

## Comprehensive review of *Sumbulut Teeb* (*Nardostachys jatamansi* DC.) and its organoleptic evaluation of three samples available in the market

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### Abstract

*Sumbulut Teeb* (*Nardostachys jatamansi* DC) belonging to the family Valerianaceae is commonly known as *Balchar*, *Iatamashi* or Indian spikenard, is an erect perennial herb. The main parts used are rhizome and rhizome oil. Because of high commerce, the rhizome of *Nardostachys jatamansi* is often subjected to adulteration with other drugs but it is essential to use genuine drugs for better therapeutic effects. Therefore, the present study is proposed to verify the *Sumbulut Teeb* available in the market to detect adulteration and to get the genuine drug. A systematic literature review has been carried out to gather authentic information on *Sumbulut Teeb* from Unani and Ayurveda classical text, Unani and Ayurveda Pharmacopeias, ethnobotanical literature, scientific journals and from the web through the macroscopic description. The rhizome samples available in the name of *Jatamansi* were collected from the market. The samples were subjected to organoleptic evaluation. The obtained results were verified by comparing the data available in the Unani Pharmacopoeia of India. The study revealed that *Sumbulut Teeb* possesses Antispasmodic, Diuretic, Carminative, Stomachic, Sedative, Antihistaminic, Anti-arthritic, Analgesic Anti-fungal and Anti-bacterial pharmacological activities. Further, it is a mouth freshener, tonic and stimulant. The organoleptic evaluation revealed that the market samples available under the name of *Jatamansi* is not actual *Sumbulut Teeb*. The sample available as *Jata makutu* is the genuine *Sumbulut Teeb*. However, further physiochemical, phytochemical and chromatographic investigations are needed to authenticate the genuine *Sumbulut Teeb* to prevent adulteration and to obtain and

maintain the high quality of this plant products.

**Keywords:** *Jatamansi*, *Jatamakutu*, *Sumbulut Teeb*, Organoleptic evaluation, Rhizome, Unani medicine

### Introduction

*Sumbulut Teeb* (*Nardostachys jatamansi* DC) belonging to the family Valerianaceae is commonly known as *Balchar*, *Iatamashi* or Indian spikenard which is an erect perennial herb that grows up to 10 – 60cm in height, stout, woody rootstock that is propagated by cuttings of the underground parts<sup>1,2</sup>. It is found in Nepal, China, and India. The main parts used are rhizome and rhizome oil. In Unani medicine this rhizome is considered as good *Mohallil* (Anti-inflammatory), *Musakkin* (Sedative), *Mufatteh* (De-obstruent), *Mufarreh vo Muqavvi e Qalb* (exhilarant and strengthening of heart), *Daf e Tasannuj* (Anti spasmodic), *Muqavvi e Dimagh vo Meda* (strengthening of brain and stomach), *Mutayyib e Dehan* (mouth perfumer), *Mudir* (diuretic) and this is useful to treat various nervous disorders such as convulsive ailments, epilepsy and hysteria, also effective in palpitation of the heart, consumption, disease of the eye, itch, boils, swellings, disease of the head, hiccough etc.<sup>3,4,5</sup>. In the Indian traditional system of medicine (Ayurveda) it is well established for its use in mental disorders, insomnia, hyperlipidemia, hypertension and heart disease. It has a protective effect on epilepsy, parkinsonism, cerebral ischemia and liver damage<sup>5</sup>.

Substituting the original crude drug either partially or fully with an intention to gain profit is known as adulteration. This can be done in various methods such as substituting with other substances which are

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lesser or free from therapeutic and chemical properties of an original drug or adding low grade or damage or false drugs which is entirely different from the original drug.<sup>6,7</sup>

This can also be explained in detail as substituting the original crude drug with other substances which do not agree with the certified official standards of the original drug. This can be lesser in quality, damaged, false, defective or even useless harmful parts of the same plant or a different plant can be substituted. In the case of *Sumbulut Teeb*, it is often adulterated with drugs that are similar in morphology, confused in synonyms, due to its unavailability etc.<sup>6,7</sup>.

Because of high commerce, the rhizome of *Nardostachys jatamansi* is often subjected to adulteration with other drugs but it is essential to use genuine drugs for better therapeutic effects. Therefore, the present study proposed to do an organoleptic evaluation to verify the *Sumbulut Teeb* available in the market along with a comprehensive review of the drug.

