



Disporum Cantonense (Lour.) Merr.: An Overview and Study of Traditional Use

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ABSTRACT: Over the past two decades, there has been a tremendous increase in the use of indigenous herbal medicinal plants in modern medicine; however, there is still a significant lack of research data in this field. This incomprehensive information base shades the development of a comprehensive research agenda especially in the context of developing Asian countries like Nepal. This chapter gives an overview of traditional medicinal plant *Disporum Cantonense*, which is called hadjora (bone-joining) in Nepali and has been used since time unmemorable in case of bone fracture. Apart from this, *D. cantoniense* has various other medicinal uses in other regions around the globe. This chapter deals with overall aspects of *D. cantoniense* with sequential demystification thus enabling a greater understanding of its use and possibility to be used as alternative medicine in the future. © 2022 Caproslyx Media. All rights reserved.

INTRODUCTION

More than 50% of the clinical drug in the world today are nature-based of which plant is the most important source.[1] An estimated 25% of modern pharmacopoeia and 18% of 150 top prescription drugs are plant-based.[2] Be it morphine from *Papaver somniferum*, Vinca alkaloids from *Catharanthus roseus*, paclitaxel from *Taxus baccata*, reserpine from *rauwolfia serpentina*, pilocarpine from *pilocarpous microphyllus*, tiotropium from *Atropa belladonna*, capsaicin from *Capsicum annuum* and many more, where about 64% of newly-synthesized drugs have their origins in natural product structures.[3-5] The basic of drug discovery of plant origin has always been its use on indigenous knowledge system often referred to as a traditional system. The prominent safety and efficacy feature of natural compounds isolated from plant origin has played a vital role in improving human health.[6] Out of approximately 250,000 species of higher plant species (comprising angiosperms and gymnosperms), only 6% have been reportedly screened for biological activity and only about 15% have been screened for phytochemical activity.[7-8] Thus, it is the need of the present time to explore the potential

for future discoveries from traditional medicinal plants with the study of their use, chemical structure and the mechanism of action related to new drug development.

Genus *Disporum* consists of 20 species primarily distributed in the temperate zone of eastern Asia.[9] *Disporum cantoniense* (Lour.) Merr. being an important species has specific medicinal superiority with studies suggesting the presence of flavonoids, anthraquinones, fatty acids, sugar, steroids and showing anti-tussive and anti-inflammatory activity.[10] *Disporum cantoniense* (Lour.) Merr. has also been effectively used in the treatment of traumatic injury, dysmenorrhea, rheumatism, cough in Chinese folk medicine and some species also being used in the treatment of gastritis, asthma, tuberculosis and as a neuroprotective agent.[11]

DIFFERENT SPECIES OF DISPORUM

1. *Disporum acuminatissimum* W.L.Sha [12]

This species is native to China (Guangxi). It has a short rhizome short, distally branched stem, blade elliptic to ovate-oblong leaf. Inflorescences terminal, umbellate, 3- or 4-

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flowered with white tepals, lanceolate or narrowly rhomboidal-lanceolate. Flowering time is Apr-May.

2. *Disporum acuminatum* C.H.Wright [13]

This species of *Disporum* is found in Myanmar. It is available as a large glabrous herb with oblong leaves, long acuminate 1 cm long Petioles and subglobose ovary. Raceme terminal inflorescence, 2 cm long pedicels. Perianth-segments lanceolate, acuminate, 2.4 cm long, 2 mm broad at the base.

3. *Disporum bodinieri* (H.Lév. & Vaniot) F.T.Wang & Tang [14]

This species is distributed throughout China, North India, Nepal and Bhutan. This plant has a creeping rhizome and is found in forests, thickets, rocky places at a height of 1200–3000 m. Stem usually branched distally. Petiole 5-10 mm; leaf blade elliptic to ovate-lanceolate. Inflorescences terminal, umbellate, 2-6 flowered; pedicels 1.5–2.5 cm, usually papillose. Flowers funnellform to broadly obconical. Flowering time is May-June.

