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Antifungal Activity of Some Essential Oils against Four Fungi

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4種의 菌類에 대한 植物精油의 抗菌作用

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ABSTRACT

Essential oils isolated from five angiospermic plants viz. *Citrus medica*, *Trachyspermum ammi*, *Nepeta hindostana*, *Amomum subulatum*, and *Hyptis suaveolens* have been tested against four fungi viz. *Aspergillus awamori*, *Alternaria matini*, *Aspergillus nidulans* and *Penicillium* sp. at 100ppm, 500 ppm, and 1,000ppm. The oils of *C. medica*, *N. hindostana* and *T. ammi* were found to be effective in checking growth of fungi, while the *Hyptis* and *Amomum* oils were observed to be the worst effective. The antifungal potency of some of the oils has been compared with synthetic fungicides viz. Dithane M-45, Ceresan and Captan.

INTRODUCTION

Although several synthetic chemicals have been prescribed as agrochemicals in plant protection, however, the use of many of them is now contained due to their side effects. Recently some higher plant products have been found to exhibit nonphytotoxic, systematic, easily biodegradable and host metabolism stimulatory fungi-toxicants in contrast to artificially synthetic fungicides(Fawcett and Spencer, 1970; Beye, 1978; Dixit *et al.*, 1978).

Some volatile products(essential oils) of angiospermic origin have demonstrated their toxic potentialities against fungal diseases of some agricultural crops and stored food commodities(Arora and Pandey, 1977; Dikshit *et al.*, 1981).

This study is to evaluate phytotoxicity of four angiospermic species against selected fungal species. Keeping these facts in from leaves of angiospermic plants viz. *Citrus*

medica, *Trachyspermum ammi*, *Nepeta hindostana*, *Amomum sublatum* and *Hyptis suaveolens* against four fungi viz. *Aspergillus awamori*, *Alternaria mali*, *Aspergillus nidulans* and *Penicillium* sp. have been carried out and the fungitoxic potentiality of these oils has been compared with some common synthetic fungicides.

MATERIALS AND METHODS

Essential oil for this study obtained from *Citrus medica*, *Trachyspermum ammi*, *Nepeta hindostana*, *Amomum sublatum* and *Hyptis suaveolens*, tested species against were *Aspergillus awamori*, *Alternaria mali*, *Aspergillus nidulans* and *Penicillium* sp.. Both angiospermic and fungal species are common in India. Fresh leaves of each angiospermic taxa were collected and their essential oils were isolated through hydrodistillation by Clevenger's apparatus following by the techniques of Langenau(1948). The oils after dehydration with capillary tubes were tested for their fungaltoxic activity against test fungi by the poisoned food technique of Grover and Moore(1962) at the oil concentration viz. 100 ppm, 500 ppm and 1,000 ppm. In this study the concentration was followed as Grover and Moore(1962). The graded concentrations of the oils were prepared with respect to compliment medium and the test fungi were inoculated separately from a seven days old culture. The growth of the colony of each treated fungal set was observed just after one day of inoculation and upto four days. The control set compared only the nutrient medium without oil. The growth of the colony of each treated fungal sets and control set were compared so as to find out the fungitoxic activity of the oils.

On the same graded concentrations, some synthetic fungicides viz. Dithane M-45, Ceresan and Captan were also tested against the test fungi by the usual poisoned food technique and their efficacy with these essential oils were compared.

RESULTS

On hydrodistillation, the oils were isolated in the collecting funnel of Clevenger's apparatus. During fungal toxicity assay of *Citrus medica* oil(Fig. 1), it was noticed that the oil was markedly effective at 100 ppm against fungi viz. *A. mali*, *A. nidulans*. The growth of *A. nidulans* was completely checked even on 500 ppm. And *Penicillium* sp. was not grow at all concentrations. Although, the growth of *A. awamori* was inhibited by the oil but it was not severe inhibition. *Trachyspermum* oil(Fig. 2) was found to be the most effective oil because it inhibited all the fungi even on 500 ppm. *A. mali* and *Penicillium* sp. were inhibited severely at 100 ppm concentration. At 100 ppm, the fungi grew some extent in diameter showed some growth but it was less than that of control set. All of test fungi 4 species were not grow on 500 and 1,000 ppm at all. In case of *Nepeta* oil(Fig. 3) *A. nidulans* and *Penicillium* sp. were found to be heavily inhibited by the oil even on 500 ppm. The growth