### Methodology

A systematic literature review was carried out to gather authentic information on *Sumbulut Teeb* from Unani and Ayurveda classical text, ethnobotanical literatures and scientific journals and from authentic websites.

The rhizome samples available in the name of *Jatamansi* were collected from the market. The samples were subjected to organoleptic evaluation. The obtained results were verified by comparing the data available in the Unani Pharmacopoeia of India, published by The Government of India, Ministry of Health and Family Welfare, Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy, New Delhi, India.

### Results

Plant taxonomy is mentioned in Table 01.

**Table 01: Plant taxonomy**

Botanical name	<i>Nardostachys Jatamansi</i>
Family name	Valerianaceae
Kingdom	Plantae
Phylum	Tracheophyta
Division	Magnoliophyta
Class	Magnoliopsida
Order	Dipsacales
Family	Valerianaceae
Genus	Nardostachys
Species	<i>N. Jatamansi</i>

### Vernacular names<sup>8</sup>

Arabic: *Sumbulut teeb*, English: Muskroot, Indian spikenard, Hindi; *Balchar, Jatamansi*, Sanskrit *Mansi, Jatila, Jatamansi*, Sinhala: *Jatamanshi*, Tamil: *Jatamanji, Jatamanshi*, Urdu: *Sumbulutteeb, Balchar*, Persian: *Sumbul-uttib*, Assamese - *Jatamansi, Jatamanshi*; Bengali: *Jatamansi*, Gujarati: *Baalchad, kalichad, Jatamasi, Kalichhad, Jatamasi*, Kannada: *Jatamamshi, Jatamansi*, Kashmiri: *Bhut-jaat, Bhutijatt, Kukilipot*, Malayalam: *Jatamanchi, Jetamanshi, Jatamamshi*, Oriya: *Jatamansi*, Punjabi: *Billilotan, Balchhar, Chharguddi*, Bhutajata: *Japaswini*

### Habitat

Found in various countries especially India, high altitudes of the Himalaya, Nepal, Bhutan and Sikkim whereas it ranges between 3000 to 5000 m.<sup>9,10,11</sup>

### Cultivation propagation and collection

Propagation of this plant is by the vegetative method. Seed germination can be improved with optimum conditions of light, dark, temperature, humidity, hormonal treatment, the composition of soil, depth of seed sowing in soil and sowing months with 15° Celsius temperature with continuous light. Seed sowing depth is 0.5cm in soil. Hormonal treatment with GA<sub>3</sub>, IAA-100PPM, and IBA-100PPM will enhance seed germination percentage. Maximum germination was found in October and February. Loss of seed viability and seed germination was higher in the summer months as

well. Storage of seed depends on temperature, the container used and duration. Under different conditions of soil and sand germination can be achieved. Therefore, it can be easily practiced for commercial cultivation.<sup>12</sup>

### **Plant description**

#### **Macroscopic**

*Jatamansi* is a perennial, erect, dwarf, hairy, rhizomatous herb. The root of this herb is woody, long and fibrous from the petioles. The rhizome is dark brown in color which is 2.5-7.5cm in length cylindrical shape with reddish-brown fibres around. 10-60cm in height (stem) which is more or less pubescent upwards and often glabrate below. 15-20 radical leaves 2.5cm in length and longitudinally nerved, glabrous or slightly pubescent. Long, sessile and oblong cauline in 1 or 2 pairs within 2.5-7.5cm<sup>13,14</sup>. Flowers are usually 1, 3 or 5 and bracts is 6mm, oblong in shape and pubescent. Corolla tube is 6mm somewhat hairy within and filaments below<sup>1</sup>. Fruits are ovate in shape and 4mm long, covered with white hairs which are often having dentate calyx teeth<sup>1</sup>. Fruit contains obovate and compressed one seed<sup>9,15</sup>

#### **Microscopic**<sup>11,16</sup>

The transverse section of the rhizome in microscopic observation shows a thin periderm and a large parenchymatous cortex. This is rich in starch and volatile oil in the endodermis containing globules. A large pith scattered with groups of sclerenchymatous cells is found within a ring of collateral vascular bundles.