4. *Disporum calcaratum* D.Don - Yunnan [15]

This species is native to China, Indo-china and India. It is found in the forest at a height of 1200–2400 m and has a slightly flexuous creeping rhizome. Stem is usually branched distally with 3-5 mm Petiole; leaf blade elliptic to ovate-lanceolate. Flowers are campanulate. Tepals are often purple, sometimes pink to dark red, oblanceolate. Stamens 1.1–1.8 cm, nearly included; filaments 0.7–1.3 cm; anthers 4–5 mm. Ovary 2.5–3 mm. Style 5–9 mm. Flowers white, green or purple. Berries subglobose. Flowering season June–July

5. *Disporum cantoniense* (Lour.) Merr. Var [16-18]

This is one of the important species native to Southern China and northwestern temperate Himalayas of Nepal and India. It is a glabrous, erect herb (70-90 cm tall) with creeping rootstocks, simple, alternate, sessile, long – pointed leaves with white, tinged with green, perianth bell-shaped flower. It has been discussed below in detail.

6. *Disporum hainanense* Merr. [19]

Mainly found in South East Asia. It is found in forests mainly in a gorge at an altitude of 500 to 1000m having simple or distally branched 15–100 cm stem. Petiole 7–10 mm; leaf blade elliptic to broadly lanceolate, base obtuse to cuneate, apex acuminate. Inflorescences terminal, umbellate, 3–5-flowered; pedicels 0.5– 2.2 cm. Flowers semi opening, fragrant. Tepals white rose, or yellow, obovate-oblanceolate, 5–9 × 2–4 mm, base saccate, apex rounded. Stamens 6–9. Berries black, subglobose, 6–9 mm in diam. Flowering season is Dec-May.

7. *Disporum jinfoshanense* X.Z.Li, D.M.Zhang & D.Y.Hong [20]

Native region of this variant is China and Taiwan. It is a perennial herb with a short rhizome. Stems are ascending, simple, rarely branched, ovate to elliptic leaves. Inflorescence

terminal, non-pedunculate flowers spreading, tepals white, slightly saccate at the base, petioles 2-4mm long and tepals densely pubescent on the inner surface. Flowering season April to May.

8. *Disporum kawakamii* Hayata [21]

This species is found in Taiwan. Its rhizomatous herb with distally branched 50–120 cm stem. Petiole 3–4 mm; leaf blade lanceolate to ovate, 10–17 × 1–5 cm, base broadly cuneate to rounded, margin slightly scabrous, apex acuminate. Inflorescences terminal and pseudolateral, 2–5-flowered; peduncle occasionally distinct; pedicels 2–4 cm, sub smooth. Flowers tubular-campanulate. Tepals cream or greenish tinged with purple near both ends, oblanceolate. Stamens 1–2 cm, included; filaments 0.8–1.2 cm; anthers 3–4 mm. Ovary ca. 3 mm. Style 0.8–1.4 cm. Flowering season Mar-May

9. *Disporum leucanthum* H.Hara [22]

Found mainly in the Himalayan range of south East Asia. Herb is rhizomatous with Branched stem. Inflorescence-terminal, white, broadly campanulate, 2 cm wide. Tepals 1.2 to 2 cm long. Anther is purple when young. Style length 6 to 12 cm

10. *Disporum longistylum* (H.Lév. & Vaniot) H.Hara [23-24]

This variety is also known as Chinese fairy bells and found in Southwest China and India. Herb is erect, slender having height up to 1 m. Rhizomes decumbent, slender, without creeping stolon. Stems usually branched in the upper part, ribbed, glabrous and green. Petioles 3–5 mm long. Leaf-blades elliptic-lanceolate, sometimes ovate, 8–12 × 2.5–3.5 cm, base obtuse, sub-oblique, apex long acuminate (usually caudate), dark green above, pale below with usually 3–5 distinct nerves from the base and 3–4 slender nerves in between the main nerves. Petioles 3–5 mm long. Inflorescences terminal, umbellate; pedicels 12–15 mm long, angular, ribbed, rugose along the ridges. Berries 3–5, black, sub-globose, 6–9 mm diameter.

