IAMJ

INTERNATIONAL AYURVEDIC MEDICAL JOURNAL

Review Article ISSN: 2320-5091 Impact Factor: 6.719

A COMPREHENSIVE REVIEW ON KOKILAKSHA (HYGROPHILA SPINOSA T ANDER)

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https://doi.org/10.46607/iamj4410072022

(Published Online: July 2022)

Open Access

Article Received: 23/06/2022 - **Peer Reviewed:** 04/07/2022 - **Accepted for Publication:** 10/07/2022

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ABSTRACT

Kokilaksha (*Hygrophila spinosa* T Ander.) is a promising medicinal plant that has been widely used for its therapeutic efficacy across a wide range of diseases as is evident in the classical texts of *Ayurveda*. *Kokilaksha* is treasured as a wonder drug used as a *Vajeekarana oushadhi* in relation to the treatment of diseases related to male infertility, in *Vatarakta, Sopha*, and *Mutrakrichra*. It has been documented with several pharmacological activities namely anti-convulsant, antineoplastic, hepatoprotective, antifungal, antispasmodic, respiratory stimulant, antibacterial, anti-inflammatory, diuretic, moderate antipyretic, hypotensive, vasodilatory, anabolic cum androgen-like activity, broncho dilatory and antitumor. The drug is explained in both *Samhita* as well as *Nighantu Kala* along with its synonyms. Owing to its abundant availability, economic importance, and therapeutic efficacy the drug *Kokilaksha* has a lot to offer to the medical fraternity. Hence an attempt has been made here to compile the classical references on the drug.

Keywords: *Kokilaksha*, *Hygrophila spinosa* T Ander, *Nighantu kala*, *Samhita*

INTRODUCTION

The role of herbal medicines in resolving health problems on a global level is invaluable which is evidenced by a significant increase in such products in recent times. *Kokilaksha* which is one such promising medicinal plant has been widely used for its therapeutic efficacy across a wide range of diseases as evident in the classical texts of *Ayurveda*. The *Nirukti* for the word *Kokilaksha* is clearly stated as the flower which resembles the eyes of a cucukoo bird. *Kokilaksha* is treasured as a wonder drug used as a *Vajeekarana Oushadha* and in the treatment of diseases related to male infertility, in *Vatarakta*, *Sopha*, and *Mutrakrichra*. The herb finds reference in the *Samhita kala* extending later into the *Nighantu kala*. The drug is not mentioned in the *veda kala*. In addition to the above diseases wherein the therapeutic efficacy of *Kokilaksha* has been documented classically as well as clinically there are several other pharmacological activities that have been attributed to the drug namely anti-convulsant, antineoplastic, hepatoprotective, antifungal, antispasmodic, respiratory stimulant, antibacterial, anti-inflammatory, diuretic, moderate antipyretic, hypotensive, vasodilatory, anabolic cum androgen-like activity, broncho dilatory, antitumor, etc. *Hygrophila spinosa* T Ander. belonging to the Acanthaceae family is considered the source plant for *Kokilaksha*. It is a stout herb believed to be indigenous to India from the Himalayas to Sri Lanka, Malaysia, Nepal especially found growing in moist places, ditches, plains, rice fields, margins of tanks, and canals. [1,2] Owing to its abundant availability, economic importance, and therapeutic efficacy the drug *Kokilaksha* has a lot to offer to the medical fraternity.

CLASSICAL REVIEW OF *KOKILAKSHA*

Samhita Kala

- *Charaka Samhita* [3]

  In *Charaka Samhita Kokilaksha* is quoted as one amongst the *Shukrashodhana gana* dravyas. It is mentioned as *Chatra*; a member of *madhuraskandha dravyas*. The drug has been mentioned as an ingredient in various *vrishya yogas* both internally as well as externally. *Kokilaksha* finds a mention in various formulations indicated for *ashmari bhedana* as well as *Vatapaittika* and *Vatakaphajarogas.*

- *Sushruta Samhita* [4,5,6]

  Sushruta in addition to the above-mentioned diseases indicates the use of *Kokilaksha* in the form of *Paneeya kshaara* in *Gulma* and *Udara chikitsa*.