#### **Parts used**

Dried rhizome<sup>9,10</sup>, Oil from rhizome<sup>10,17</sup>, Root<sup>9,10,15,17</sup>

#### **Chemical constituents**<sup>18</sup>

Essential oils: Coumarins and Sesquiterpenes

Major sesquiterpenes: Jatamansone, Valerone, Jatamansol, Jatamansic acid, Dihydrojatamansine and Nardosatchone

Minor constituents: Jatamol A, Jatamol B, Nardosinone, Spirojatamol, Oroseolol, Oroselone Jatamansinone, Valeranal, Sesalinnardostachyins and Seychelane, Xynthogalin, Alkaloids, Actinidines.

### **Unani perspective**

Temperament (*Mizaj*)<sup>3,4,5</sup>

Hot 1<sup>0</sup> & Dry 2<sup>0</sup> (*Garamvo Khusk*)

Adverse Effects (*Muzir*)<sup>3,4,5</sup>

Not good for kidneys

Corrective (*Musleh*)<sup>3,4,5</sup>

*Roghan e Gul* (rose oil), *Kateera*, *Isapgol*

Substitute (*Badal*)<sup>3,4,5</sup>

*Sad kufi*, *Izharmakki*

Therapeutic Dose (*Miqdar-e-Khurak*)<sup>3,4,5</sup> - 3-5g

National Formulary of Unani Medicine (*Murakkabat*)<sup>[12]</sup>

*Jawarish e Fanjnosh*, *Barshasha*, *Anoshdaru*, *Anoshdarululvi*, *Kohal e Roshani*, *Safoof e Mohazzil*, *Iyarij e Faiqra*, *Roghan e Babuna*, *Zimad e Sumbulutteeb*

#### **Pharmacological actions of Sumbul ut Teeb**<sup>9,10,15,17</sup>

Tonic (*Muqawwiyat*), Stimulant (*Muharrrik*), Antispasmodic (*Daf e Tasannuj*), Diuretic (*Mudir e boul*), Carminative (*Kasurriyah*), Stomachic (*Muqawwi e Meda*), Sedative (*Musakkin*), Mouth perfumer (*Mutayyib e Dahan*), Antihistaminic, Anti-arthritis, Analgesic, Strengthen heart (*Muqawwi e qalb*), Strengthen nerves (*Muqawwi e Asab*), Anti-fungal and Anti-bacterial

#### **Therapeutic uses of Sumbul ut Teeb**<sup>9,17,18</sup>

Growth and blackness of hair are promoted, the luster of the eyes are increased, effective in cough and chest pain, restores inflammation in the intestine and increases the appetite.

Fresh root infusions are used to treat epilepsy, hysteria, and convulsions<sup>19,20</sup> and act well in palpitation of the heart<sup>19</sup>. Roots are aromatic and bitter and they possess stimulant and anti-spasmodic property which is useful in intestinal colic and inhaled in bronchial affections. They are also used to improve the complexion, hiccough, dysmenorrhea and insomnia, produce hypotension, increase learning process, effective in treating eye diseases, itching, boils and swellings and in diseases of head. Tincture of it is used in intestinal colic and flatulence.<sup>19</sup> Alcoholic extract enhances the learning process. During bronchial asthma (difficulty in breathing) composition of a compound powder is burnt and inhaled. Rhizome mixed with water is

applied to the eyes in stupor and coma stage of snake bite. It is also given internally in powder form or decoction in combination with other drugs. *Jatamansi* oil is a good flavoring agent therefore it is used in medicinal oil preparations and acts well as an antiarrhythmic drug.<sup>21</sup> *Nardostachys jatamansi* is used as a hepatoprotective drug, cardio-tonic, diuretic, analgesic, helps to relieve the phlegm in cough and asthma, proves useful in hepatitis and treats enlargement of the liver.

#### **Phytochemical studies of Sumbulut Teeb**

Repeated chromatography with a silica gel and recrystallization with solvents showed the presence of nardal, jatamansic acid, and nardin during the bioassay-guided purification of the hexane fractions of the rhizomes of *Nardostachys jatamansi*. The structure of the compounds was explained on the basis of UV (Ultraviolet), IR (Infra-red rays), <sup>1</sup>H (Hydrogen) and <sup>13</sup>C (Carbon) and Mass spectral data and comparison with an authentic sample.

