

Conservation Status of *Cornus macrophylla*: An Important Medicinal Plant from Himalaya

Hafiza Saira and Muhammad Iqbal*

Department of Botany, PMAS-Arid Agriculture University, Rawalpindi, Pakistan

*Corresponding author: Muhammad Iqbal, Department of Botany, PMAS-Arid Agriculture University, Rawalpindi, Pakistan, Tel: +92-313 533 8714; E-mail: mmiqbhalli@gmail.com

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Abstract

Cornus macrophylla is important traditional and endangered plant species of western Himalaya. In Pakistan it is found in Nandiar and Hillian sub-valleys of district Battagram in range of 1800-3000 m. It is also present in China, Japan, Afghanistan, and India from 1500-2700 m. *C. macrophylla* stem bark contains flavonoid contents. According to the *International Union for Conservation of Nature* (IUCN), red list *C. macrophylla* lies in vulnerable category. However, *C. macrophylla* exists beneath criteria D of critically endangered species in Pakistan as only 47 full-grown plants were brought into being in diverse parts of district Battagram. There are various threats behind the decrease in *C. macrophylla* number in western Himalayan which may include deforestation, over-exploitation and climate changes. Conservation strategies are required to protect plants of *C. macrophylla*. The fruit of *C. macrophylla* is being used for different ailments like malaria, allergy, infections, inflammation, diabetes, cancer and as lipid peroxidative so an effort should be taken to conserve this significant plant species with promising medicinal properties.

Keywords: Medicinal plant; Pharmacology; Endangered; Conservation; Western Himalaya

Distribution of *C. macrophylla*

Genus *Cornus* belongs to the family Cornaceae, comprised of 55 species, and dispersed in the temperate region. Three species *C. macrophylla*, *Cornus capitata* and *Cornus oblonga* are found in Pakistan. It is distributed from 1500 m to 2700 m in Japan, China, Afghanistan, the Himalayas in Pakistan and India (Figure 1). It is a fairly common tree in Pakistan [1]. A number of plants are present in graveyards but very few are located in paddy fields and other water reservoirs in district Battagram [2].



Figure 1: Distribution of *Cornus macrophylla* in Western Himalaya.

Habitat and community structure

C. macrophylla is a broad leaves plant located in moist ravines, temperate and lower temperate forest at altitude of 1800 to 3000 meter. It is mostly present with other species like *Celtis tetrandra*, *Juglans regis*, and *Betula alnoides* [2,3].

Morphological description

Cornus species are widely characterized by shining pretty colourful flowers and fruits, generally grown as ornamental plants. *C. macrophylla* is a medium sized tree, 12-15 m tall (Figure 2). Leaves are 7-15 cm long, 3.4-9 cm broad, ovate, pubescent, hairs are modified, apex is acuminate and petioles are 1.5-4 cm long. Flowers are in terminal branched cymes. Pedicels and peduncles are slightly hairy. Calyx toothed, hairy, persistent. Petals are oblong and pubescent on the outer surface. Another filament is longer than petals. Styles are swollen at the top. Fruit is globular (Figure 3). Flowering period starts from April and remained till June [4,5].

Fuel wood species

Due to lack of natural gas facility, local people use this plant species used as fuel wood for cooking and heating during winter [6].

Timber yielding plant

C. macrophylla wood is used for making furniture due to its fairly hard, scented and fine grained texture.

Thatching/sheltering plant

Inner barks of young shoots of *C. macrophylla* are utilized to compose strong ropes because of presence of fibre contents in bark. It is used for cordage. Due to hard texture of *Cornus* plants wood it is

mostly used as timber on roof with other plants as thatching and sheltering to support the roof [5].



Figure 2: *Cornus macrophylla* (15 m Tall plant).



