

# Toxicity of Essential Oil



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## Introduction

The term “essential oil” is defined as “an odorous product, generally of complex composition, obtained from a botanically defined raw material, either by water vapor extraction, by dry distillation, or by an appropriate mechanical process without heating.

Plants produce a wide array of secondary metabolites during their growth and development. Essential oils also known as ethereal or volatile oils are among the most important compounds of secondary metabolism of aromatic plants. Being secondary metabolites, essential oils are not vital for growth and development of the producing plant. Their role has been hypothesized to include protection against pathogens and pests by acting as antifeedants, antibacterial, antivirals, antifungals and insecticides. In a number of plants, the essential oils suppress growth of neighboring plants through allelopathic effects hence offering the producing plant a competitive advantage.

Since ancient times, essential oils are recognized for their medicinal value and they are very interesting and powerful natural plant products. They continue to be of paramount importance until the present day. Essential oils have been used as perfumes, flavors for foods and beverages, or to heal both body and mind for thousands of years. Besides that the utilization of essential oil is very extensive and covers a wide range of human activity some of the important uses as; ingredients in the manufacture of soaps, cosmetics, perfumery, healthcare herbal products, confectionary, aerated water, syrups, disinfectants, insecticides, fungicides.

Most essential oil compounds have a “non-specific” toxic effect, whereby the absorption of these lipophilic compounds into cellular membranes can eventually lead to disruption of membrane permeability. The primary toxic outcome is that of the disruption of ion channel function in nerve cells, first affecting the heart and central nervous system, leading to cardiac and respiratory depression. To create such effects, however, require huge dosages, in the order of 300mL and beyond.

Certain aromatic compounds, most notably 1,8 cineole (as in many *Eucalyptus* species), camphor (borneone) (as an isolated compound or as in *Rosmarinus officinalis* CT camphor and *Lavandula latifolia*) and methyl salicylate (as a synthetically derived compound or as in *Gaultheria procumbens*) have specific toxic effects at much lower doses. These compounds make up the bulk of both serious and fatal poisonings in children and adults, due not just to their toxicity, but to the common availability of products containing these compounds and their reputed beneficial properties.

With some essential oils or at least with the monoterpenes constituting them, dermal toxicity was observed, among them are the clove, eucalyptus, wintergreen, which are known for their irritability. Bergamot and angelica essential oils cause photosensitivity; D-limonene produces further irritating transdermal absorption 40; and another that tea-tree oil can cause skin allergies.

## Materials and Methods

### Acute Oral Toxicity Test

The Guidelines for Testing of Chemicals, Acute Oral Toxicity Acute Toxic Class Method 423 of the Organization for Economic Cooperation and Development (OECD), was used. The toxicity of substances were settle several classes as: not classified, dangerous, toxic, very toxic, and highly toxic as shown in Table 1.

Twelve hours before starting the study food was suspended while the body weigh was monitored moments before the administration of the oil. Animals were randomly assigned in two groups one was: a control group treated with physiological saline and the other was experimental group treated with the essential oil at dose of 2000 mg/kg of body weight, using an orogastric tube. Clinical observations of animals were performed four times per day, paying attention to behavior, general physical condition, nasal mucosa, changes in skin and fur, respiratory frequency, somatomotor activity, and possible occurrence of signs such as tremors, convulsions, diarrhea, lethargy, drooling, low response to stimuli, sleep, photophobia, and coma. Palpation of the abdomen was carried out as well. After 48 hours of clinical observation without any signs of toxicity, the experimental group receives 2000 mg/kg of oil. The statistical test applied was “t-Test for independent groups”, implemented in the STATISTIC V. 7.0 for Windows; P values <0.05% were regarded as significant. The animals were humanely euthanized at the end of the study.

**Table 1:** Classification of substances according to the guideline of the Globally Harmonized system of classification and labeling of chemicals (GHS), third edition

S.N.	Ranges (mg/kg)	Category	Classification	Hazard Statement
1	> 2000mg/kg	Category 5	Not classified	May be harmful if swallowed
2	> 300 ≤ 2000mg/kg	Category 4	Dangerous	Harmful if swallowed
3	> 50 ≤ 300mg/kg	Category 3	Toxic	Toxic if swallowed
4	> 5 ≤ 50mg/kg	Category 2	Very toxic	Fatal if swallowed
5	< 5mg/kg	Category 1	Highly toxic	Fatal if swallowed

## Anthopogon Oil

### Sunpaati, Dhup

**Scientific name:** *Rhododendron anthopogon* D. Don

**Family:** Ericaceae

**Other names:** Anthopogon (Eng)



**Description:** An evergreen, strongly aromatic shrub-let to 60 cm to 1 m tall; leaves simple, alternate, short stalked, oval to ovate, 2.5 – 4 cm long, densely scaly beneath, and aromatic characteristic smell when crushed; flowers white or yellowish tinged with pink, 4 – 6 in compact terminal clusters; fruits capsules, about 3 mm long, encircled by persistent calyx.