Volatile and non-volatile constituents have been discovered in *Nardostachys jatamansi* which has the major portion of sesquiterpenes as volatile components and coumarins, alkaloids, sesquiterpenes, lignans and neolignans as major components of nonvolatile compounds. The essential oil in the root is mainly composed of sesquiterpenes and coumarins.<sup>11</sup>

#### **Pharmacological studies**

##### **Hair growth promotion activity**<sup>22,23</sup>

Rhizomes of *Nardostachys jatamansi* which contains hexane extract has a response in hair growth promotion activity.

##### **Anti-depressant like effect**<sup>24,25,26</sup>

The anti-depressant activity of the methanolic extract of *Nardostachys jatamansi* DC is useful in patients suffering from depression due to sleep disturbances.

##### **Hypolipidemic effect**<sup>27,28,29</sup>

Levels of low-density lipoproteins (LDL) and very-low-density lipoproteins (VLDL) can be reduced and cardio-protective high-density lipoproteins (HDL) cholesterol levels can be increased with the administration of *Nardostachys jatamansi*. This acts by its inhibitory effect on lipid peroxidation chain

reaction and also helps to reduce triglyceride levels. A study also reported that *Nardostachys jatamansi* is useful in increasing HDL-cholesterol/cholesterol ratio during the intake of ethanolic extract.

##### **Hepato-protective activity**<sup>30,31</sup>

Increased levels of serum transaminase and alkaline phosphatase tend to reduce during intake of the extract of *Nardostachys jatamansi*. 50% ethanolic extract acted against thioacetamide induced hepatotoxicity. Research studies also proved that rats intoxicated with LD90 (Lethal dose) dose of the hepatotoxic drug survived in the pretreatment with the extract.

##### **Antioxidant activity, Anti cataleptic activity**<sup>32,33</sup>

Lipid peroxidation quantified by thiobarbituric acid reactive substance (TBARS) was protected due to the activity of anti-peroxidation in *Nardostachys jatamansi*. In a comparison of individuals who had consumed haloperidol and *Nardostachys jatamansi* extract the individuals with the administration of *Nardostachys jatamansi* extract showed a maximum reduction in the cataleptic scores.

##### **Anti-hyperglycemic effects**<sup>34</sup>

Diabetic rats with alloxan induction when given ethanolic extract of *Nardostachys jatamansi* for 7 days exhibited significant anti-hyperglycemic activity. The study concluded that there is a notable anti-hyperglycemic effect in the model of diabetes mellitus.

##### **Antifungal and Antibacterial activity**<sup>35,36</sup>

Studies reveal that methanolic extract of *Nardostachys jatamansi* is effective against most of the microorganisms. Therefore, it justifies its role as an antimicrobial and antifungal agent.

##### **Anticonvulsant effects**<sup>37</sup>

Ethanolic extract of *Nardostachys jatamansi* in the roots alone and in combined with phenytoin was considered to observe the anticonvulsant activity and neurotoxicity. A remarkable decrease in the extension/flexion ratio was noticed during increased seizure threshold with the root extract against maximal electroshock seizure (MES).

##### **Effect on Parkinson's disease**<sup>38</sup>

6-OHDA was injected in Wistar rats and detected that the drug produced a significant decrease in

biogenic amine and an increase in Dopamine<sub>2</sub> receptors.

#### **Radioprotective activity**<sup>39</sup>

*Nardostachys jatamansi* root extract showed effective actions against exposure to radiations. This protected against damage caused by exposure to radiation by regulating antioxidant enzymes, scavenging free radicals and preventing oxidative stress.

#### **Cardiotonic and actions in Respiratory disorders**<sup>40</sup>

Antiarrhythmic activities and hypotension action of the plant have been studied in various studies. Pre-treatment with the extract of *Nardostachys jatamansi* prevented and restored the antioxidant enzyme activity and lipid peroxides to normal levels.

#### **Tranquilizing activities**<sup>41</sup>

Sesquiterpene, valeranone (Yatamanson) which were separated from the rhizome of *Nardostachys jatamansi* showed a significant action of tranquilizing activity. The study demonstrated a prolongation of barbiturate hypnosis in rodents.

Anticancer activity<sup>42</sup>.

Proliferation of both the cell lines of neuroblastoma was inhibited after the intake of alcohol extract (95%) of *Nardostachys jatamansi*.

