## *Tetraclinis articulata* (Vahl.) Masters.
Cupressaceae

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### Morphological Description

Large coniferous evergreen tree, 12-15 m tall, with a reddish-brown scented trunk, having flattened branches and scale-like leaves. The tree bears characteristic cones

It is considered a tree of particular beauty, because of the division of the branches into striated segments; where the segments join the spring decurrent leaves known as "the hair."

If it grows in rock fissures and rocky slopes it may grow up only to 5 m in height.

### Geographical Distribution

**Local:** The largest area of distribution is in Morocco (607 900 hectares). It is found in 6 zones: 1-Rif mountains; 2-Eastern Morocco; 3-Eastern middle Atlas; 4-Valleys of the central plateau and eastern Meseta; 5-Western Middle Atlas and High Atlas; 6-Anti Atlas.

**Regional:** Morocco, Algeria, Tunisia, Libya.

In the semi-arid to humid ecoclimatic zones of the North African countries, the major natural shrubland ecosystems are dominated, among others, by Tetraclinis articulata (0.94 million hectares).

**Global:** Arar tree is endemic to the mountainous regions of North Africa: Morocco, Algeria, Tunisia, with isolated populations occurring in Malta and near Cartagena, Spain.

### Ecology

Grows in hot, dry areas. Warm and xeric conditions.

## *Tetraclinis articulata* (Vahl.) Masters.

*Callitris vulgaris* Schrader; *Callitris quadrivalvis* Vent.; *Callitris articulata* (Vahl.) Mirbel; *Callitris articulata* Murb. ; *Thuja articulata* Vahl. ; *Thuya articulata* Vahl. ; *Cupressus articulata* (Vahl.) J. Forbes ; *Thyia articulata.*

**Arabic:** Aaraar, Sandarus, Ar'ar berboush, Shajrat el-hayat. عرعر- سنضروس- عرعر بربوش
**Berber:** Azouka, Imijad, Tazout.
**English:** Arar tree, Arartree, Sandarach tree, Thyia, Sandarac tree, Sandarac Gum Tree, Juniper gum tree, Alerce, Thuja, Gharghar, thuya from Berberie.
**French:** Thuya de berbérie, Thuya, Callitris, Thuia articulé, Thuia à la sandaraque, Vernix.

As most conifers, it can withstand drought to a considerable degree, and is capable of withstanding a certain degree of salinity as it grows in coastal localities. Though it burns easily, the tree is not usually killed by fire since its vegetative growth is usually stimulated by fire. It produces shoots from a rootstock below ground level after the passage of fire. It would be an excellent tree for afforesting rocky slopes. Very ornamental as a tree, and its use as such is increasing since its declaration as the national tree.

### Status

The species is listed as rare on the IUCN's Red List of plants, which notes that populations are vulnerable in Morocco.

In Morocco, priority is given to in situ conservation within reserves and protected areas.

Red List Category & Criteria:
**Year Assessed:** 1997
**Assessor/s:** Conifer Specialist Group
**Country Names:** Algeria, Malta, Morocco, Spain
Biome Terrestrial
**Range and Population:** The populations in Malta and southern Spain are highly threatened. In North Africa the species is also restricted in range.
**Habitat and Ecology:** It coppices well.

### Data Sources

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conifer species completed by the IUCN/SSC Conifer Specialist Group between 1996 and 1998.
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## Parts Used

Leaves, Fruits, Wood, Resin, Oil,

**Oil:** The tar or oil is extracted by destructive distillation of wood as is the case in Cade oil from Juniperus oxycedrus. This is what is called Gatran el-Ghalid (thick tar). It is less fluid than Cedrus tar and the cade oil. It is also more acidic, less estimated and used as substitute in the treatment of wounds especially in livestock.

**Resin:** The resin exudes spontaneously or from incisions made through the bark in the trunk and branches. It quickly solidifies when exposed to air. The hardened resin can be then harvested by peeling it from the trees.

Sandarac = sandarach or gum sandarac: A brittle and faintly aromatic translucent resin obtained from *Tetraclinis articulata*, is a, breaking into cylindrical pieces. It is soluble in alcohol. It is used in the manufacture of spirit varnishes, and, when dissolved in oil, to make cooked varnishes. It is also used in powdered form to clean vellum and to prepare it for writing purposes. Its most outstanding property is its hardness. Also called "gum juniper."

An essential oil can be obtained by steam distillation of this resin or by dissolving the resin in a solution of potassium hydroxide. It is also possible to isolate the essential oil from a neutralized alcoholic solution of sandarac. The alcohol is then evaporated and the alkaline solution is extracted with ethyl ether. After removal of the ether, a small amount of essential oil is left. Sandarac oil is pale yellow or almost colorless and has a slightly balsamic odor.

**Wood: Names and Descriptions**

Thuya Burl, Thyine wood: The fragrant and beautiful sweet-smelling root wood of *Tetraclinis articulata.* Golden reddish brown with heavy small dark 'eyes'. Hard, heavy (density: 1.10 à 1.20), oily, aromatic. Turns well and take a high shine. This burl wood is amazingly hard and polishes up like glass. It is stable and works very well.