11. *Disporum lutescens* Koidz [25]

This species is rare and is usually found in native regions in Japan. It grows in organically rich, moist shaded soil. It gives a bell-shaped yellow 5-8" long flower which blooms in May-June. Leaves are ovate to lanceolate green.

12. *Disporum megalanthum* F.T.Wang & Tang [22, 26]

This species is found in China. It is Rhizomatous with a branched stem and grows on moist soil. Inflorescence-axillary, white, narrowly campanulate, 3 cm wide. Tepals 2.5 to 3.8 cm long. Anther is yellow when young. Style length 12 to 18 cm. Flowering season is May–July.

13. *Disporum nantouense* S.S.Ying [27]

This variant is mainly available in Taiwan. Herbs are stoloniferous. Stem simple or 1–5-branched distally, 15–60 cm. Petiole 0.3–2.5 mm; leaf blade lanceolate to ovate, 5.5–8.5 × 0.9–3.0 cm, 3 longitudinal veins prominent, base

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rounded, apex attenuate-acuminate. Inflorescences terminal, 1–3-flowered; pedicels 0.9–2.1 cm. Flowers tubular-campanulate. Tepals white to cream spotted with violet distally, yellowish-green apically, base gibbous-spurred, apex acute; spurs 1.2–1.5 mm. Stamens 1.0–1.7 cm, included; filaments minutely papillose proximally; anthers innate, 2.0–3.5 mm. Ovary 2.0–3.5 mm. Style 1.0–1.6 cm. Berries globose, 7.8–9.2 mm in diam. Seeds brown. Flowering season Apr–May.

14. *Disporum sessile* (Thunb.) D. Don [28]

This species is widely distributed in Japan, Korea and is also known as Japanese fairy bells. It is a perennial herb of temperate forest. It prefers moist soil.

15. *Disporum shimadae* Hayata [29]

This species is widely distributed in Taiwan. It has a short rhizome and simple or distally branched stem of 15–50 cm. Petiole absent to 2 mm; leaf blade linear-lanceolate to oblong-lanceolate, base cuneate to rounded, apex acute. Inflorescences terminal, (1 or) 2–5-flowered; pedicels 0.7–1.8 cm. Flowers open campanulate. Tepals yellow, rarely green apically, ovate-oblong to ovate-spatulate. Stamens 1.2–1.7 cm, included; filaments 0.9–1.4 cm, glabrous or sparsely papillose; anthers 2–3 mm. Ovary 2.5–3 mm. Style 1.1–1.7 cm. Flowering season is Mar–Apr.

16. *Disporum smilacinum* A. Gray [30]

This variant is native to Japan, Korea, Sakhalin Island of Russia and Shangdong province of China. The herb grows 4–8" tall and 8–12" wide in a moist shaded land or acidic or neutral pH.

17. *Disporum tonkinense* Koyama

This variety of *Disporum* is native to Vietnam and Japan.

18. *Disporum trabeculatum* Gagnep [31]

This species is native to China and Vietnam. It has a hard rhizome with a simple or distally branched stem. Petiole 3–10 mm; leaf blade ovate-lanceolate to elliptic, apex acute to acuminate. Inflorescences terminal, umbellate, 2–5-flowered; pedicels 1–3 cm. Tepals whitish, yellowish, or purplish. Stamens are slightly shorter than or equaling tepals; filaments 5–9 mm, minutely papillose proximally; anthers 3–5 mm. Ovary 2–2.5 mm. Style 5–14 mm. Flowering season Mar–Jun. Forests; 900–2000 m.