#### **Adulteration**

Substituting the original crude drug either partially or fully with an intention to gain profit is known as adulteration. This can be done in various methods such as substituting with other substances which are lesser or free from therapeutic and chemical properties of an original drug or adding low grade or damaged or false drugs which is entirely different from the original drug.<sup>6,7</sup>

This can also be explained in detail as substituting the original crude drug with other substances which do not agree with the certified official standards of the original drug. This can be lesser in quality, damaged, false, defective or even useless harmful parts of the same plant or a different plant can be substituted. In case of *Sumbulut Teeb*, it is often adulterated with the drugs which are similar in orphology, confused in synonyms, due to its unavailability etc.<sup>43</sup>

#### **Reasons for adulteration**<sup>44,45,46</sup>

Having names that looks alike in traditional systems of medicine is the main reason for adulteration which causes confusion in vernacular names, not having proper knowledge of the original drug description, herbs often reciprocate, having similarity in the shape and structure externally (morphologically) is another reason for adulteration, unavailability or reduction of authentic plant, similarity in color and ignorance during collections can be some reasons for adulteration.

#### **Macroscopic characters of market samples collected from Sri Lanka and India**

The general appearance of the herb looks similar to other related species. Therefore, a proper study should be done for the exact identification of the morphological characters. Visual appearance to the naked eye is known as macroscopic identification. Size, color and taste are important parts of morphology of a particular drug. For each particular morphological group, a particular systemic examination can be carried out. (Anonymous, 1996).<sup>12</sup>

#### **Organoleptic assessment**

The five main sense organs of a human (eye, nose, tongue, ear and skin) being used to assess a drug is known as organoleptic or macroscopic assessment. This can be analyzed by seeing the color, size, shape, other external features, smell, taste, touch (soft/ hard/ hairy/ sharp etc.) and hearing of sounds. The first sample was purchased at an herbal drug shop, Gabo's Lane, Colombo 11, Sri Lanka, under name of *Jatamansi* (Figure 01). The organoleptic characters of sample one is shown in Table 02.



**Fig. 1: Sample 01**

**Table 02: Organoleptic characters of sample 01**

Rhizome	Characters
Shape	Irregular or appears like coral reefs, no fibrous covering
Size	4 to 5 cm long, 1 to 3 cm diameter
Colour	Dark brown with some light brown spots in between
Fracture	Hard and difficult to break
Surface	Rough
Odour	Gives a strong fragrance
Taste	Sour and acidic like, pungent and slightly bitter

The second sample was purchased from Jani Jahan Khan Road, Royapettah, Chennai, India which is available as *Sumbul-ut-Teeb* (Figure 2). The organoleptic characters of the second sample are shown in Table 3.

**Fig. 02: Sample 02**

The third sample was purchased at an herbal drug shop, Gabo's Lane, Colombo 11, Sri Lanka, which is having similar macroscopic characters of *Sumbulut Teeb* described in the Unani Pharmacopoeia of India (Figure 03). The name of the third sample given by the local vendors is "*Jata makuta*". The organoleptic characteristics of the third sample are shown in Table 04.

**Table 03: Organoleptic characters of sample 02**

Rhizome	Characters
Shape	Cylindrical shape surrounded by reddish brown fibres forming a network which are skeletons of sheathing leaves
Size	3 to 7 cm long, 0.5 to 1.5 cm in diameter
Colour	Dark brown and reddish brown internally
Fracture	Breakable
Surface	Fibrous
Odour	Strong fragrance
Taste	Acrid, slightly bitter and aromatic

**Fig. 03: Sample 03****Table 04: Organoleptic characters of sample 03**

Rhizome	Characters
Shape	Cylindrical, covered with reddish brown fibres
Size	11 to 14 cm long, 0.4 to 0.5 mm width
Colour	Dark brown with reddish brown shades
Fracture	Breakable
Surface	Fibrous
Odour	Slight fragrance
Taste	Sour acidic like, slightly bitter

### Discussion

Assessment of a drug is known as a confirmation of its identity, its quality persistence, purity and detection of its nature of adulteration. Obtaining the genuine drug is important to have good coordination between the quality of raw materials, in process materials and the final products.

For pharmaceutical purposes, the quality of medicinal plant material must be as highly similar to the quality of other medicinal preparations. The morphological, microscopic, physicochemical and chromatographic studies play a major role to identify, differentiating and authenticating the original plant from adulterants. Identification of the drug through morphological features is the first step in the authentication of the drug to detect adulteration.

