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File: ■ Tea Tree (*Melaleuca alternifolia*, Myrtaceae)
■ Contact Dermatitis

HC 101674-570

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RE: Review of Contact Dermatitis Associated with Tea Tree Oil Exposure

de Groot AC, Schmidt E. Tea tree oil: contact allergy and chemical composition. *Contact Dermatitis*. 2016;75(3):129-143.

Tea tree (*Melaleuca alternifolia*, Myrtaceae) essential oil prepared from the leaves or terminal branchlets (branch tips) of the tea tree has antimicrobial, anti-inflammatory, antitumoral, and analgesic properties. Therefore, it is used for treating common skin diseases like acne and eczema, skin infections such as herpes simplex and warts, wounds, burns, insect bites, dandruff, and nail mycoses. Tea tree oil (TTO) is a common ingredient in a wide range of topical medications, cosmetics, and household products. Of all essential oils, TTO has caused the greatest number (over 90 cases) of contact allergic reactions reported in the literature. This article reviews the literature regarding the chemical composition of TTO and allergic contact dermatitis reactions to TTO.

Over 220 constituents of TTO have been reported in more than 50 studies. The composition of TTO varies widely depending upon the chemotype, plant part used, and method of distillation. Although six main chemotypes have been recognized, almost all commercial products contain the terpinen-4-ol dominant (type 1) chemotype. The other major constituents of commercial TTO are terpinolene, γ-terpinene, 1,8-cineole, α-terpinene, α-terpineol, *p*-cymene, and α-pinene.

Exposure to oxygen, light, heat, and humidity changes the composition of TTO over time. The antioxidants α-terpinene, γ-terpinene, and terpinolene are oxidized to *p*-cymene; the level of antioxidants decreases and *p*-cymene level increases up to ten-fold; and the formation of peroxides, endoperoxides, and epoxides such as ascaridole occurs. With aging, TTO becomes green-brownish in color, the aroma becomes turpentine-like, and the viscosity changes. Prolonged oxidation and aging leads to crystallization of compounds and formation of long, thin needle-like crystals.

TTO is responsible for causing contact allergy and allergic contact dermatitis. In routine skin patch testing with 5% TTO, the incidence of positive reactions ranged from 0.1% to 3.5% of the population. The highest rates were observed in Australian studies. The relevance to previous exposure to TTO ranged from 20-66% in these studies.

Approximately two-thirds of the case reports were related to the application of pure TTO for treatment of various skin diseases. In some of the reported cases, the allergic reactions were caused by application of topical formulation containing TTO, and six cases were due to occupational exposure to high concentrations of TTO. Studies of the sensitizing potential of TTO have shown that the fresh oil is a weak to moderate sensitizer, but oxidation significantly increases its sensitizing potential. The most frequently reported sensitizers are ascaridole, terpinolene, α-terpinene (and its oxidation products), 1,2,4-trihydroxymenthane, α-phellandrene, and limonene. Other constituents which may contribute to sensitivity include myrcene, aromadendrene, D-carvone, L-carvone, terpinen-4-ol, viridiflorene, and more rarely (<5%), sabinene, 1,8-cineole, and *p*-cymene. "Most positive patch test reactions to TTO … probably result from sensitization to the oil itself. However, in some cases, they may possibly reflect prior sensitization to an ingredient of the oil."

In addition, co-reactivity to oil of turpentine, as well as fragrance mix I, benzoin (*Styrax benzoin*, Styracaceae) resin, balsam of Peru (*Myroxylon balsamum* var. *pereirae*, Fabaceae) resin, colophonium, and other essential oils has been reported.

—Blake Ebersole

Referenced article can be accessed at http://onlinelibrary.wiley.com/doi/10.1111/cod.12591/epdf.