**Flowering and fruiting:** May - July

**Part used:** Leaves

**Uses:** Leaves are aromatic, stimulant and administered as an errhine to produce sneezing. Its decoction is used in cold, cough and chronic bronchitis.

**Chemical constituents:** Leaves give ursolic acid and quercetin. Bark also contain quercetin (Husain et al, 1992)

Leaves afford aromatic oil containing  $\alpha$ - and  $\beta$ -pinene, d-limonene, 3-cyclohexene, linalylpropanoate, butanoic acid, caryophyllene, copaene, caryophyllene oxide, guaiol,  $\delta$ -selinene, 2-naphthalenemethanol and naphthalenamine (Mizuho Suzuki, 1995).

**Distribution in Nepal:** Sub-alpine to alpine zones in between 3000 – 4800 m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Anthopogon Oil	1347	Harmful if swallowed	lots of urination in high dose

## Artemisia Oil

### Titepaati

**Scientific name:** *Artemisia indica Willd.*

**Family:** Compositae

**Other names:** Mug-wort (Eng), Surparna (Sans)



**Description:** A tall aromatic perennial shrub about 2.4 m tall; leaves alternate, lower leaves ovate in outline deeply pinnatisect with small stipule like lobes at the base, pubescent above and tomentose beneath, uppermost leaves smaller, 3-fid or entire, lanceolate; flowers sub-globose heads in sub-erect or horizontal paniced racemes; fruits Oblong-ellipsoid minute achenes.

**Flowering and fruiting:** June – July.

**Parts used:** Leaves and young shoots

**Uses:** Plant is stomachic, purgative, deobstruent, antispasmodic, anthelmintic, insecticide, and prescribed in infusion and electuary in cases of obstructed menses and hysteria. It cures asthma, itching, anorexia, gastritis, rheumatism, bronchitis, fever, headache, hemorrhage and diarrhea. Externally it is used in skin diseases and foul ulcers. It is applied to the head of the young children for the prevention of convulsion.

**Chemical constituents:** Plant contains Maackiain and Exiguaflavanone A (Watanabe, T. et al, 2005).

Plant affords essential oil containing  $\alpha$ - and  $\beta$ -thujone. (Shrestha, P.M. et al, 1994)

**Distribution in Nepal:** Tropical to temperate zones in between 300 –2400 m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Artemisia Oil	> 2000	May be harmful if swallowed	

## Calamus Oil

### Bojho

**Scientific name:** *Acorus calamus* Linn.

**Family:** Araceae

**Other names:** Sweet flag (Eng), Bach, Ghorbach (Hind), Vacha, Uragandha (Sans)



**Description:** A rhizomatous herb growing on marshy places; leaves bright green, 15 – 25 cm long and 0.2 – 0.5 cm broad, ensiform with distinct midrib; flowers small, yellow green arranged in cylindrical spadix.

**Flowering and fruiting:** June - July

**Parts used:** Rhizomes

**Uses:** The rhizome is aromatic, bitter, carminative, emetic, anthelmintic, expectorant, antispasmodic and nerve tonic. It is used in dyspepsia, colic, remittent fevers, diarrhea, dysentery, bronchial and chest affections.

**Chemical constituents:** Rhizome and root afford an essential oil containing  $\beta$ -asarone as major constituent and calamene, calamol, asarone, camphene,  $\alpha$ -pinene and asaronaldehyde as other constituents (Srivastava, D. L., et al, 2006)

$\beta$ -caryophyllene, tatarine A and C also reported from the rhizome. (Watanabe, T, et al, 2005)

**Distribution in Nepal:** Tropical to temperate zones of in between 500 – 2300 m from east to west.

**Place of representative collection:** Jumla, Jumla district, Karnali zone (West Nepal) Bojhoghari, Kathmandu district, Bagmati zone (Central Nepal)

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Calamus Oil	350	Harmful if swallowed	Death within 30 min, drunkenness and lots of urination in high dose

## Chamomile Oil

### क्यामोमाईल (chamomile)

**Scientific name:** *Matricaria chamomilla*  
(**synonym:** *Matricaria recutita*)

**Family:** Asteraceae.

**Other names:** chamomile (Eng),



**Description:** *M. chamomilla* has a branched, erect and smooth stem, which grows to a height of 15–60 cm (6–23.5 in). The long and narrow leaves are bipinnate or tripinnate. The flowers are borne in panicle flower heads (capitula). The white ray florets are furnished with a ligule, while the disc florets are yellow. The hollow receptacle is swollen and lacks scales. The flowers bloom in early to midsummer, and have a strong, aromatic smell.

