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Review on traditional medicinal plant: *Trillium govanianum* (Nag Chhatri)

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Abstract
Trillium govanianum belongs to the genus *Trillium* (family: Melanthiaceae *alt.* Trilliaceae) commonly known as 'nag chhatri' or 'teen patra', is a native species of the Himalayas. In folk medicine, the rhizomes of *T. govanianum* are used to treat boils, dysentery, and inflammation, menstrual and sexual disorders, as an antiseptic and in wound healing. The plant has analgesic, anti-inflammatory, anticancer and antifungal properties. The detailed pharmacological investigations are required for this plant so that the medicinal activities of this plant could further be exploited.

Keywords: *Trillium govanianum*, Analgesic, Anti-inflammatory, Anticancer, Antifungal

Introduction
The medicinal plants are mainly used in the traditional system of medicine. More than 80% of the population in developing countries is dependent upon traditional system of medicine [1]. The genus *Trillium* consists of 31 species, widely distributed from the western Himalayas to Japan, China, Kamchatka (Russia) and North America [2] and is an important source of bioactive compounds of different classes like steroids, glycosides, terpenoids, sterols, saponins, sapogenins and flavonoids [3-5]. *Trillium govanianum* belongs to the genus *Trillium* (family: Melanthiaceae *alt.* Trilliaceae) commonly known as 'nag chhatri' or 'teen patra', is a native species of the Himalayas. *Trillium govanianum* a lesser known medicinal plant in trade during past decades has gained popularity in commercial utilization these days. This species is distributed between 2,500 to 4,000 m across the Himalayan region [6]. It is one of the most sought after medicinal species of the western Himalayan region [7]. The plant is a small herb preferring shady areas with stocky 15 g-25 cm purple-red stem carrying plain broadly ovate green leaves, powerfully deflexed, deep oxblood red and green flower at the apex. The underground part of the plant, i.e. rhizome is key material of trade containing trillarin which on hydrolysis yield diosgenin and used in preparation of steroidal and sex hormones [8]. *T. govanianum* is used in various traditional medicines containing both steroids and sex hormones. In folk medicine, the rhizomes of *T. govanianum* are used to treat boils, dysentery, and inflammation, menstrual and sexual disorders, as an antiseptic and in wound healing [9-11].

Classification

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Liliopsida
Subclass	Liliidae
Order	Liliales
Family	Liliaceae
Genus	*Trillium* L.
Species	*T. govanianum*

Physicochemical parameters
Total ash value in the rhizome of *T. govanianum* is 12.5%, water soluble ash 4.0%, acid soluble ash 2.4% and acid insoluble ash 0.8% w/w.

Extractive values are high for solvents like water (21.5%) and methanol (18.75%) as compare to non-polar solvents, which is an indicative of abundance of sugars, and other polar compounds like glycosides, saponins, flavonoids and steroids [12].

Fig: *Trillium govanianum*

Phytochemical analysis

The preliminary (qualitative) phytochemical tests on *T. govanianum* rhizome revealed the presence of secondary metabolites in methanolic extract and its fractions, such as glycosides, steroidal saponins, tannins, sterols and flavonoids [13].

Therapeutic uses

Analgesic and Anti-inflammatory activity

The crude methanol extract and its solvent fractions showed anti-inflammatory and analgesic responses, exhibited by significant amelioration of paw edema and relieve of the tonic visceral chemical and acute phasic thermal nociception. In the oxidative burst assay, based on IC50, the crude methanol extract and n-butanol soluble fraction produced a significant inhibition, followed by chloroform and hexane soluble fractions as compared to ibuprofen. Similarly, the isolated compounds pennogenin and borassoside E exhibited significant level of oxidative burst suppressive activity. The observed activities might be attributed to the presence of steroids and steroid-based compounds. Therefore, the rhizomes of this plant species could serve as potential novel source of compounds effective for alleviating pain and inflammation [14].

Anticancer activity

The methanolic extract of the roots of *T. govanianum* and its solid-phase extraction (SPE) fractions are cytotoxic against four human carcinoma cell lines: breast (MCF7), liver (HEPG2), lung (A549) and urinary bladder (EJ138), with the IC_{50} values ranging between 5 and 16 µg/mL [9].

Antifungal activity

A new spirostane steroidal saponin, govanoside A along with three known compounds borassoside E, pennogenin and diosgenin were isolated from rhizomes of *Trillium govanianum*. Govanoside A and borassoside E compounds exhibited good to moderate activities against Aspergillus niger ATCC 16888, Aspergillus flavus ATCC 9643, Candida albicans ATCC 18804, and Candida glabrata ATCC 90030 [15].

Antioxidant activity

The rhizomes of *T. govanianum* exhibited the antioxidant activity. However, the antioxidant activity of the extract as well as its fractions was lower than BHT and ascorbic acid. This low scavenging capacity of the extract or its fractions might be attributed to the presence of large sized fatty constituents [13].

Conclusion

Trillium govanianum is one of the most sought after plant in western himalayan region but we found that the pharmacological investigations are not complete of this plant. The plant has analgesic, anti-inflammatory, anticancer and antifungal properties. To our surprise we don't found any literature regarding antibacterial, antiviral, anthelmintic, hepatoprotective activities of this plant. So pharmacological investigations regarding various activities of this plant can be done so that the medicinal activities of this plant could be exploited.

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