19. *Disporum uniflorum* Baker ex S. Moore [32]

This variety is available in China and Korea. It is usually found in a temperate forest of altitude 100–2500 m. The rhizome is shortly creeping, 4–7 mm thick, with stolon 1–5 cm × 3–6 mm. Stem simple or branched distally, 20–80 cm. Petiole 5–10 mm; leaf blade broadly elliptic to oblong-ovate, apex shortly acuminate to acute; inflorescences terminal, 1–3-flowered; pedicels 3–5 mm. Flowers cylindrical-campanulate. Tepals yellow, spatulate-oblong to obovate, anthers 4–8

mm. Ovary 4–5 mm. Style 1.5–2.3 cm. Berries blue-black, subglobose, 8–10 mm in diam. Flowering season is Mar–Jun.

20. *Disporum viridescens* (Maxim.) Nakai [33–34]

This species is distributed in China, Japan, Korea and Russia. It is a rhizomatous plant 30 to 80 cm tall with a branched stem. Leaves are ovate with a very short petiole. Flowers opening. Tepals greenish-white, 1.5 to 2 cm long. Flowering time is May to June. Berries 1 cm in diameter.

***DISPORUM CANTONIENSE* (LOUR.) MERR. VAR [35–36]**

Scientific classification

Kingdom: Plantae
Sub-kingdom: Tracheophyte
Phylum: Angiosperm
Class: Monocots
Order: Liliales
Family: Liliaceae/Colchicaceae
Genus: *Disporum*
Species: *D. cantoniense*

Vernacular Names

Nepali: Hadjora, Bhui hadjora, Kukur daino [37–39]; English: Night Heron; Common name: Chinese Fairy Bells.

Description

A rhizomatous perennial herb (70–90 cm tall) having bamboo-like stems. [16] Leaves simple, alternate, sessile, long-pointed, loosely sheathing towards base; upper leaves lanceolate, ovate, oblong to oblanceolate, 6–22 × 1–6 cm, acuminate, cuneate at base. [16,18,40] Inflorescences terminal cymose, 5–6 flowered, pendulous. Fruits subglobose berries, 0.5–0.8 cm in diameter [18] Flowers strong-scented, pale green, white or yellowish or dull purple, campanulate. Tepals lanceolate to oblanceolate, 1–2.5 cm long, acuminate at apex [16,40] Maximum root length (10+–1.41 cm), root longevity (67+–1.26 days), below-ground biomass (0.60+–0.11 g plant⁻¹), root porosity (8.10+–2.36 %) [41] The species is hermaphrodite (has both male and female organs). The chromosome numbers and karyotype *D. cantoniense* (2n= 14 and 16)

Flowering and Fruiting: April – October [18,42]

Distribution

Disporum cantoniense (Lour.) Merr. var is widely distributed in Asian Himalayas to Indonesia, via south China, Indo-China and Taiwan. The plant can be found in countries on this range: Bhutan, India, Laos, Myanmar, Nepal, Sikkim, Thailand, Vietnam, Cambodia, the Malay peninsula and Sumatra. [43] In China, it is especially present in various parts of Yunnan Province. [44] Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan [45] In Nepal, *Disporum cantoniense* (Lour.) Merr. var is distributed evenly in the Central and Eastern hilly regions. [39]

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Silvicultural characteristics

Disporum cantoniense (Lour.) Merr. var is a fast-growing herbaceous plant and occurs in primary forests. It grows in humusy, consistently moist but well-drained soils in part shade to full shade locations. This species can also tolerate heavy shade. The soil of wild *D. cantoniense* (Lour.) Merr. var has strong adaptability, it is of higher demand of organic matter. [46]

Phenological characteristics

D. cantoniense (Lour.) Merr. var prefers moist soil, cool shady places at elevations of 1100 - 2900 meters in Nepal with a mean annual temperature of 20-40°C and pH: 4.5 to 6.5.[22] It is best grown in partial shade in moist peaty or woodland soil and spread rapidly through creeping rhizomes when they are grown in leafy soil.[28,43]