- *Acharya Vagbhata* advocates the use of *Kokilaksha Kashaya* in the management of *Vatarakta*. [7]

Nighantu Kala [8,9,10,11,12,13,14,15,16,17]

1. *Shodala Nighantu* mentions *Kokilaksha* in *Lakshmanaadi Varga* along with 8 synonyms
2. *Madanapala Nighantu describes Kokilaksha* in *Abhayadi Varga* with its synonyms and *Guna Karma*.
3. *Kaiyadeva Nighantu* briefs about the drug in *Oshadhi Varga*. In this text, two types of *Kokilaksha* have been mentioned. The second variety has been given 3 synonyms namely *Karambashali*, *Brihatkesha*, and *Khaggala*.
4. *Bhavaprakasha Nighantu mentions about Kokilaksha* under *Guduchyadi Varga*
5. *Nighantu Adarsha* has explained it in *Paataladi Varga*
6. *Raja Nighantu and Priya nighantu describe Kokilaksha* in *Satahwadi Varga*. Characteristic features of *Kokilaksha* beeja as being red (*arunabha) sookshma* and *pichila* along with the morphological features of habit and habitat have been described in *Priya nighantu*.
7. *Sarswata Nighantu talks about Kokilaksha* in *Ulpadi Varga*.
8. *Hareetakyadi Nighantu* mentions *Kokilaksha* in *Guduchyadi Varga*
9. *Chamatkari Nighantu* -Author quotes *Kokilaksha* as *Ikshura in Chamatkari nighantu*; amongst the 225 other drugs in the text.
10. *Abhidhanaratnamala/Shadrasa Nighantu mentions Kokilaksha* as *Kshura*, being one amongst the *Swadu skanda dravyas*.
11. *Madhavadravyaguna* text *Kokilaksha* mentions it as one among the *Vividhoushadhivarga Dravyas*.
12. *Hridayadeepaka Nighantu* mentions *Kokilaksha* in the *Ekapada Varga*

13. *Abhidhanamanjari* lists *Kokilaksha* in the *Sankeerna varga*
14. *Ashtanga Nighantu enlists Kokilaksha* along with its synonyms under *Viprakeernaprakarana*
15. *Rajavallabha Nighantu* opines *Kokilaksha* to be *Vatahara* and *Amavata hara*
16. *Siddhamantra describes Kokilaksha* as one of the *dravyas* under *Vataghna varga*

***Nirukti* and meaning of synonyms** [18]

Synonyms based on Habit:

- *Baalika*-Growth of the plant is compared to a girl (*baalika*) neither too long, stout or strong nor too short i.e., neither a tree nor a very small plant
- *Shrinkhala/Shrinkhalika*- Gregarious shrub having several nodes or joints on the shoot

Synonyms based on Habitat:

- *Aakhara*- Grows in a place near water bodies in pits and burrows.
- *Taalajamakhaanam* -Grows near ponds lakes and water bodies

Synonyms describing Leaves:

- *Kshatrapatra- patraih kshatam* Covered by or protected by its own leaves
- *Guchalu*- Leaves grow in one place like in a bunch
- *Sukshmapatraka*- Leaves are narrow, thin with a pointed tip

Synonyms based on Spines:

- *Bahukantakah*- It has many thorns
- *Kanthagucha* - Prickled thorned barbed; *gucha* means – shrub/ cluster/ bundle /bush / of thorns
- *Vajrakantakah*-The spines of the plant are very strong

Synonyms describing its Stem:

- *Shrinkhalika/Shrinkhala*-A plant having several nodes or joints on the shoot
- *Kaandekshu- Ikshu sadrusha kaandatwat*

The stem of the plant resembles that of sugarcane

- *Vajrasthi* -The stem is very strong

Other Synonyms

- *Ikshura/Ikshuraka- Ikshum ikshu gandham raati iti*

The plant emanates a smell similar to sugarcane

- *Kshuraka- Ikshum raati iti ikshurah*

It acts like a weapon to destroy diseases like amavata

- *Bhikshu- Bhikshu yaachane*

People will ask for this plant

- *Kaakekshu- Kaaka iva ikshu yasyasa kaakekshu*

The plant bears resmblance to the eyes of a crow

- *Ikshugandha*

The root and stem of this plant smell like that of sugarcane

- *Kshura*

Sharp which can cut in this connection that which can cut off or destroy disease like a weapon or the sharpness of the spines

- *Kshuramedhaandah- Kshuramedhasya aadharah, Medha*-head *Anda- aadhara* or base

