

REVIEW / PHARMACOLOGICAL ACTIVITY OF *PLATYCLADUS ORIENTALIS*Jaiswal Amit<sup>1\*</sup>, Kumar Abhinav<sup>1</sup>, Mishra Deepali<sup>2</sup>, Kasula Mastanaiah<sup>3</sup><sup>1</sup>Department Of Pharmacology, RKDF College Of Pharmacy, Bhopal, (M.P.) India<sup>2</sup>Department Of Pharmacy, Sir Madanlal Institute Of Pharmacy, Etawah (U.P.) India<sup>3</sup>Department Of Pharmacology, The Erode College Of Pharmacy, Erode, Tamilnadu, India

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## ABSTRACT

*Platycladus orientalis*, also known as Chinese Arborvitae or Biota. It is native to northwestern China and widely naturalized elsewhere in Asia east to Korea and Japan, south to northern India, and west to northern Iran. It is a small, slow growing tree, to 15-20 m tall and 0.5 m trunk diameter (exceptionally to 30 m tall and 2 m diameter in very old trees). The different parts of the plant are traditionally used as a diuretic, anticancer, anticonvulsant, stomachic, antipyretic, analgesic and anthelmintic. However, not many pharmacological reports are available on this important plant product. This review gives a detailed account of the chemical constituents and also reports on the pharmacological activity activities of the oil and extracts of *Platycladus orientalis*.

**Keywords:** Dry distillation, Phytochemistry, Pharmacological activity, *Platycladus orientalis*.

## INTRODUCTION

Botanical Name : *Platycladus orientalis*.

Family: Cupressaceae.

## Taxonomic Hierarchy

Kingdom:	Plantae	- Plants
Subkingdom:	Tracheobionta	- Vascular Plants
Super division:	Spermatophyte	- Seed plants
Division:	Coniferophyta	-Conifers
Class:	Pinopsida	
Order:	Pinales	
Family:	Cupressaceae	
Genus:	Platycladus	
Species:	<i>Platycladus orientalis</i> .	<sup>1</sup>

cultivated in Europe since the first half of the 18th century. In cooler areas of tropical Africa it has been planted primarily as an ornamental.<sup>4</sup>

## Uses

In Réunion the main use of *Platycladus orientalis* is as an antirheumatic. The cones are crushed and soaked in alcohol for 2–3 days. Painful joints are rubbed with the extract. Small branches are used to make a tea which is drunk to overcome varicose veins, haemorrhoids and menopausal problems. They are used to improve the circulation, to bring down fever and to treat gastric ulcers. In Mauritius tea from branches and leaves is used to cure throat inflammation, fever and influenza. In traditional Chinese medicine the leaves are credited with bitter stomachic, refrigerant, astringent, diuretic, tonic and antipyretic properties. A decoction or the juice of the leaves has been used to relieve all kinds of bleeding, gastric ulcers, gonorrhoea and colds. The seeds are prescribed as a sedative, tranquillizer, antitussive and haemostatic. In Indo-China the ground leaves are used as an emmenagogue and antitussive, the seeds as a tonic, sedative, tranquillizer and aphrodisiac. A decoction of the twigs is prescribed to treat dysentery, skin affections and cough.<sup>5</sup>

## Production and international trade

Dried herbal materials of *Platycladus orientalis* are traded from Asia. Retail prices in 2001 amounted to US\$ 7 for 500 g dried leaves, US\$ 8.7 for 100 g of extract granules of leafy parts and US\$ 12 for 100 g of extract granules of charred leafy parts. Essential oils from leaves, cones and wood are also traded internationally.<sup>6</sup>

## Properties

The leaves and cones of *Platycladus orientalis* contain an essential oil with high amounts of  $\alpha$ -pinene, sabinene, 3-carene, limonene and cedrol. In Egyptian material the highest yield was obtained from fresh cones. Pinusolide, a labdane-type diterpene, and pinusolidic acid were isolated from leaf extracts. Pinusolide is a potent platelet-activating-factor (PAF) antagonist. The results of tests on mice suggest that pinusolide may prove value in the treatment of hypotension and pinusolide analogues may provide the possibility of new PAF specific antagonists. Other proven effects of leaf extracts include the haemostatic properties, in-vitro and in-vivo antitumour activity and an activity similar to that of vitamin K. In an antibacterial screening the aqueous leaf extract inhibited the growth of gram-positive bacteria, and significantly inhibited aflatoxin production of *Aspergillus parasiticus* on products such as rice, wheat, maize and groundnut. Methanol extracts of leaves and cones



Figure 1: Tree, Fruits and Bark

## Synonym(s)

*Biota orientalis*,

*Cupressus pendula* Thunb.

*Platycladus stricta* Spach

*Thuja acuta* Moench

*Thuja chengii* Borderes & Gausson

*Thuja decora* Salisb.