Cultivation

Disporum cantoniense (Lour.) Merr. var can be propagated through seeds in nursery beds and then transplanted into open fields. It can be cultivated in both temperate and tropical regions.[43] The growing soil required for *D. cantoniense* is pH was 4.50-6.71, organic matter content 0.05-5.85 g/kg, total nitrogen content 5.96-77.49 g/kg, available nitrogen content 44.65-774.68 mg/kg, available potassium content 44.45-611.80 mg/kg, available phosphorus content 5.84-17.70 mg/kg, available Fe 32.17-157.89 mg/kg, available Mn 2.34-260.46 mg/kg, available Cu 0.42-5.31 mg/kg, available Zn 1.23-17.37 mg/kg, available Ca 235.05-14182.84 mg/kg and available Mg 64.36-803.39 mg/kg. It is suggested to plant wild *D. cantoniense* by applying optimum organic fertilizer and micro-element fertilizer as base fertilizer according to the actual soil status. [46]

Regeneration

Propagation of this plant occurs through seeds.[47] Plants spread rapidly using creeping rhizomes when they are grown in leafy soil.[48]

Plant material of interest

An ethnobotanical study suggests the use of roots of *D. cantoniense* (Lour.) Merr. var as traditional medicine.[39,49] Along with roots, leaves and stems also have been studied for the presence of different constituents with medicinal value.[50-51] Leaves of this plant are also used for a vegetable purpose.[37]

TRADITIONAL USE AND PHARMACOLOGICAL ACTIVITY

People in rural areas have been using *D. cantoniense* (Lour.) Merr. var (bhui harjora) for bone fracture and dislocation of bone by making a paste of its extract and poultice together with a splint and applying over the infected area traditionally for many years. There have not been many studies and research on *D. cantoniense* (Lour.) Merr. var with a very significant property of anti-oxidant and analgesic property.

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This property is very important in the case of bone healing and it shows such characteristics very effectively and safely. [52]

Disporum Cantoniense

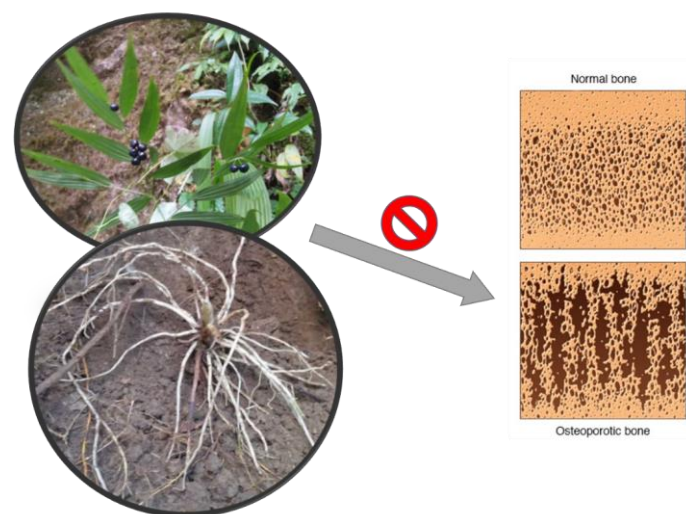


Figure 1. Antiosteoporotic activity of *Disporum cantoniense*.

The phytochemical analysis of *D. cantoniense* (Lour.) Merr. var root extracts showed the presence of carbohydrates, flavonoids, alkaloids, glycoside, tannins and polyphenols.[11] A study conducted to study the bone-healing activity of *D. cantoniense* (Lour.) Merr. var with its Ethanol extract 95% of the whole plant showed anti-osteoporotic activity in a rat model (**Figure 1**). *D. cantoniense* (Lour.) Merr. var was not just found to heal the fracture but also aided to relieve the pain showing analgesic effect.[53] The study also showed that the root extract had a high content of natural calcium, flavonoids, phosphorus, Vitamin C, and beta-carotene, which were found to have a specific effect on bone fracture healing. The anabolic steroidal principle from *D. cantoniense* (Lour.) Merr. var shows a marked influence on the rate of fracture healing by influencing early regeneration of all connective tissues involved in the healing and quicker mineralization of callus.