**Flowering and fruiting:** March – April.

**Parts used:** flower.

**Uses:** German chamomile is used in herbal medicine for a sore stomach, irritable bowel syndrome, and as a gentle sleep aid. It is also used as a mild laxative and is anti-inflammatory and bactericidal.

**Important chemical constituents:** The essential oil contains terpene bisabolol, farnesene, chamazulene, flavonoids (including apigenin, quercetin, patuletin and luteolin) and coumarin.

**Distribution in Nepal:** Tropical to sub-tropical zones in between 100 and 1000m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Chamomile Oil	1900	Harmful if swallowed	Death on Next day

## Cinnamomum Oil

### Tejpaat, Sinkaauli, Taj

#### Scientific name:

*Cinnamomum tamala* (Buch. – Ham.)

Nees & Eberm *Cinnamomum albiflorum* Nees

#### Family: Lauraceae

**Other names:** Indian cassia lignea (Eng), Tejpat (Hind), Tamalpatra (Sans).

**Description:** A medium sized evergreen tree about 8 meter tall; leaves simple, short stalked, leathery, ovate – lanceolate, long pointed 10- 15 cm long with 3 conspicuous nearly parallel veins arising from near the base, bright pink when young in spring, aromatic when crushed; flowers pale yellow, in terminal and axillary-branched clusters; fruits Ovoid drupe, black, succulent.

**Flowering and fruiting:** March – April.

**Parts used:** Leaves and bark.

**Uses:** Leaves are carminative. Bark is useful in diarrhea, flatulence, and nausea. Leaves and bark are used in spices.

**Important chemical constituents:** Leaves and twigs produce essential oil containing cinnamaldehyde as major constituent; others include  $\alpha$ - and  $\beta$ -pinene, limonene,  $\beta$ -phellandrene, p-cymene, ocimene,  $\gamma$ -terpinene camphor, linalool, borneol,  $\beta$ -caryophyllene,  $\alpha$ -terpineol, benzyl cinnamate, benzaldehyde, eugenylacetate, eugenol and cinnamyl acetate. (Husain, A. et al, 1992)

The essential oil from leaves contains trans-caryophyllene, p-eugenol and myricetin (Watanabe, T et al, 2005)

**Distribution in Nepal:** Tropical to sub-tropical zones in between 450 and 2000m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Cinnamomum Oil	1400	Harmful if swallowed	Death on Next day



## Citronella Oil

### Citronella

**Scientific name:** *Cymbopogon winterianus* Jowitt ex Bor

**Family:** Poaceae

**Other names:** Citronella Java type (Eng)

**Description:** Perennial from a shallowly rooted rhizome. Culms tufted, robust, up to 2 m or more tall. Leaf sheaths glabrous, reddish inside; leaf blades relatively thin, drooping for 2/3 of their length, 40–80 (–100) × 1–1.5 (–2.5) cm, abaxial surface glaucous, adaxial surface light green, margins scabrid, base narrow, apex long acuminate; ligule 2–3 mm. Spathate compound panicle large, lax, up to 50 cm, much branched, main axis zig-zag, finally nodding; spatheoles reddish brown, 1.2–2.5 cm; racemes 1.5–2.5 cm; rachis internodes and pedicels softly ciliate on margins; pedicel of homogamous pair not swollen. Sessile spikelet elliptic-lanceolate, 4–5 × ca. 1 mm; lower glume flat or slightly concave, sharply 2-keeled, keels narrowly winged, 3-veined between keels; upper lemma very shortly 2-lobed, awn short or absent, not exerted from spikelet.

**Parts used:** Leaves

**Uses:** The essential oils are natural products that exhibit a variety of biological properties, such as analgesic anticonvulsant and anxiolytic (Almeida et al.2001, 2003 and 2004). The steam volatile essential oils extracted from its leaves are used in perfumery, cosmetics, pharmaceuticals and flavoring industries. In traditional medicine, the oil has been used as an aromatic tea, vermifuge, diuretic, and antispasmodic. Citronella oil is commonly known for its natural insect repellent properties.