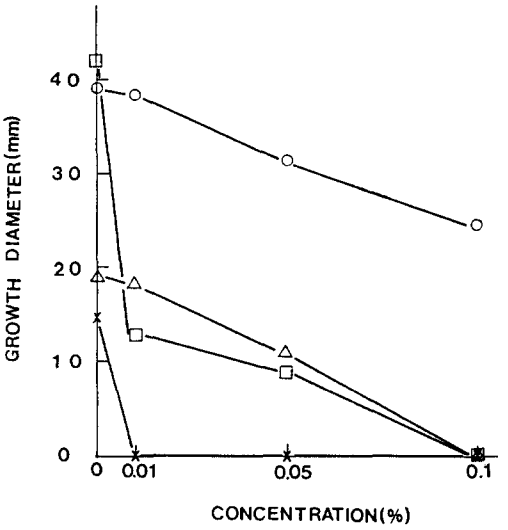

Fig. 1. Colony diameter of fungi taxa grown in CM medium at different concentrations of *Citrus medica* essential oil.
Keys to species: ○, *Aspergillus awamori*; △, *Alternaria mali*; □, *Aspergillus nidulans* and X, *Penicillium* sp.

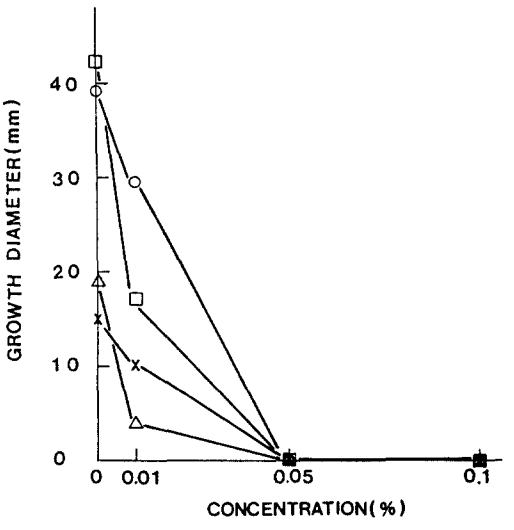

Fig. 2. Colony diameter of fungi taxa grown in CM medium at different concentrations of *Trachyspermum ammi* essential oil.
Keys to species: ○, *Aspergillus awamori*; △, *Alternaria mali*; □, *Aspergillus nidulans* and X, *Penicillium* sp.

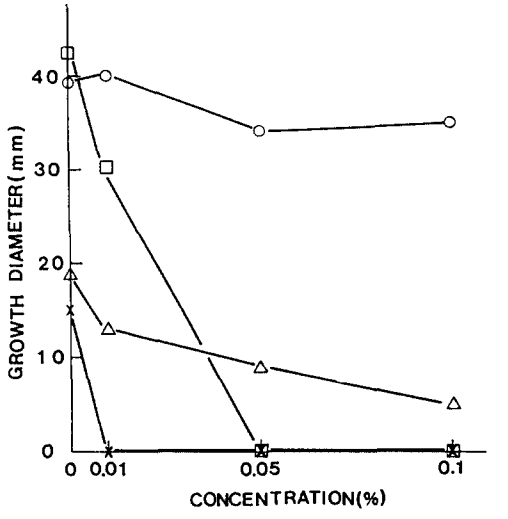

Fig. 3. Colony diameter of fungi taxa grown in CM medium at different concentrations of *Nepeta hindostana* essential oil.
Keys to species: ○, *Aspergillus awamori*; △, *Alternaria mali*; □, *Aspergillus nidulans* and X, *Penicillium* sp.

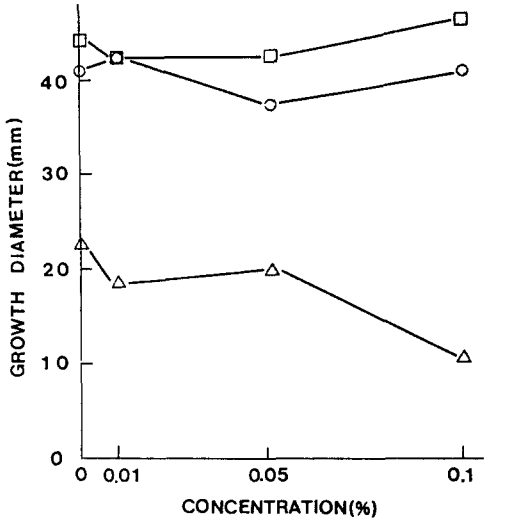

Fig. 4. Colony diameter of fungi taxa grown in CM medium at different concentrations of *Hyptis suaveolensi* essential oil.
Keys to species: ○, *Aspergillus awamori*; △, *Alternaria mali*; □, *Aspergillus nidulans* and X, *Penicillium* sp.