In a flavonoid survey of 10 *Disporum* species using hydrolyzed leaf extracts, the flavonols, quercetin and kaempferol were found to be the main constituents of five North American species while in the five Asian taxa the flavone luteolin was the main component with some apigenin and chrysoeriol.[54] The study also concluded the presence of a high amount of flavonoids viz. Luteolin, apigenin and chrysoeriol 7- glucosides, luteolin and chrysoeriol 4'-glucosides, luteolin 7-rutinoside, luteolin 7-diglucoside, luteolin and apigenin 7,4'-diglucosides in *Disporum cantoniense* (Lour.) Merr. var when correlated between leaf flavonoids, taxonomy and plant geography in the genus *Disporum*.

The recent trend has been to blend traditional knowledge with modern health care practices to provide effective health care services to a wider population. *Disporum cantoniense* (Lour.)

Merr. var the root is also used for sprains in Panchthar district, Nepal. [49] *Disporum cantoniense* (Lour.) Merr. var has also been used in the stomach-related problem. [55] Medicinal plants and their uses in indigenous medicine are well known to many Nepalese communities.

Apart from bone healing activity, *D. cantoniense* (Lour.) Merr. var also possesses anti-inflammatory, antitussive activities and antipyretic activity.[56-57] A juice made from the root is used in the treatment of fever.[57] The plant root extract has also been used in the treatment of rheumatism, algomenorrhea, traumatic injury, fever and cough.[11]

The antitussive activity assay for the root extraction of *Disporum cantoniense* (Lour.) Merr. var was carried out with coughing mice induced by ammonia liquor. The results showed that the ethanol and water extractions of *D. cantoniense* (Lour.) Merr. var possess strong antitussive activity, and the high dose of the former was better than the positive control, and then the constituents of the ethanol extraction were separated and purified by various modern chromatographic techniques. Their structures were identified by Physico-chemical properties and spectroscopic data. As a result, eight compounds were isolated and identified as stigmast-4-en-3-one(1), (22E, 24R)-ergosta-5, 7, 22-trien-3 β -ol(2), obtucarbamate A(3), obtucarbamate B(4), neotigogenin(5), azo-2, 2'-bis[Z-(2,3-dihydroxy-4-methyl-5-methoxy) phenyl ethylene] (6), dimethyl [[carbonylbis (azanediy)] bis(2-methyl-5, 1-phenylene)] dicarbamate (7) , and quercetin-3-O-pB-D-glucopyranoside(8).[58]

Disporum cantoniense (Lour.) Merr. var is also used to cure hyperactivity cough, injury, rheumatic pain, numbness and children with a high fever. Apart from this, the Leaf of the plant is used as a vegetable and the plant as a whole is used as feeders for farm animals. [59]

CONCLUSION

Study of ethno botanical plant *Disporum cantoniense* (Lour.) Merr. var enables a greater understanding of its use and possibility to be used as alternative medicine in future. Preservation and conservation of these medicinal plants should be encouraged so that it can be sustainably utilized to produce a concomitant therapeutic agent and also help in the improvement of national economy.

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AUTHOR'S CONTRIBUTION

SR and KB designed and collected the subject materials. HB and RKS wrote, edited and finalized the paper.

ETHICS STATEMENT

The authors have taken all the necessary permissions as per ethical guidelines wherever applicable. The authors will be responsible for all the technical content mentioned in the manuscript. Journal and Publisher will not be responsible for any copyright infringement and plagiarism issue.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

Not declared.

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