Figure 3: Fruits of *Cornus macrophylla*

Pharmacological properties

Fruit of *C. macrophylla* fruits are rich source of potential ingredient which used to make many traditional medicines for remedy of liver and kidney problems. It is also used as analgesic, tonic, diuretic and for the preservation of foods. The fruit of *C. macrophylla* is being used for different ailments like malaria, allergy, infections, inflammation, diabetes, cancer and as lipid peroxidative [7].

Antioxidant properties

Phenolic compounds are the largest group of phytochemicals and responsible for the antioxidant activity of plants or plant products [8]. Flavonoids were found in the methanolic extract of *C. macrophylla*. Flavonoids protect against oxidative stress. These chemicals scavenge peroxy radicals effectively due to their good reduction potentials relative to alkyl peroxy radicals and thus are effective inhibitors of lipid peroxidation. The presence of B-ring catechol group

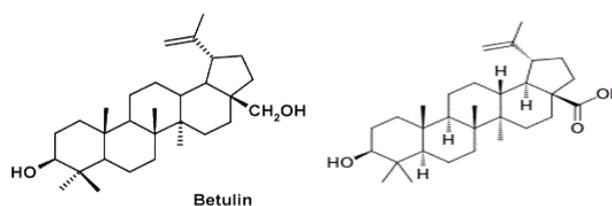
(dehydroxylated B-ring) is responsible for hydrogen donating ability of flavonoids and hence scavenging of reactive radical species [9]. Antioxidant activity of this plant is because of presence of flavonoids, tannins, and other phenolic contents.

Role in pathological conditions

It is worth mentioning that mostly whole plant extracts is used in experiments for therapeutic purpose but sometime secondary metabolites are subjected to pharmacological assays. Antimicrobial, analgesic, anti-inflammatory, anticancer activities have been reported for flavonoids, glycosides, tannins etc. [10-12]. Saponins have shown anticancer activity, antimicrobial activity, analgesic and anti-inflammatory activity [13-15]. It is observed that flavonoids, glycosides, tannins, saponins, anthraquinones are present in *Cornus macrophylla*. This shows the range of therapeutic potential of *Cornus macrophylla*.

Antimicrobial activity

It has been reported that ethanolic extract of *Cornus macrophylla* showed significant activities against *Pseudomonas aeruginosa*, *Proteus vulgaris* and *Micrococcus luteus* [16]. The stem bark of *C. macrophylla* Wall is extracted with ethanol at room temperature and the extract after removal of the solvent, is fractionated through solvent separation, biologically and phytochemically screened out for bioactive phytoconstituents, and followed by various chromatographic techniques such as column chromatography, thin and thick layer chromatography. Four constituents can be ultimately obtained and characterized through spectral studies as 3',4',5'-*O*-trimethyl-3,4-methylenedioxy ellagic acid, betulin, betulinic acid and 5'-*O*-trimethyl-3,4-methylenedioxy ellagic acid, which are reported from this plant. Later, Crude extract and its solvent extracted fractions are screened for their antibacterial activities. Computational studies of 3',4',5'-*O*-trimethyl-3,4-methylenedioxy ellagic acid is carried out to explore its anti-inflammatory profile which is further validated experimentally. Constituents obtained from *C. macrophylla* wall.



Betulin Betulinic acid.

Threats towards its extinction

The development of botanical gardens and inspiration of home gardens or kitchen garden may be an encouraging step towards sensible use of medicinal plants in the upper areas of Himalaya where land is not available for successful farming. The people of the concern area usually rely on the plants for a variety of reasons, ultimately increasing extinction of flora [17]. These include increase the demand for timber, fuel wood, torchwood, fodder and medicinal uses. Plants are facing adverse type of stresses like careless damage, illicit cutting, shrubs/trees smuggling, overgrazing, loss of habitat and deforestation, leading in environmental deterioration [18]. Various other factors such

as increase in human population and continuous unsustainable use of plants for medicinal, timber, firewood, fodder and thatching purposes has upshot in decrease of *Cornus* species [19].