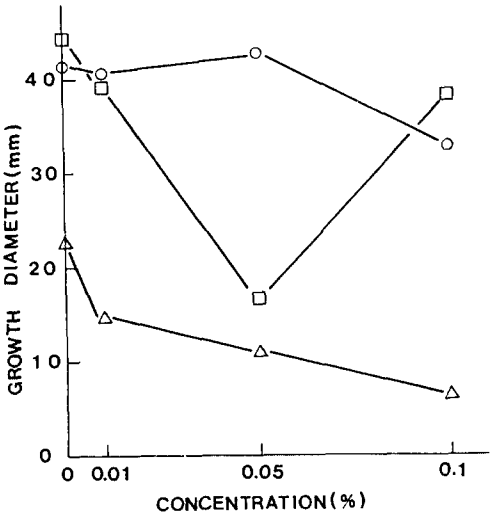

Fig. 5. Colony diameter of fungi taxa grown in CM medium at different concentrations of *Nepeta hindostana* essential oil.
Keys to species: ○, *Aspergillus awamori*; △, *Alternaria mali*; □, *Aspergillus nidulans* and X, *Penicillium* sp.

of other fungi was shown comparatively less inhibition than the above mentioned species. The *Hyptis* and *Amomum* oils(Fig. 4, 5) did not show prominent antifungal activity. Although there was some inhibition in the growth of fungi but it was not absolute against any fungi intensely.

During testing of efficacy of some synthetic fungicides against there test fungi, a selective fungitoxic potentiality have been observed. However, most of the oils were found to be more efficacious when their efficacy was compared with these synthetic fungicides (Table 1).

DISCUSSION

The data presented indicate that the essential oil from five angiospermic plants inhibits the growth of the tested fungi. There was appreciable fungitoxic potency in *Citrus*, *Nepeta* and *Trachyspermum* oils. However, the potency was found to be dependent on the fungi tested and each oil showed a type of selective toxicity. *Penicillium* sp. was the most sensitive among tested fungi to the essential oils. Moreover, the superiority of efficacy of some of the oils shows an another attribute for their possible exploitation as botanical fungicides. The essential oils are a mixture of a number of volatile compounds, which are mainly terpenoids(Harborne, 1973).

The finding suggest that the oils may constitute a renewable source of fungitoxicants of natural origin after suitable field trials. Since the oils are effective against storage fungi; the stored food commodities be protected by the vapours of the oils and the oils may show the possiblity of their exploitation as storage fungitoxicants. Further studies like animal toxicity and detailed chemical investigations of these oils are warranted.

Table 1. Minimum inhibitory concentration of some synthetic fungicides against some storage fungi

Fungicides	Minimum inhibitory concentration(ppm)			
	Aspergillus awamori	*A. mali*	*A. nidulans*	*Penicillium* sp.
Dithane M-45	2,000	1,500	1,500	1,000
Ceresan	500	500	1,000	1,000
Captan	1,500	1,500	1,500	1,500

摘 要

5種 管束植物 즉, *Citrus medica*, *Trachyspermum ammi*, *Nepeta hindostana*, *Amomum subulatum*과 *Hyptis suaveolens*로부터 抽出한 정유(精油)를 처리하여 4종 곰팡이에 대한 抗菌力 실험을 실시하였다. 그 결과 *C. medica*, *N. hindostana* and *T. ammi*의 精油가 곰팡이의 생장을 크게 抑制했으며 *A. subulatum*과 *H. suaveolens*의 정유는 억제력이 적었다. 植物體로부터 추출한 精油와 合成抗菌劑, 즉 Dithane M-45, Ceresan, Captan과 비교하여 본 결과 본 실험에 사용한 天然化學物質이 더 효과적으로 곰팡이 생장을 抑制했다.

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