*Thuja orientalis* L.<sup>2</sup>

## Vernacular names

English: Thuja orientalis, Hindi: Morpankhi, Oriental thuja, Oriental arborvitae.<sup>3</sup>

## Origin and geographic distribution

The natural distribution of *Platycladus orientalis* is obscured by its long history of cultivation in large parts of Asia. It is assumed to have originated from northern and north-eastern China, Korea and Siberia. Its distribution has extended to Japan, Taiwan and Central Asia, and it is locally naturalized in Indo-China. It has been

inhibited the growth of *Candida albicans*. Immunosuppressant activity was observed in mice fed with a diet containing 10% seed oil.<sup>7</sup>

### Botany

Monocious shrub or small to medium-sized tree up to 20 m tall, in cultivation often forming multiple stems; bark thin, reddish brown, peeling in thin longitudinal strips; branches ascending. Leaves decussately opposite, scale-like, those of finer lateral sprays, 2 mm long, tightly appressed. Male cones terminal, 2–3 mm long; female cones axillary, oblong, 20–25 mm × 10–18 mm, with 6–10 fleshy scales, with a recurved horn below the tip of each scale, central 4 scales fertile with 2(–3) seeds. Seeds ovoid, flattened, 5–7 mm × 3–4 mm, wingless.

*Platycladus* comprises only one species and is closely related to *Thuja*. It can easily be distinguished by the vertical arrangement of its sprays of foliage, which lack odour when crushed, the strongly hooked cone scales and its wingless seeds.<sup>8</sup>

### Ecology

In Asia *Platycladus orientalis* usually grows on steep rocky hillsides and cliffs. This explains the success of plantings on poor, excessively drained soils, as well as the success of smaller cultivars in rock and succulent gardens. *Platycladus orientalis* is also tolerant of soils with a high pH. It prefers full sun but is tolerant of partial shade.

### Management

*Platycladus orientalis* can be raised easily from cuttings and seed. Cultivars are best raised from cuttings, but side-veener grafting is possible as well. Growth of seedlings is enhanced by NPK 10:20:10 application. This markedly increases stem diameter growth. A high level of P in NPK mixtures increases root length and the number of branches. The fresh and dry weight of leaves greatly increases with increasing N and P levels.

After harvesting the leafy parts can be dried and stored for future use. The seeds are obtained by opening the dried cones and used fresh. The essential oil from leaves and cones can be extracted by steam distillation.<sup>9</sup>

### Genetic resources and breeding

*Platycladus orientalis* has a large area of distribution and is widely cultivated, and is therefore not at risk of genetic erosion. Numerous cultivars are registered in horticultural trade, ranging from dwarf types to trees, types with needle-like leaves when young, golden green or slightly variegated types or with filamentous branches.<sup>10</sup>

### PHYTOCONSTITUENT

Qualitative assay, for the presence of plant phytoconstituents such as carbohydrates, alkaloids, glycosides, flavonoids, tannins and saponins were carried out on the powdered leaves following standard procedure

Flavonoidic constituents:

- Rutin
- Quercitrin
- Quercetin
- Amentoflavone

Table I. Chemical composition of the fruit oil of *T. orientalis*

Compound	Percentage
Tricyclene	0.4
$\alpha$ -Pinene	52.4
$\beta$ -Pinene	3.3
Myrcene	3.6
$\Delta$ -3-Carene	14.2
$\beta$ -Phellandrene	5.1
$\gamma$ -Terpinene	0.2
$\alpha$ -Terpinolene	4.0
Terpinene-4-ol	0.3
$\alpha$ -Terpineol	0.1
Bornyl acetate	1.2
$\alpha$ -Terpinyl acetate	0.5
$\beta$ -Elemene	0.3
$\beta$ -Caryophyllene	2.6
Thujopsene	0.6
$\alpha$ -Humulene	1.2
Germacrene-D	1.0
Elemol	0.5
$\alpha$ -Cedrol	6.5

Table II. Chemical composition of the leaf oil of *T. orientalis*

Compound	Percentage
$\alpha$ -Thujene	0.7
$\alpha$ -Pinene	21.9
$\alpha$ -Fenchene	2.6
Sabinene	0.8
$\beta$ -Pinene	1.6
Myrcene	2.6
$\alpha$ -Phellandrene	1.3
$\Delta$ -3-Carene	10.5
$\rho$ -Cymene	2.2
Limonene	7.2
$\gamma$ -Terpinene	0.2
$\alpha$ -Terpinolene	3.2
Linalool	0.2
Terpinene-4-ol	0.2
Thymoquinone	0.2
Bornyl acetate	1.0
Geranyl acetate	0.4
$\beta$ -Elemene	0.3
$\beta$ -Cedrene	1.2
$\beta$ -Caryophyllene	3.0
Thujopsene	2.2
$\alpha$ -Humulene	1.7
Germacrene-D	0.8
$\beta$ -Himachalene	0.3
$\Delta$ -Cadinene	0.4
Elemol	1.6
$\alpha$ -Cedrol	20.3
$\alpha$ -Cadinol	0.9

