Tukod-langit, Kamraj  
Helminthostachys zeylanica (Linn.) Hook.  
FLOWERING FERN  
Ru di wu gong

Abstract: Helminthostachys zeylanica Linn commonly called “kamraj”. This is a pteridophyte and have high medicinal value and used in various parts of the world. The whole plant parts like roots and leaves use as medicine. It is an endangered flora of India therefore; less information is available about to this plant.
Classification of Helminthostachys zeylanica (L.) Hook.
Kingdom: Plantae, Division: Pteridophyta,
Class: Psilotopsida, Order: Ophioglossales, Family:
Helminthostachyaceae, Genus: Helminthostachys,
Species: zeylanica.

Other vernacular names
BENGALI: Ekbir.
INDONESIA: Rawu bekubang, jajalakan, pakis kaler.
MALAYSIA: Tunjok langit, akar paku, jelai.
THAILAND: Kut chong, tin nok yung, phak nok yung.

Introduction
India is the home of biological and cultural diversity. Different communities have used the rich plant biodiversity of India for various purposes such as food, medicine, fodder, fuel and religious proposes. The Himalaya is considered as one of the most important botanical region of the world. In the Himalayan region, a chronic form of disturbance is found in which people remove only a small fraction of forest biomass in the form of grazing, lopping, surface burning and litter removal. The problem with this form of disturbance is that plants or ecosystems often do not get time to recover adequately because the human onslaught never stops. Foothills Kumaun region of Uttarakhand is a transition zone between hill and Gangetic plain, so this region have wide floristic diversity and the soils and climate of this region provide such an environment which has generated different types of vegetation which have great economic medicinal, aromatic and artistic value. However, due to heavy industrialization, urban expenditure, construction of roads the forest area are degenerated and many economical plants are facing danger of extinction. Therefore, the aim of this paper is to highlight the habitat, cultivation, collection, and medicinal uses of this endangered fern “Helminthostachys zeylanica (L.) Hook.” at foothills of Kumaun Himalaya, Uttarakhand.

Constituents
- Studies yielded stilbenes and flavonoids with antioxidant activities.
- Yields four flavonoids -- ugonin A, B, C, and D, stigmasterol, fucosterol and dulcitol.

Properties
- Expectorant, good antidote for snakebites, antiasthmatic.
- Considered aperient, aphrodisiac.

Parts utilized
- Rhizome.
- Wash and dry under the sun.
- Use rhizomes for propagation; preferably in shaded and moist area.

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Habitat
The habitat of this plant constitutes deciduous forest in plain areas. The plant refers shade and grows in moist localities. These moist locations are rich in humus and decayed organic matter. It flourishes well as undergrowth, chiefly in the forest of Teak (Tectona grandis), Safada (Eucalyptus hybrid), mixed forest of Rohini (Mallotus philippenensis), Khair (Acacia catechu), and Shisham (Dalbergia sisso). It is also associated with species of Lasura (Cordia myxa), Duddhi (Holarrhina antidysentrica), and Siris (Albizzia procera). Nevertheless, in study site it show best in specific habitats with Mallotus philippenensis – Dalbergia sisso and Eucalyptus hybrid-Mallotus philippenensis.
Distribution
Helminthostachys zeylanica (L.) Hook. is a monotypic genus found only in Indo-malesia regions and the Polynesian Islands including New Zealand. Also grows abundantly in North Australia. In India, it is mostly found in Eastern U.P., Uttarakhand, Bengal plains, Assam, and South India.

Description
Helminthostachys zeylanica (L.) Hook. is an annual plant belong to family Helminthostachyaceae. It is well reported in month of middle June to late September in an altitude of 235 to 275 meter. The plant measure a height to 10.5 to 2.0 feet long. The basal area is 0.55 to 0.85cm. It has clusters of sporangia on stems of fertile spike like fronds. The rhizome is short, creeping, underground and stout. They can fear either solitary fronds or several fronds. Leaves are lanceolate with the margins entire or irregular serrate. Only one leaf on folds is one in one season so that it is monophyllous. The spike is 12 to 15 cm long and arises from the base of the leaves with its own stripe. Below the spike is a sterile leaf segment called trophophore. Both sporophore and trophophore arise from a common petiole.
Cultivation
This plant grows in wet season of June to September. It grows best in light brownish gray type soil and sandy loam soil texture with a pH of 6.5. The moisture content is 16.65±5.85 to 17.25±1.95%, waterholding capacity of soil 34.10±5.42 to 36.22±5.76%, organic carbon is 0.28±0.09 to 0.59±0.06%, organic matter is 0.49±0.17 to 1.01±0.10%, total nitrogen is in range of 0.003±0.001 to 0.007±0.007%, available phosphorus is in range of 6.00±2.12 to 6.38±1.43 kg/ha and available potassium is in range of 83.99±59.14 to 248.41±78.62 kg/ha. It usually grows quickly during rainy season. For cultivation, purposes the roots (rhizomes) should harvested during the wet season in July to August.