**Chemical constituents:** Essential oil of the plant contains mainly citronellal (32-45%), geraniol (11-13%), geranyl acetate (3-8%), limonene (1-4%)

**Distribution in Nepal:** Cultivated in tropical to sub-tropical zones from east to west.

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Citronella Oil	500	Harmful if swallowed	lots of urination



## Eucalaptus Oil Masalaa

**Scientific name:** *Eucalyptus camaldulensis*

**Family:** Myrtaceae

**Other names:** river red gum (Eng)



**Description:** Trees, to 25 m tall. Bark dark gray, white, brown, or red, smooth, exfoliating. Branches sometimes pendulous, terete, youngest parts ridged. Young leaves opposite; leaf blade broadly lanceolate, 6-9 × 2.5-4 cm. Mature leaves with a slender 1.5-2.5 cm petiole; leaf blade narrowly lanceolate to lanceolate, 6-30 × 1-2 cm, slightly twisted, thinly leathery, both surfaces with small black glands, secondary veins at an angle of ca. 45° from midvein, intramarginal veins ca. 0.7 mm from margin. Inflorescences axillary, simple, umbels 5-11-flowered; peduncle 1-1.5 cm, slender, terete. Flower buds ovoid, 5-8 mm. Hypanthium semiglobose, ca. 3 mm; stipe 3-12 mm; calyptra hemispheric, rostrate to obtusely conic, 5-7 mm, apically constricted, apex obtuse, acute, or acuminate and beaked or not. Stamens 5-7 mm; anthers elliptic, dehiscent longitudinally. Capsule subglobose, 5-6 mm in diam.; disk broad; valves (3 or)4(or 5), exserted from hypanthium.

**Flowering and fruiting:** Dec-Aug.

**Parts used:** Leaves

**Uses:** An essential oil is used for medicinal purposes, especially as a cough remedy and expectorant, but it also has febrifuge, tonic, astringent, antiseptic, haemostatic and vermifugal properties.

**Chemical constituents:** Essential oil of the plant contains 1,8-cineole,  $\beta$ -pinene,  $\gamma$ -terpinene, p-cymene, terpinen-4-ol and globulol

**Distribution in Nepal:** Cultivated in tropical to sub-tropical zones from east to west.

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Eucalaptus Oil	1664	Harmful if swallowed	Death on Next day

## French Basil Oil

### Baabari phool

**Scientific name:** *Ocimum basilicum* Linn.

**Family:** Labiatae



**Other names:** Sweet basil, Common basil, French basil (Eng), Babuyituli (Hind), Barbari, Arjakah (Sans)

**Description:** An erect annual herb, 60 – 90 cm tall; leaves simple, opposite, stalked, ovate, acuminate, toothed, gland dotted beneath; flowers purplish white in racemes; fruits nutlets light brown.

**Parts used:** Roots, leaves, flowers and seeds

**Uses:** Roots are used in bowel complaints of children. Leaves are useful in the treatment of cough for which the warm juice with honey is given. Flowers are carminative, diuretic, stimulant, and demulcent. Seeds are mucilaginous, infusion given in gonorrhea, dysentery, and chronic diarrhea.

**Chemical constituents:** Plant produces essential oil containing 1,8-cineol, eugenol, limonene, ocimene, geraniol, cis-3-hexenol, citronellol,  $\alpha$ -terpineol, camphor, methyleugenol, methyl cinnamate, linalool, methyl chavicol (Husain, A. et al, 1992)

**Distribution in Nepal:** Cultivated

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	French basil oil	> 2000	May be harmful if swallowed	

## Hedychium Oil

### Pankhaaphool, Paanisaro

**Scientific name:** *Hedychium spicatum* Sm.  
*Hedychium album* Buch. – Ham ex Wall.

**Family:** Zingiberaceae

**Other names:** Ginger lily (Eng), Kapurkachari (Sans)

**Description:** A perennial rhizomatous herb, 0.9 – 1.5 m tall; leaves simple, alternate, sheathed base, oblong to 30m long, 4 – 12 cm broad, shining; flowers white with orange red base in a dense terminal spike 15 – 25 cm borne on a robust leafy stem; .fruits globular capsules.

**Flowering and fruiting:** July - August

**Parts used:** Rhizome

**Uses:** Rhizome is bitter, astringent, fragrant, stomachic, carminative, tonic, stimulant, emmenagogue, expectorant, good in liver complaints, vomiting, diarrhea, in inflammation and pains; used in snake-bite. The rhizomes possess strong aromatic odor and bitter camphoraceous taste. The rhizomes are considered to have insect repellent properties and are used for preserving clothes

**Chemical constituents:** Rhizome produces essential oil containing cineol,  $\gamma$ -terpinene,  $\beta$ -phellandrene, p-cymene, limonene, linalol and  $\beta$ -terpineol as major constituents. Rhizomes also contain sitosterol and glucoside, a furanoid diterpin- hedychenone, and 7-hydroxyhedyche- none (Husain, A. et al, 1992)

It contains Diterpines, starch and mucilage. It also contains essential oil methyl paracumarin acetate and ethyl cinnamic acetate. (Watanabe, t. et al, 2005)