Keeping in view the importance, organoleptic evaluation of market samples was done to compare the macroscopic description of *Sumbulut Teeb* available in Unani Pharmacopoeia of India, Part I, Volume I. Macroscopic description of *Sumbulut Teeb* has been described in Unani Pharmacopoeia of India, rhizome is dark brown in color which is 2.5-7.5cm in length cylindrical shape with reddish brown fibers around forming a network which are skeletons of sheathing leaf bases, they can break easily, has a strong fragrance, taste, sour and slightly bitter.

When comparing the organoleptic features of market samples, it is recognized that Sample 01 is not similar to the macroscopic description of *Sumbulut Teeb* given in the Unani Pharmacopoeia of India but samples 02 and 03 revealed resemblance to the Pharmacopoeial description of *Sumbulut Teeb*. However, market sample 03 is under name of *Jata makuta* which is the actual *Sumbulut Teeb* available in the market.

The drug *Jata makuta* is *Flickingeri amacraei* (Lindl.) and belongs to family Orchidaceae. In Ayurveda, it is known as *Jivanti*. The rhizome of this plant is creeping, annulate and green coloured, 0.4 – 0.5 mm width, 11 – 14 cm long, 5 – 6, distinct nodes present on rhizome and rooting is from the nodes of the rhizome. The plant has branching stems terminating in a fusiform pseudobulb which is 2.5-5 cm long, shining, flat and grooved longitudinally. Leaves are 1.2-4.2 cm broad, sessile, linear, oblong or lanceolate, obtuse, dark green and shining above, paler beneath and has many veins. Flowers are bilaterally symmetrical, bisexual, white with pale yellow and 1-3 arising from the pseudobulb at the

base of the leaf. Peduncles are 5.4mm long and enveloped by a number of scaly leaves. Floral bracts are 1.8mm long, broadly ovate, acute, fleshy and 3-veined. Dorsal sepals are 10.5-11mm long, oblong, acute and 5 or 7-veined. Lateral sepals are 10-11mm long, oblong, acute and 7 veined. Petals are 9.5-10mm long, lanceolate, oblong, midlobe recurved, crenulate and crisped. Anther terminal, pollinia 4 in two pairs, ovary inferior, 3 capillary, unilocular with numerous parietal ovules. The plant flowers during March and August. Distribution of this plant are Assam, Mizoram, Nagaland Orissa, Nilgiri hills, Sri Lanka, Nepal, Myanmar, Laos and Vietnam. Therefore, the drug known as *Jata makuta* in Sri Lankan market is the real *Sumbulut Teeb*. The drug which is known as *Jatamansi* is not an actual *SumbulutTeeb*.<sup>47</sup>

### Conclusion

For pharmaceutical purposes the quality of medicinal plant material must be as high similar to the quality of other medicinal preparations. The morphological, microscopic, physicochemical and chromatographic studies play a major role to identify, differentiate and to authenticate the original plant from adulterants. Identification of the drug through morphological features is the first step in the authentication of the drug to detect adulteration. Having names that looks alike in traditional systems of medicine is a main reason for adulteration which causes confusion in vernacular names, not having proper knowledge on the original drug description, Herbs often reciprocate, having similarity in the shape and structure externally (morphologically) is another reason for adulteration, unavailability or reduction of authentic plant, Similarity in color and ignorance during collections can be some reasons for adulteration. Therefore, the authentication of herbal drugs and identification of adulterants from genuine medicinal herbs are essential for both pharmaceutical companies as well as public health and to ensure the reproducible quality of herbal medicine.

The purpose of standardization of medicinal plant products is obviously to ensure therapeutic efficacy.

Therefore, an effort has been made in this study to authenticate *Sumbulut Teeb* is available in the market. The study revealed that the market sample available under the name of *Jata makutu* is the genuine drug of *Sumbulut Teeb*. The sample is available as *Jatamansi* which is not an actual *Sumbulut Teeb*. However, further physiochemical, phytochemical and chromatographic investigations are needed to authenticate the genuine *Sumbulut Teeb* to prevent adulteration and to obtain and maintain the high quality of this plant products. It is also necessary to identify the sample which is known as *Jatamansi* in the market.

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