Deforestation

Deforestation in the Himalayas is normally accredited to demographic demands and additional associated effects like increase in demand for farming land, livestock development, and forest use for fodder, fuel wood and timber. Similarly in contrast to these, some social issues like social associations, observation and ethics about natural resources as conceived by various social groups, problems of access to and control over resources and issues of power with respect to deforestation have not often been addressed in latest literature as major factor behind deforestation [20].

Collection process of medicinal plants in Pakistan

In Pakistan collection of medicinal plants done by local people from natural environment. These native people are uninformed about collection process and mostly play a role of middle men in trade of medicinal plants like *C. macrophylla* at national and international markets. This indirect chain of supply leads in increase of prices of the crude drugs almost 100% [21].

Environmental changes

Different environmental changes like variations in temperature and moisture contents cause decrease in viability and vigor of seeds. *C. macrophylla* seeds are short-lived and may be spoiled by temperature variation due to climatic changes [22].

Conservation strategies

The environment of Himalaya region of Pakistan is moist temperate which demands extraordinary concentration for the conservation and sensible use of natural resources. The decline in forest cover and connected key alterations in community composition has led to the reduction of native medicinal flora and relevant conventional knowledge. Widespread and exhaustive surveys are obligatory to set up an inclusive record of fodder resources of Himalaya. There is a need of wakefulness movement at both governmental and public level in order to endorse alertness among the people regarding the importance and conservation of flora. Cultivation of medicinal plants on scientific lines will be useful to reduce pressure on natural flora. Public contribution in a conservation plan and awareness through training or mass media should be guaranteed.

The program like sustainable use of medicinal plants and approach of the community on the way to markets would assist to fortify socio-economic status of these diffident areas, which would further facilitate the people to acquire fundamental services and thus improved lives. Cultivation of the medicinal plants like *C. macrophylla* should be launched as crops on secondary level. A rare species is not only important at national or local level but also for the global biodiversity. Plants in general and medicinal plants in particular area are an ultimate and valuable resource that needs proficient, sensible and sustainable management and conservation practices. Hence, instant conservation actions should be made in order to shelter the taxon from extinction [23]. These measures includes proper citations and conservation of native knowledge, proper conservation guidance to native communities, anthropogenic impacts like overgrazing and

deforestation should be minimized and endangered and threatened species should be introduced in botanical gardens.

Several other conservation studies and efforts are made to conserve it, but a more comprehensive and multiple-approach conservation policies are required to ensure its conservation. Indirect methods like calllogenesis and somatic embryogenesis can be applied for production of plantlets helping in establishment of large scale plant nurseries [24-26]. Ali et al. [27] established a protocol for synthetic seed production by using artificial coating material (sodium alginate) and complexing agent (calcium chloride). This synthetic seed technology can also be very helpful for medicinal plants such as species. These seeds can be stored and viable for comparatively longer period if provided suitable conditions. Germination of seeds can be enhanced by treating seeds with exogenous hormone like chemicals dissolved in water [28].

Long term monitoring programs and propagation studies may prove fruitful in conserving such critically endemic species. These recommendations are suggested for further research in future are biodiversity conservation awareness and information must be provided by people, anthropogenic activities should be avoided, for plant conservation protected area should be formed and afforestation plan should be introduced. Efforts must be made to ensure public participation in conservation programs and awareness through training or utilization of mass media coupled with permanent monitoring programs. Permanent monitoring programs should be developed and conservation strategies should be planned to maintain threatened species [29-32].

Conclusion

This study expressed inclusive information regarding present status, major threats, conservations status and strategies to *C. macrophylla* in Himalayan region. Scientific struggle about this plant also prop up and authenticate knowledge of this patrimony. It also has exposed scope for isolation of novel compounds for modern therapeutic significance as analgesic, anti-inflammatory, anticancer activities. There is a need to update IUCN red list and proper conservation measure should be taken to conserve endangered flora.

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