**Distribution in Nepal:** Sub-tropical to temperate zones in between 1500 – 2100 m from east to west.

**Place of representative collection:** Phulchoki (1500 m), Lalitpur district, Bagmati zone (Central Nepal)

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Hedychium Oil	>2000	May be harmful if swallowed	No death at 2000mg/kg



## Jatamansi Oil

### Jataamansi, Bhulte

**Scientific name:** *Nardostachys grandiflora* DC.  
*Nardostachys jatamansi* DC.

**Family:** Valerianaceae

**Other names:** Spikenard (Eng), Jatamansi, Bhutkeshi, Balchhar (Hind)

**Description:** An erect perennial herb 40 – 75 cm tall with rootstock covered with the dark fibers; leaves basal or radical leaves elongate, linear to lanceolate, 15 – 20 cm long, acuminate, base narrowed into petiole. Cauline leaves sessile or sub-sessile with rounded base; flowers rose purple to pinkish white in terminal cymes arranged in bunches; fruits capsules.

**Flowering and fruiting:** June – July.

**Part used:** Roots and rhizomes

**Uses:** The root is excellent substitute of valerian. The oil obtained from the roots is well known hair tonic. The rhizome is considered as tonic, stimulant, antispasmodic, diuretic, deobstruent, emmenagogue, stomachic and laxative. An infusion of the rhizome is reported to be useful in epilepsy, hysteria, palpitation of heart, and cholera. A tincture of it is given in intestinal colic and flatulence. It is also used as aromatic adjunct in the preparation of medical oils.

**Chemical constituents:** Rhizome and roots afford essential oil containing valeranone (jatamansone), spirojatamol, patchouli alcohol, norsesy-chelanon,  $\alpha$ - and  $\beta$ -patchoulene, jatamol A & B, jatamansic acid, terpenic coumarins- oroseol, jatamansin (Sipahimalani, J. L, 2002)

**Distribution in Nepal:** Upper temperate to sub-alpine zones in between 3200 – 5000 m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Jatamansi Oil	>2000	May be harmful if swallowed	



## Juniper leaf Oil

### Dhupi

**Scientific name:** *Juniperus recurva* Buch. – Ham ex D. Don

**Family:** Cupressaceae

**Other names:** Drooping juniper (Eng)

**Description:** A spreading shrub to about 10 m tall, terminal tips curved; leaves awl shaped, 6–8 mm, long, in whorls of 3, more or less adpressed to the branchlets and loosely overlapping; fruits purplish brown to black, shining when ripe., ovoid, 8–13 mm in diameter, 1-seeded.

**Flowering and fruiting:** June - August

**Part used:**

**Uses:** Plant is bitter, pungent, acrid, appetizer, carminative, anthelmintic, and laxative and used in diarrhea, abdominal pain, diseases of spleen, ascites, tumors, piles, bronchitis, indigestion, constipation, and vaginal discharges. Berries are stomachic, aphrodisiac and styptic. Essential oil from fruits is emmenagogue, abortifacient, tonic, anthelmintic, good for toothache, piles and cooling to the brain. Leaves are aromatic and used as incense.

**Chemical constituents:** The essential oil contains  $\alpha$ -pinene, sabinene,  $\delta$ 3-carene, limonene, terpinen-4-ol,  $\gamma$ -cadinene,  $\delta$ -cadiene, elemol, cubenol, epi- $\alpha$ -cadinol, epi- $\alpha$ -muurolol,  $\alpha$ -cadinol and 4-epi-abietal (Adams, R.P. et al, 1998)

**Distribution in Nepal:** Temperate to alpine zones in between 2500 – 4600 m from east to west.

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Juniper leaf Oil	>2000	May be harmful if swallowed	



## Lemongress Oil

### Pirhe ghaans, Lemon grass

**Scientific name:** *Cymbopogon flexuosus* Nees

**Family:** Graminae



**Other names:** Lemon grass (Eng), Lemon grass , Gandhatrina (Hind), Bhustrinah (Sans)

**Description:** A perennial grass about 3 m tall; leaves linear-lanceolate, 125 cm long, 1.7 cm broad, flowers grayish or grayish green, rarely purple tinged, in drooping panicles.

**Flowering and fruiting:** July – Sept.

**Parts used:** Plant and leaves

**Uses:** Plant is aromatic, stimulant, diaphoretic, antispasmodic, anthelmintic and laxative. Leaves are chewed to cure sore gums. Oil is used as insect repellent.

