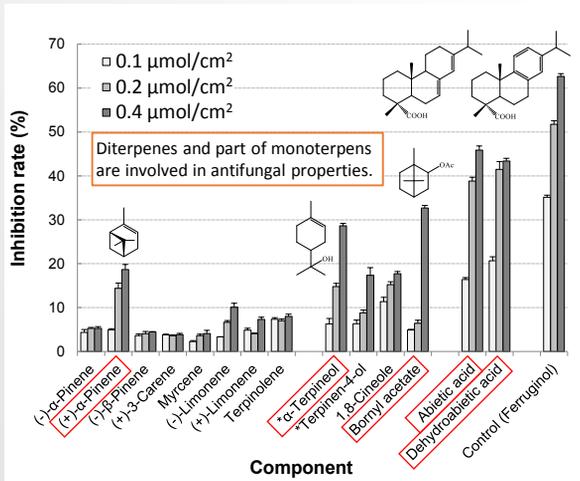


Fig.4 Antifungal properties of terpenoids in *P. abies* resin against *H. parviporum*.

For more details, see the following reference.

Forest Pathology
 For. Path. 44 (2014) 353–361
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 doi: 10.1111/fpp.12106
Antifungal properties of terpenoids in *Picea abies* against *Heterobasidion parviporum*
 By N. Kusumoto^{1,2,3}, T. Zhao², C. Swedjemark², T. Ashtiani², K. Takahashi² and A.-K. Borg-Karlson²

“Mild heat treatment (MHT) enhances antifungal activities of Japanese conifer essential oils”

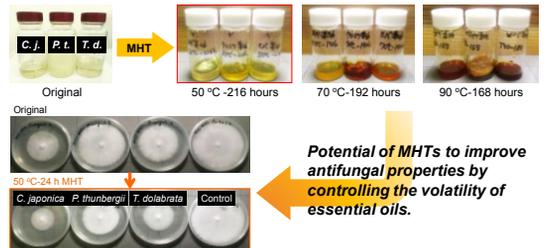


Fig.5 Changes in conditions and antifungal properties by MHTs.

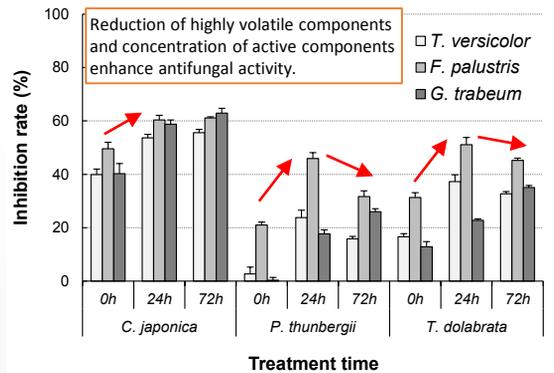


Fig.6 Antifungal properties of mild heat treated (50 °C) essential oils.

For more details, see the following reference.

Journal of Essential Oil Research, 2015
 Vol. 27, No. 5, 388–394, http://dx.doi.org/10.1080/10412905.2015.1045903
 Taylor & Francis
Evaporation of volatiles from essential oils of Japanese conifers enhances antifungal activity
 Norihisa Kusumoto^{1,2,3} and Sakae Shibata²

Future research prospects:

Several recent studies have suggested that the terpenoid components in conifers may be genetically regulated. This implies that there are phylogenetic differences in chemical defenses among individuals of the same species, although the key constituent groups and mechanisms of functional expression remain unclear. We are currently analyzing terpenoids linked to genetic background on an individual basis, and as these data accumulate, we expect to be able to select conifer resources with superior chemical defense capabilities based on genetic background. This will provide ecologically useful knowledge and greatly expand the possibilities for sustainable utilization of terpenoid components in conifers.