That which is an adhara or base for the spines in the plant; in this case, the plant stem is the the base for the spines in the entire plant

- *Tailakanda*

That which possesess snigdha amsa in its stem

- *Tilakantaka*

A plant whose thorns or spines possess snigdha amsa

- *Shrugaali -Srujati maayaam iti shrugaali*

It creates or does miracles in its ability to cure diseases

- *Ikshugandhika / ikshugandha -Ikshoh gandhah ivagandhah asyah iti*

The moola and kaanda of the plant posessess sugarcane like the smell

- *Kshurika*

A knife / a dagger / small razor refers to the the potency of the plant to destroy diseases

- *Ikshubaalika*

A kind of reed. It resembles a sugarcane plant in its baalika awastha /young stage wherein the leaves are seen along its nodes and when it matures the leaves are shed.

Kokilaksha is mentioned as *Kshuraka, Indra* and *Ikshuraka* in *Charaka Samhita* while *Kshuraka* and *Ikshura* by Vagbhata.

Table 1: Elucidates the different synonyms of the drug *Kokilaksha* as per different *Nighantus*

Synonyms	BP. N	R. N	So. N	M.N	K. N	Ni. Ad	Har. N	P. N	As. N
Ikshubaalika	+				+		+		+
Dhwanksha					+				
Bhikshu	+				+		+		
Sukhara			+						
Kantaki								+	
Sookshmapatraka			+						
Aakhara			+						
Kanthagucha			+						
Guchalu			+						
Kandekshu	+					+	+		+
Kakekshu	+						+		+
Ikshura	+	+	+	+	+	+	+	+	
Tailakanda				+					
Baalika				+					
Ikshugandhika				+	+				
Kshura				+	+		+		
Kshuramedhanda				+					
*Tikshariksh*u				+					
Kshatrapatra			+						
Bahukantaka			+						
Sthulakantaka									+
Makhanam/ Talajamakhanam								+	
Ikshugandha	+	+					+		
Kshuraka	+	+					+		
Shrugaali		+							
Shrunkhala		+							
Ranaka		+							
Shrungaalaghanti		+							
Vajrasthi		+							
Vajrakantakah		+							
Ikshura		+		+	+				
Kshuraka		+							
Pikekshana		+							
Pichila		+							
Ikshugandha		+		+		+			
Kshura				+					
Kandekshu				+		+			
Ikshubaalika				+					
Bhikshu				+					
Kshurika				+					
Kakekshu				+					

(*BP. N- Bhavaprakasha Nighantu, R.N -Raja Nighantu, So. N-Sodhala Nighantu, Ma. Ni-Madanapala Nighantu, K. N-Kaiyadeva Nighantu, Ni. Ad-Nighantu Adarsh, Har Ni- Hareetakyadi Nighantu, P.N-Priya Nighantu, As. N-Ashtanga Nighantu*)

Vernacular Names

Table 2: Showing Vernacular names of *Kokilaksha (Hygrophila spinosa* T Ander) [2,19,20]

LANGUAGE	*Hygrophila spinosa* T Ander
Sanskrit	*Kokilaksha*
English	Long leaved Barleria
Hindi	Talamakhana,Gokhulakanta
Kannada	Kolavalike, Kolvanke
Malayalam	Vayalchulli, Nirchulli
Tamil	Neremulli, Nirmalli, Golmidi, Kettu
Telugu	Neerugubbi
Marathi	Talimakhana, Vikhara, Talikhana, Kalsunda
Gujarati	Gokhru, Ekharo
Bengali	Kuliyakhara, Kulekhade, Kantakalika

Rasapanchaka [8,9,10,11,12,14,17]

Table 3: Showing *Rasapanchaka* of *Kokilaksha* according to different authors

Rasapanchaka	**P.N.**	**Ma. Ni**	**K. N**	**BP. N**	**Har Ni**	**Ni. Ad**	**R. N**
Rasa							
Madhura	+	+	+	+	+	+	+
Tikta		+	+	+	+	+	
Amla		+	+	+	+		
Guna							
Guru		+					
Snigdha			+			+	
Pichila	+	+	+		+		+
Sookshma	+						
Veerya							
Sheeta	+	+	+	+	+	+	+
Vipaka							
Madhura		+				+	
Doshaghnata							
Vatahara		+	+	+	+		
Pittahara		+				+	
Kaphahara		+				+	+
Raktahara		+	+		+		