**Chemical constituents:** Herbs afford an essential oil containing citral a and citral b as major component and others are  $\alpha$  and  $\beta$ -pinene, camphene, limonene, linalool, nerol, geraniol and geranyl acetate (Masuda, Y., 1919)

**Distribution in Nepal:** Cultivated

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Lemongress Oil	1266	Harmful if swallowed	Death on same day

## Mentha Oil

### Pudinaa

**Scientific name:** *Mentha arvensis* Linn.

**Family:** Labiatae



**Other names:** Mint (Eng), Pudina (Hind), Pudina, Putiha (Sans)

**Description:** A perennial herb, 60 cm high; leaves simple, opposite, short stalked, oblong, 2.5 - 5 cm long, obtusely or acutely serrated; flowers small, lilac in axillary whorls; fruits nutlets, smooth.

**Flowering and fruiting:** June - August

**Parts used:** Leaves

**Uses:** Dried plant is aromatic, antispasmodic, carminative, stomachic, refrigerant, stimulant, emmenagogue, and diuretic.

**Chemical constituents:** Herb produces aromatic oil containing menthol and menthone as major constituents. (Husain et al,1992)

**Distribution in Nepal:** Cultivated in tropical to subtropical zones from east to west.

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	mentha oil	1600	Harmful if swallowed	in high dose, looks like anesthetized within 5 min, Death on same day

## Palmarosa Oil

### Paamaarosa



**Scientific name:** *Cymbopogon martinii* (Roxb.) W. Watson  
*Andropogon martini* Roxb.

**Family:** Graminae

**Other names:** Palmarosa (Eng), Gandhabel, Rusa ghans (Hind), Dhya-makah, Rohisah (Sans)

**Description:** A perennial grass to 3 m tall; leaves linear-lanceolate, cordate or amplexicaule, 8 – 50 cm long, 1 – 3 cm broad; flowers spikelets in panicles turning reddish brown when mature.

**Flowering and fruiting:** July - August

**Parts used:** Plant

Plant is acrid, aromatic, carminative, diuretic, cardiotonic, and febrifuge.

**Chemical constituents:** Plant contains essential oil. Major constituents of oil are geraniol, geranyl acetate, citronellol, and linalool. (Husain et al, 1992)

**Distribution in Nepal:** Cultivated

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Palmarosa oil	1600	Harmful if swallowed	Death on same day in high dose

## Patchouli Oil

### Pachouli

**Scientific name:** *Pogostemon cablin* (Blanco) Bentham

**Family:** Lamiaceae

**Other names:** mint or deadnettle (Eng)



**Description:** Herbs or subshrubs, perennial, aromatic. Stems erect, 30-100 cm tall, tomentose. Petiole 1-6 cm; leaf blade circular to broadly ovate, 2-10.5 × 1-8.5 cm, herbaceous, adaxially dark green, sparsely tomentose, abaxially tomentose, base cuneate-attenuate, margin irregularly incised, apex obtuse to acute; lateral veins ca. 5-paired. Spikes 4-6.5 × 1.5-1.8 cm, densely tomentose, terminal and axillary; verticillasters 10- to many flowered, basally somewhat lax; peduncle 0.5-2 cm; bracts and bracteoles linear-lanceolate, somewhat shorter than to as long as calyx, densely tomentose. Calyx tubular, 7-9 mm, tomentose outside, minutely tomentose inside; teeth subulate-lanceolate, ca. 1/3 as long as calyx tube. Corolla purple, ca. 1 cm, lobes villous outside.

**Flowering and fruiting:** Stamens bearded. Fl. Apr

**Parts used:** an essential oil obtained from the leaves

Patchouli is used widely in modern perfumery . Patchouli leaves have been used to make an herbal tea. insect repellent

**Chemical constituents:** Plant contains essential oil. Major constituents of oil are a-patchoulene, b-patchoulene, a-bulnesene, a-guaiene, norpatchoulenol, pogostol, caryophyllene, seychellene and patchouli alcohol

**Distribution in Nepal:** Cultivated

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Patchouli Oil	>2000	May be harmful if swallowed	