### Volatile constituents of the fruit and leaf oils of *Thuja orientalis* L. grown in Iran

The composition of the hydrodistilled essential oils from the fruits and leaves of *Thuja orientalis* L. grown in Iran was analyzed by GC/MS. Nineteen and twenty-eight compounds have been identified in the volatile oils of the fruit and leaf, respectively. While the fruit oil contained alpha-pinene (52.4%), delta-3-carene (14.2%), alpha-cedrol (6.5%) and beta-phellandrene (5.1%), the leaf oil contained alpha-pinene (21.9%), alpha-cedrol (20.3%), delta-3-carene (10.5%) and limonene (7.2%) as the main components.<sup>11</sup>

**Patent Application Title: Plant Extract Compositions for Affecting Sleep**

A composition for modulating physiological sleep disorders, said composition comprising a therapeutically effective amount of a *Platycladus orientalis* extract, and a pharmaceutically acceptable carrier.

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**PHARMACOLOGY****Anthelmintic activity of *Platycladus orientalis* leaves**

Ethanol extract from the leaves of *Platycladus orientalis* is found to be effective for their anthelmintic activity against *Pheretima posthuma*. Three concentrations (1%, 2.5% and 5%) of extract were studied in activity, which involved the determination of time of paralysis and death of the worm. The extract exhibited significant dose dependent anthelmintic activity. Piperazine citrate in same concentration as that of extract was included as standard reference and distilled water as control. The anthelmintic activity of ethanol extract of *Platycladus orientalis* has therefore been demonstrated for the first time.<sup>13</sup>

**Antipyretic activity on *Platycladus orientalis* leaf**

Ethanol extract of the leaf of *Platycladus orientalis* is found to be effective for their antipyretic effect. Intraperitoneal administration of boiled milk at a dose 0.5 ml/kg body weight in albino rabbit leads to pyrexia. Intraperitoneal (i. p. route) administration of ethanolic extract of the leaf of *Platycladus orientalis* at a dose 80 mg/kg body weight were shown significantly reduce the elevated body temperature of rabbit which was compared with standard aspirin (market product) and solvent used.<sup>14</sup>

**Antipyretic activity on *Platycladus orientalis* in rat**

The study was conducted to screen the antipyretic activity of alcoholic extract of the leaf of *Orientalis*. *Platycladus orientalis* is a potent medicinal plant in the Indian systems of medicine. Traditionally it is used as a diuretic, anticancer, anticonvulsant, stomachic, antipyretic, analgesic, etc. In the present study the alcoholic extract of the leaf of *Platycladus orientalis* were studied for their antipyretic activity by Brewer's yeast-induced pyrexia in rats. It was observed that the alcoholic extract produced significant antipyretic activity ( $p < 0.05$ ). The extract showed marked antipyretic activity in a dose dependent manner.<sup>15</sup>

**Cytotoxicologic Studies of the Extracts of *Platycladus orientalis***

Isolation and identification of some potent anti-tumor compounds from medicinal plants, has motivated researchers to screen different parts of plant species for anti-tumor effects. It has been reported that several conifers possess cytotoxic activities on some human tumor cell lines.

In this study male and female branchlets or fruits of two different species of Iranian conifers were collected from the northern parts of Iran and identified. Hydroalcoholic extracts of them were prepared by percolation. The cytotoxic effects of the extracts on three human tumor cell lines (Hela, KB, and MDA-MB-468) were determined. Different concentrations of extracts were added to cultured cells and incubated for 72 h. Cell survival was evaluated using MTT-based cytotoxicity assay. Cytotoxicity was considered when more than 50% decrease was seen in cell survival. Although the extracts from *Platycladus orientalis* significantly decreased Hela and MDA-MB-468 cell survival, their effects were not considerable. Extracts from

fruit and branchlets of male and female *Juniperus sabina* showed cytotoxic activities against Hela and MDA-MB-468 cells. It is concluded that extracts of *Platycladus orientalis* have cytotoxic effects on cancer cells.<sup>16</sup>