(*P.N-Priya Nighantu, Ma. Ni-Madanapala Nighantu, K. N-Kaiyadeva Nighantu, BP. N- Bhavaprakasha Nighantu, Har Ni-Hareetakyadi Nighantu, Ni.Ad – Nighantu Adarsh , R.N -Raja Nighantu*)

Karmas [8,9,10,11,12,13,14,17]

Table 4: Showing *Karmas* of *Kokilaksha*

Karmas	**P. N**	**Ma. Ni**	**K. N**	**BP. N**	**Har Ni**	**Ni. Ad.**	**R. N**	**So. N**
Vrishya	+	+	+	+	+	+	+	+
Balya		+					+	
Ruchya		+					+	
Santarpana		+					+	
Mutrajanana								
Sukrasodhana		+		+				
Stanyajanana		+		+		+		
Mutrala		+				+		
Vedanasthapana		+						
Nidrajanana		+						
Sukrajanaka			+					

(*P.N-Priya Nighantu, Ma. Ni-Madanapala Nighantu, K. N-Kaiyadeva Nighantu, BP. N- Bhavaprakasha Nighantu, Har Ni-Hareetakyadi Nighantu, R. N -Raja Nighantu, Ni.Ad – Nighantu Adarsh, So.N – Sodhala Nighantu*)

Rogaghnata [8,9,10,11,12,14,17,21]

Table 5: Showing *Rogaghnata* of *Kokilaksha* according to various authors

Rogaghnata	**R. N**	**P. N**	**Har Ni**	**Ma.D**	**K. N**	**BP. N**	**Ma. Ni**	**Ni. Ad.**
Amavata				+	+			
Vatarakta	+		+	+	+	+	+	+
Trishna			+		+	+	+	
Ashmari		+	+		+	+	+	+
Sopha	+		+		+	+	+	+
Visha					+			
Netraroga			+		+	+		
Pandu					+			
Anaha					+			
Udara					+		+	+
Vibandha					+			
Ama			+		+	+		
Shoola					+			
Vataroga			+		+		+	
Atisara	+				+		+	
Sukravikara							+	
Yakrutroga							+	+
Kamala							+	
Sandhivata								+
Kasa							+	
Mutrakrichra							+	
Anidra							+	+

(*R.N -Raja Nighantu, P.N-Priya Nighantu, Har Ni- Hareetakyadi Nighantu, K.N-Kaiyadeva Nighantu BP. N-Bhavaprakasha Nighantu, Ma. Ni-Madanapala Nighantu, Ni. Ad – Nighantu Adarsh, Ma.D-Madhavadravyaguna*)

THERAPEUTIC USES [22]

- Use of *Kokilaksha moola* along with *Sita* has been mentioned for *Sukhaprasava*
- *Kokilaksha moola* used in the form of *kashaya* internally as well as externally tied on the head has been used for *Nidrajanana (Hareeta Samhita)*
- *Use of Kokilaksha bhasma* in *Sotha Chikitsa* internally
- *Kokilaksha kwatha* is advised in *Vatarakta*

IMPORTANT *YOGAS* OF *KOKILAKSHA* [19,23]

- *Panaviraladi Bhasma (Kshara)* –Indicated in *Udara, Sopha*
- *Vastyamayanataka Ghrita*
- *Rasnairandadi Kwatha Choorna* –Indicated in *Vataroga, Shoola, Shopha* and *Vatarakta.*
- *Kokilakshadi Kwatha*-Indicated in *Vatarakta* contains *Kokilaksha* as one of the main ingredients along with *Guduchi*
- *Kameshwara Modaka*-Indicated as one of the *yogas* for *Vajeekarana*
- *Sri Kameshawra Modaka*-Indicated in *Grahani* contains *Kokilaksha* as an ingredient
- *Shrimadananada Modaka* –Indicated in *Vajeekarna*
- *BrihatShatavari Modaka* –Indicated for *Vajeekarna*
- *Rasa Guggulu*-Indicated in *Upadamsa*

- *Mopharva*-Contains *Kokilaksha* as an ingredient indicated for *Vajeekarna*
- *Paushtika Churna*

TAXONOMICAL CLASSIFICATION OF *KOKILAKSHA*

Table 6: Showing the taxonomical /botanical classification of *Kokilaksha* [2]

TAXONOMICAL POSITION	***Hygrophila spinosa* T Ander**
Kingdom	Plantae
Subkingdom	Dicotyledonae
Division	Tracheophyta
Class	Magnoliopsida
Series	Bicarpellate
Order	Lamiales
Family	Acanthaceae
Genus	Hygrophila
Species	Spinosa
Latin name	*Hygrophila spinosa* T Ander

MORPHOLOGY OF *Hygrophila spinosa* T Ander [1,2,20,25]

ETYMOLOGY [26]

Term meaning of *Hygrophila spinosa* T Ander.