## Sugandhakokila Oil

### Sugandhakokilaa

**Scientific name:** *Cinnamomum tenuipile*

**Family:** Lauraceae



**Description:** Small to large trees, 4-16(-25) m tall, 10-50 cm d.b.h. Bark gray. Branchlets slender; old branchlets glabrate, somewhat angled, striate; young branchlets very densely gray tomentose. Leaves alternate, somewhat clustered at apex of branchlet; petiole 1-1.5 cm, concave-convex, densely gray tomentose; leaf blade obovate or subelliptic, 7.5-13.5 × 4.5-7 cm, papery, densely tomentose initially but soon glabrate abaxially, densely villous except tomentose along midrib and lateral veins initially but soon entirely glabrate adaxially, midrib and lateral veins elevated abaxially, impressed adaxially, lateral veins 6 or 7 pairs, arcuate-ascendant, evanescent near leaf margin, transverse veins elevated abaxially, slightly impressed adaxially, veinlets inconspicuous on both surfaces, base broadly cuneate or subrounded, apex rounded or obtuse or shortly acuminate. Panicle axillary or subterminal, 4.5-8.5(-12) cm, slender, 12-20-flowered, branched; branches short, 1-1.5 cm, terminal ones 3-flowered cymes; peduncle slender, ca. as long as 1/3 of inflorescence, peduncle and rachis very densely gray tomentose. Pedicels 3-5 mm, densely gray tomentose. Flowers yellowish, small, ca. 3 mm. Perianth densely sericeous-puberulent on both sides; perianth tube obconical, ca. 1 mm; perianth lobes 6, ovate or oblong, subequal, ca. 2 mm, inner ones broader. Fertile stamens 9, ca. 1.6 mm (of 1st and 2nd whorls) or ca. 2 mm (of 3rd whorl); filaments longer than anthers, as abaxial side of anther villous, those of 3rd whorl each with 2 stalked orbicular glands, others glandless; anthers of 1st and 2nd whorls oblong-orbicular but those of 3rd whorl oblong, all 4-celled; cells introrse (of 1st and 2nd whorl) or lateral-extrorse (of 3rd whorl). Staminodes 3, ca. 1.5 mm, triangular-lanceolate, long stalked, villous. Ovary ovoid, ca. 1.2 mm, glabrous; style slender, ca. 1.5 mm; stigma discoid. Fruit subglobose, up to 1.5 cm in diam., red-purple when mature; perianth cup in fruit elongate, up to 1.5 cm, dilated into a shallow cup and up to 8 mm wide at apex, truncate or somewhat dentate on margin.

**Flowering and fruiting:** Feb-Apr, fr. Jun-Oct.

**Part used:** Seeds

**Uses:** Sugandha Kokila essential oil are digestive, anti-arthritic, carminative, analgesic, antiseptic, relaxant, stomachic, antimicrobial, emmenagogue, astringent and antibiotic.

**Chemical constituents:** In essential oil of *Cinnamomum glaucescens*,  $\alpha$ -pinene,  $\beta$ -pinene, camphor, sabinene, eucalyptol,  $\alpha$ -terpineol, 1,8-cineole,  $\beta$ -phellandrene (trace),  $\beta$ -myrcene, p-Cymene, linalool and trans methyl cinnamate.

**Distribution in Nepal:** Sub-tropical zone in between 1000 – 1500 m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Sugandhakokila Oil	>2000	May be harmful if swallowed	

## Valerian Oil

### Sugandhawal, Samaayo

**Scientific name:** *Valeriana jatamansi* Jones  
*Valeriana wallichii* DC

**Family:** Valerianaceae

**Other names:** Indian valerian (Eng), Tagar (Hindi), Natah, Tagar (Sans)

**Description:** A perennial herb to 45 cm tall with thick, horizontal, nodular and aromatic root stock; leaves basal leaves with ovate-heart shaped acute blade, 2.5 – 8 cm, and toothed or wavy-margined, long stalked; stem leaves few, small, entire or pinnate lobed; flowers white or pink tinged, in terminal clusters, borne on erect nearly leafless stem; fruits small with persistent pappus like calyx.

**Flowering and fruiting:** April – May.

**Part used:** Rhizome and roots

**Uses:** It is used as a substitute of Valerian. Rhizomes and roots are useful in hysterical fits, other nervous disorders and flatulence. Roots are used in afflictions of eyes and blood and enlargement of liver and spleen. Oil extracted from the rhizome is used in cosmetics industries.

**Chemical constituents:** Rhizomes and roots contain cyclopentapyrans, acacetin-7-O-rutinosides, valtrate, didrovaltrate, linarin iso valerinate, valepotriates and an iridoid ester glycoside- valeriosidatum. Essential oil from roots without rootlets contains calarene,  $\beta$ -bargamotene, valerone,  $\alpha$ -curcumene, maalioloxide and maaliol. Main acids present in the oil are isovaleric acid and (+)- $\beta$ -methyl valeric acid. Other acidic constituents are formic, propionic, butyric, palmitic and stearic acids and isovaleryl ester of D(-)- $\alpha$ -hydroxyvaleric acid. Essential oil from roots with rootlets contain  $\beta$ -sitosterol, substantial amount of patchouli alcohol and small amount of patchouli alcohol and small amounts of  $\alpha$ -,  $\beta$ - and  $\gamma$ -patchoulene and maaliol in traces (Husain et al, 1992).