Uses
Whole parts of this plant are used as various medicinal purposes in not only India as well as different areas of abroad based on literature available as discuss. The decoction of rhizome is used for curing impotency. The leaf juice relieves blisters on the tongue. The powdered 5.00 gm rhizome along with cow’s milk is used for vitality and brain tonic. Rhizome of the plant is cleaned thoroughly with water, crushed and deeply boiled along with cow’s milk and decoction given with black pepper (Piper nigrum) to the patient for two months in curing leucorrhea also its rhizome with about 5.00 gm of rhizome of safed musli (Chlorophytum tuberosum Roxb. Baker.) and root of semul (Bombax ceiba Linn.), are made into paste which is given for one month for waist pain as tonic in India (Singh et al., 1989). This species is an important village medicine in Moluccas with a decoction being used to treat boils and ulcers. It is used as slight aperients in the Moluccas. This plant is also used for vitality and brain tonic. The young leaves are cooked as vegetable. Rhizome powder is given for spermatorrhoea and for improving memory power.

Threats and Conservation
The world’s forests are under pressure destroyed for timber by paper industries and local natives for fuel. The subtropical zone of Uttarakhand highly rich is floristic diversity and forest resources, so many timber, medicinal, aromatic, gum, resin and volatile oil producing plants located here. Therefore, overutilization of these plants many species are in danger of being eliminated from nature. In recent past the frequency of this species in nature has declined considerably because of its exploitation to meet the over grazing in forests. In natural habitat,
germination of this plant is very poor and propagation is mostly through rhizomes. Because this species is already endangered, it needs immediate attention for conservation for research and researchers in future.

Uses

**Nutritional**
- Young leaves popular as salad vegetable.
- Excellent source of phosphorus and iron; a fair source of calcium.

**Folkloric**
- For coughing due to tuberculosis, asthma, poisonous snakebites: boil 6 to 10 grams dried drug in a cup of water and drink the decoction.
- For snakebites: crush the fresh plant and poultice the wound.
- For fractures and bone strengthening.
- Rhizome is chewed with betel for whooping cough.
- In India, used in Kerala for the treatment of hepatic disorders; rhizome also used for curing impotency; rhizome is chewed with areca for whooping cough.
- In Bangladesh, Khagrachari tribe use the plant to stop hemorrhages. Decoction of rhizome used in impotency. In Bandarban, root juice used with other plants for treatment of jaundice. Leaf Juice used for tongue blisters.
- In China, rhizome is used as antipyretic and antiphlogistic.
- In Malaysia, rhizome used as a tonic. Decoction of leaves used as tonic after childbirth. Rhizome mixed with Piper betel for cough and venereal diseases.
- In Java, used for dysentery, catarrh, phthisis.
- In the Moluccas, used to relieve constipation.

**Medicinal Properties**

- Hepatoprotective: Study of ethanolic extracts of rhizomes of HZ showed significant hepatoprotective effect against CCl4-induced damage liver damage in rats and presents scientific rational for its folkloric use in liver diseases.
- Antioxidants: (1) Study yielded eight flavonoids, ugonins E-L (1-8) from the rhizomes of HZ. Compounds 6, 7 and 8 showed significant antioxidant activity. (2) Study yielded three new cyclized stilbenes, ugonstilbene A, B and C which exhibited moderate antioxidant activity.
- Neuroprotective: Study has isolated Ugonin K, a flavonoid from the rhizomes of H zeylanica. Results suggest ugonin K has neuroprotective activity through activation of ERK1/2 and PI3K?Akt signal pathways which protects against H2O2-induced apoptosis.
- Anti-Inflammatory / Flavonoids: Study isolated 8 new prenylated flavonoids, ugonins M-T together with five known compounds, ugonins J–L (9–11), 5,4′-dihydroxy-4″,4″′-dimethyl-5″-methyl-5″′H-dihydrofurano[2″,3″:6,7]flavanone, and quercetin. Some compounds showed inhibition of superoxide anion generation and elastase release by human neutrophils in response to FMLP/CB.
- Aphrodisiac: Administration of a methanol extract of H. zeylanica rhizome to male mice significantly stimulated the sexual behavior as shown by increase in number of mounts, mating and reproductive performance.
- Antioxidant Flavonoids: Eight flavonoids, ugonins E-L were isolated from the rhizomes of Helminthostachys zeylanica. Compounds 3-8 were evaluated for their antioxidative activity in a DPPH assay. Compounds 6,7 and 8 were more active than Trolox.
- Ugonin J Flavonoid / Antioxidant: Study isolated Ugonin J from the dried rhizomes of H. zeylanica. A previous study has shown antioxidant activity with Ugonin J, K, and L.
- Cytotoxicity / Toxicity of Combinations: Three plants -- Tacca integrifolia, Helminthostachys zeylanica, and Eurycoma longifolia. All three were cytotoxic to human cell lines, Hep2 and HFL1. A combined extract of E. longifolia and H. zeylanica was more cytotoxic than a single extract on Hep2 cell line. Study suggests there is higher toxicity risk of consuming combination of H. zeylanica with either T. integrifolia or E. longifolia, and products using these combinations should be avoided.
- Ugonin K Flavonoid / Promotion of Osteoblastic Differentiation and Mineralization: Study showed a potential anabolic effect of ugonin K on bone probably through activation of p38- and ERK-mediated Runx2 and osterix expressions to induce synthesis of osteoids and formation of bone nodule.

**Key Words:** Ethnomedicinal uses, Helminthostachys zeylanica (L.) Hook., Kamraj, Tukod langit, Di Wu Gong, impotency