## Constituents

Flavones (amentoflavones, cupressuflavone and kinokiflavone). Essential oil of stems and wood of Moroccan thuya were studied: Essential oil of stems; yield: 0.25-0.80%; contain bornyle acetate (30.5%), camphor (18.6%), borneol (10.2 %), limonene (8.6 %), terpene-1-ol-4 (5.8%) and thuyone (less than 1 %).

Essential oil of wood; yield: 2%; contain carvacrol (28%), p-methoxythymol (22.1%), thymohydroquinone (16.1%), cedrol (7.2%), terpene-1ol-4 (5.4%), alpha-pinene (3.8%), and alpha-cedrene (3.6%). This Essential oil may be an interesting source of carvacrol.

## Pharmacological Action and Toxicity

The Antimicrobial activity of sandarac resins was reported. The study of the effects of sandarac varnishes containing chlorhexidine on the human dental plaque flora was investigated. The results suggested that sandarac varnishes containing high concentrations of chlorhexidine could be used successfully for long-term suppression of Streptococcus mutans in dental fissures.

The induction of apoptosis in human melanoma, breast and ovarian cancer cell lines using an essential oil extract from *Tetraclinis articulata* was studied. All cell lines tested were inhibited in a dose-dependent fashion. Melanoma, breast and ovarian cancer cells gave IC50s of around 80 micrograms/ml whilst the IC50s on peripheral blood lymphocytes was almost double this value. It was concluded that the essential oil contains components that are effective at inducing apoptosis.

The heartwood of this species was reported to

contain several dermatologically active compounds including thymoquinone, carvacrol, and beta- and gamma-thujaplicins.
Decoction of leaves is abortive and dangerous to use.

## Traditional Medicine and Indigenous Knowledge

**Uses**

A drug made of a mixture of leaves and cones is combined with skim milk *(L'ben)* and administered as a emetic in intoxication cases and for treatment of severe diarrheas and gastric pains. Also used as an expectorant.
Crushed leaves in poultices on both sides or on the top of the head against dizziness, headache, neck pain, insolation and fever of children.
Leave's powder is used externally on wounds or applied to the umbilical wound of the newborn baby for healing.
The plant was reported to be used in the eastern part of Morocco for diabetes.
Combined with henne *(Lawsonia innermis)* they are used to treat hair (applied to the hair about one hour before washing it).
In fumigation the Araar is used to ease and fasten delivery in women, and against sorcery.
The resin is used to fill up the tooth wholes.
One peace of sandarac humidified with rose's water is applied to the eyelid against inflammation of eyes.
Tar produced from old wood for dermal diseases, especially in veterinary medicine.

## Other indications:

In Arabian countries sandarac is still burned to treat colds. People also take the resin internally to treat roundworms and tapeworms. Sandarac is said to be used in India for hemorrhoids and diarrhea and the tincture for friction in cases of low spirits.

## History

The tree was known in antiquity; the Greek philosopher and naturalist Theophrastus (born circa 370 BC) describes it in his History of Plants botany work (E III 7). According to Theophrastus, "thyon" (Tetraclinis) grows near the temple of Zeus at the Libyan Cyrene, looks like a cypress tree and has resistant wood and strong roots from which "they make the most beautiful artifacts".
The wood was used in burning incense, and under the name of citron-wood was highly prized by the Romans for ornamental woodwork. It yields the sandarach resin of commerce.
The resin collected in Essaouira region was exported to Europe for varnish industries and for pharmacy (fabrication of plaster). It was exported through the port of "Mogador" the old name of the city of Essaouira.

**Modern treatment**

Sandarac has a wonderful warm, light, fruity, balsamic, frankincense-like fragrance. Sandarac's warm balsamic fragrance works well in the evenings. It relaxes, calms and eases tension. It is helpful in cases of insomnia caused by tension or stress. Sandarac is cleansing, strengthening and clarifying.

## Diseases

Severe diarrheas, gastric pains, dizziness, headache, neck pain, insulation, fever of children, umbilical wound of the new born baby, diabetes, inflammation of eyes.
As emetic, and expectorant. To treat hair, to ease and fasten delivery in women, to fill up the tooth wholes.
Dermal diseases (veterinary medicine)

## Other uses of the plant (Ethnobotany)

Stems with leaves and cones are used as tanning products of the skins in the region of Essaouira. Root wood is very appreciated by cabinetmakers in

Essaouira and Rabat. The beautiful burled root wood is incredibly hard and polishes up like glass. It is used to make unique and beautiful handcrafted items, such as jewelry boxes, trays, tables, desktop item, pens... all said to be treasured for a lifetime. Just dip a piece of cotton cloth in vegetable oil and wipe your box or desktop organizer to shine. It is said that its unique fragrance along with its delicate texture qualified it to be used for decorating the interior trim of the finest automobiles. The wood is used locally as heating fuel. Resin or gum sandarac is used in the manufacture of spirit varnishes, and, when dissolved in oil, to make cooked varnishes. It is also used in powdered form to clean vellum and to prepare it for writing purposes. Its most outstanding property is its hardness.
The main use of sandarac is to produce varnish. Still today the best varnish is that produced by dissolving the sandarac into turpentine. Up to recently the export of sandarac was one of the most important items of Moroccan trade; it was exported from the harbor of Mogador and, for this reason, it is known in trade as Mogador sandarac.

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