**Distribution in Nepal:** Sub-tropical to temperate zones in between 1500 – 3300 m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Valerian Oil	>2000	May be harmful if swallowed	



## Wintergreen Oil

### Dhasingare, Patpate, Machhino

**Scientific name:** *Gaultheria fragrantissima* Wallich

**Family:** Ericaceae

**Other names:** Wintergreen (Eng), Gandhapura (Hind), Hemanta harit (Sans)



**Description:** A much branched evergreen aromatic shrub about 3 m tall; leaves simple, alternate, stalked, oblong-lanceolate to elliptic, serrate, stiffly coriaceous, dotted with glands, up to 13 cm long; flowers small, greenish white fragrant in short axillary bunches; fruits capsule, sub globose, enclosed in bluish sepals.

**Flowering and fruiting:** April – May.

**Part used:** Twigs and leaves

**Uses:** The winter green oil is obtained from the distillation of fresh twigs and leaves. The oil is aromatic, stimulant, carminative and antiseptic. The oil is also used in various forms of rheumatism. The oil is applied externally in liniments in the form of a suitable ointment to counteract their irritating effects. It has vermifugal action against hookworm.

**Chemical constituents:** Leaves contain hyperoside (quercetin-3-galactoside, ursolic acid,  $\beta$ -sitosterol and essential oil containing methyl salicylate (major constituents).

1. Husain, A. et al, 1992
2. Srivastava, D.L. and Shakya, D.M., 2003.

**Distribution in Nepal:** Sub-tropical to temperate zones in between 1200 – 2600 m from east to west

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Wintergreen Oil	1606	Harmful if swallowed	Sudden death in high dose

## Xanthoxylum Oil

### Timur

**Scientific name:** *Zanthoxylum armatum* DC.

*Zanthoxylum alatum* Roxb.

**Family:** Rutaceae



**Other names:** Toothache tree, Prickly ash (Eng), Timru (Hind), Tumburu (Sans)

**Description:** A prickly shrub or small tree up to 6 m tall growing on shrub-beries; leaves pinnate, leaflets 5 -11, lanceolate, more or less serrate, each serrature with a pellucid gland, dark glossy, terminal one larger than laterals; flowers small, yellow in terminal or axillary panicles; fruits globose, wrinkled, reddish when ripe, aromatic; seeds globose, shining black.

**Flowering and fruiting:** April – May.

**Parts used:** Seeds and bark.

**Uses:** Seeds and barks are used as an aromatic, tonic in fever, dyspepsia and cholera. Fruits are used in toothache and considered as carminative and stomachic. Fruits, branches and thorns are also used as fish poison.

**Chemical constituents:** Dried seed affords an essential oil containing lemonene, linalool and methyl cinnamate as major components and  $\alpha$ -pinene, l-thujene,  $\beta$ -pinene, sabinene, myrcene,  $\gamma$ -terpinene, p-cymene, terpenin-4-ol, piperitone, carvone, cuminaldehyde, methyl cinnamate as other constituents (Adhikari, S.R. and Karlsen, J. 1987).

Dried bark and branches contain lignans-sesamin, fargesin, eudesmin and epi-eudesmin; a neutral lactone – pulvatiide, dictamine, 8-hydroxydictamine and  $\gamma$ -fagarine. Wood and bark contain magnofluorine and xanthoplanine. Roots contain magnofluorine, xanthoplanine, skimmianine, dictamine and  $\gamma$ -fagarine and root-bark-spilanthol. Seeds contain flavonoids-tambulin and tambulol (tambaletin) (Husain, A. et al, 1992)

**Distribution in Nepal:** Sub-tropical to temperate zones in between 1500 – 2400 m from east to west

**Place of representative collection:**

Godawari (1500 m), Lalitpur district, Bagmati zone (Central Nepal)

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Xanthoxylum Oil	1843	Harmful if swallowed	Death on Next day

## Yellow Zedoary Oil

### Banahaledo, Bandhaale

**Scientific name:** *Curcuma zedoaria* Rosc

**Family:** Zingiberaceae



**Other names:** zedoary, white turmeric, or kentjur

**Description:** The fragrant plant bears yellow flowers with red and green bracts and the underground stem section, a rhizome, is large and tuberous with numerous branches. The leaf shoots of the zedoary are large and can reach 1 meter (3 feet) in height.

**Flowering and fruiting:** April - May

**Parts used:** Rhizomes

**Uses:** The plant is used traditionally to treat inflammation, pain, and a variety of skin ailments including wounds, as well as menstrual irregularities and ulcers.

**Chemical constituents:** Essential oil of rhizome contains curcuminoid 1,7-bis(4-hydroxyphenyl)-1,4,6-heptatrien-3-one, and the sesquiterpenes procurcumenol and epiprocurcumenol

**Distribution in Nepal:** Tropical – sub-tropical zones from east to central part.

Median lethal dose (LD50) of Essential Oil

S.N.	Essential Oil	LD50 (mg/Kg BW)	Hazard Statement	Remarks
1	Yellow Zedoary Oil	1950	Harmful if swallowed	Death on Next day

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