**Antifungal Activity of Ethanol Extract from *Platycladus orientalis***

Based on growth rate methods, different parts of *Platycladus orientalis* ethanol extract is found to be effective for their antifungal activities against 21 kinds of plant fungi. The results showed the inhibition rates of extract from the leaves, branchlets, cones and seeds of *P. orientalis* against 4 kinds of plant fungi were notable at 50 g/L (amount to the quality of drying *P. orientalis*). The antifungal activity of extract of *P. orientalis* leaves was best; the EC50 of leaves extract against *Coniothyrium diplodiella*, *Elsinoe ampelina*, *Phytophthora melongenae* and *Penicillium expansum* were 5.424, 3.186, 8.913 and 19.000 g/L respectively. The antifungal activities of extracts by petroleum ether, ethyl acetate and n-butanol against *Valsa mali* and *E. ampelina* was tested, the results showed that the antifungal activities of extracts by petroleum ether, ethyl acetate were both notable. At 0.5 g/L, the inhibition rates of petroleum ether extract against *V. mali* and *E. ampelina* were 80.35% and 60.23% respectively. The inhibition rates of ethyl acetate extract were 81.88% and 64.06% respectively. In one word: the ethanol extract of leaves, branchlets, cones and seeds had antifungal activities and the antifungal activity of leaves extract was the best; the inhibition composition was in the petroleum ether and ethyl acetate extracts.<sup>17</sup>

**Anti-inflammatory effects of total flavonoids isolated from *Platycladus orientalis***

The inflammatory models in mice and swelling of rats' hind paws were induced by dimethylbenzene and by carrageenan respectively. The contents of PGE 2 and NO in the hind paws of rats were measured. Results The total flavonoids isolated from *Platycladus orientalis* remarkably inhibited the ear edema induced by dimethylbenzene in mice at the dose of 12.5~50.0 mg/kg<sup>-1</sup> and the swelling of rats' hind paws induced by carrageenan at the dose of 25.0, 50.0 mg/kg<sup>-1</sup>. In the inflammatory model of a rat's hind paws induced by carrageenan, total flavonoids can decrease the contents of PGE 2 and NO in the hind paws of rats. Conclusion Total flavonoids isolated from *Platycladus orientalis* have an anti-inflammatory effect which may be related to decreasing the contents of PGE 2 and NO.<sup>18</sup>

**Antioxidant Activity of Leaves and Fruits of Iranian Conifers**

*Platycladus orientalis* and *Taxus baccata* are Iranian conifers. The antioxidant activity of leaves and fruits of these 11 different taxa were evaluated. The leaves of both male and female, and fruits of these plants were collected from different areas of the country. Methanol extract of leaves and fruits of these taxa were prepared. Antioxidant activity of each extract was measured using two different tests of the ferric thiocyanate method and thiobarbituric acid. Results indicated that the methanol extracts of leaves, of male and female, and fruits of all these species (27 samples) possessed antioxidant activity when tested with both methods. The antioxidant activity was then compared with those of  $\alpha$ -tocopherol (a natural antioxidant) and butylated hydroxytoluene (a synthetic antioxidant). Methanol extract of fruits of *C. semipervirens* cv. *Cereifeormis* showed the highest antioxidant activity while the methanol extract of leaves of *C. semipervirens* var. *semipervirens* possessed the lowest antioxidant activity. However, our finding showed that most of the tested extracts were showing strong antioxidant activity even higher than  $\alpha$ -tocopherol.

### Antiproliferative effects of essential oils and their major constituents in human renal adenocarcinoma and amelanotic melanoma cells

The purpose of this study was to evaluate cytotoxic activity of *Platycladus orientalis*, *Prangos asperula* and *Cupressus sempervirens* ssp. *pyramidalis* essential oils and to identify active components involved in inhibition of population growth of human cancer cell lines. **Materials and methods:** Essential oils were obtained by hydrodistillation and were analysed by gas chromatography and gas chromatography coupled to mass spectrometry. Antiproliferative activity was tested on amelanotic melanoma C32 cells and on renal cell adenocarcinoma cells, using the sulphorhodamine B assay. **Results:** *Cupressus sempervirens* ssp. *pyramidalis* leaf oil exerted the highest cytotoxic activity with an  $IC_{50}$  value of 104.90  $\mu\text{g/mL}$  against C32, followed by activity of *P. orientalis* and *P. asperula* on the renal adenocarcinoma cell line ( $IC_{50}$  of 121.93 and 139.17  $\mu\text{g/mL}$ , respectively). *P. orientalis* essential oil was also active against amelanotic melanoma with an  $IC_{50}$  of 330.04  $\mu\text{g/mL}$ . Three identified terpenes, linalool,  $\beta$ -caryophyllene and  $\alpha$ -cedrol, were found to be active on both cell lines tested. **Conclusions:** Our findings provide novel insights into the field of cytotoxic properties of essential oils. This study provided evidence on how cytotoxic activity of the oils is not always related to their major constituents, except for lower activity found in both cell lines for  $\alpha$ -cedrol. Interestingly,  $\beta$ -caryophyllene and linalool exhibited comparable  $IC_{50}$  values to the commercial drug vinblastine on the ACHN cell line. This opens a new field of investigation to discover mechanisms responsible for the observed activity.<sup>19</sup>

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