Hygrophila –Seen near waterlogged areas /pits

spinosa-has spines

Asteracantha =asterius –a star-like, cantharus-tankard (a large drinking vessel) *longifolia* = longi- long, folia- leaves (having long leaves)

Synonyms

Asteracantha longifolia Nees.

Hygrophila auriculata (Schum.) Heine

Habit: A stout herb with numerous fasciculate usually unbranched, sub quadrangular erect stems, thickened at nodes.

Habitat: The plant is indigenous to India distributed from the Himalayas to Sri Lanka, Myanmar, Malaysia, Nepal especially seen growing in moist places, ditches, plains, rice fields, and margins of tanks and canals.

Stem: Numerous fasciculate usually unbranched sub quadrangular erect stems 0.6-1.5m high, thickened/ swollen at the nodes, more or less hispid with long hairs. Externally grayish- brown, creamish- brown on the cut surface.

Leaves: Greenish brown 1-7 cm long, 0.5 – 1 cm wide sparsely hispid on both sides, tapering at the base, sessile (or at least without clearly defined petioles), in verticals of 6 at a node, the outer 2 leaves of the whorl large, reaching 18 by 1.3-3.2 cm, oblong-lanceolate, 4 inner leaves reaching about 3.8 cm long, each of the 6 leaves with the nearly straight sharp yellow spine, 2.5-4.5 cm long, in its axil.

Flowers: It is in a whorl of 8 (in 4 pairs) at each node; bracts about 2.5cm long.

Calyx 4-partite; upper sepal 1.6-2cm long, broader than the other 3, which are 1.3 cm long, all linear-lanceolate coarsely, hairy on the back, and with hyaline ciliate margins

Corolla purple-blue, reaching 3.2 cm long, widely 2-lipped: tube 1.6 cm long, abruptly swollen at the top; lips subequal,1.6cm long, the upper lip 2 –fid with oblong truncate lobes, the lower lip with 2 entire crest-like longitudinal folds or callosities on the palate, deeply 3-lobed, the lobes oblong or slightly obovate, rounded or truncate. Filaments are quite glabrous, one short and one long filament of each pair united at the base. Anthers are two-celled with 4 ovules in each cell. Style slightly pubescent, filiform, stigma simple, and involute with a fissure on the upper side.

Fruit: It is a 2-celled capsule, 8mm long, linear-oblong, pointed 4-8 seeded

Root: They are mostly adventitious, whitish to brown with no characteristic odor and taste

CULTIVATION AND PROPAGATION [1,24]

It is propagated by seeds. The plant tolerates a variety of soils and can be cultivated in wet and marshy places.

Micropropagation: It can also be propagated in vitro using leaf explants. The multiple shoots obtained from leaf explants cultured on MS (Murashige & Skoog) medium supplemented with different concentration of Thidiazuron (TDZ) (0.01 mg/l to 0.5mg/l), N6 - Benzyladenine (BA) (0.5 to 2.5 mg/l) and α Napthalene acetic acid (NAA)(0.5mg/l).

IDENTITY, PURITY, AND STRENGTH [20]

Foreign matter: Less than 2 %, Total Ash: Less than 9%, Acid-insoluble: Less than 1%, Alcohol-soluble extractive: Not less than 4%, Water-soluble extractive: Less than 20%

CHEMICAL CONSTITUENTS [1, 25]

Flowers-Flavonoids like Apigenin-7-0-glucuronide ad 7-0-glucoside

Seeds –histidine, lysine, phenylalanine, with linoleic acid and oleic acid, palmitic and stearic acids, xylose, uronic acid, polysaccharides, xylan, lipase, protease, saponin, sterols, sterol I, II, III, IV, asteracanthine, asteracanthicine

Root– lupeol (Triterpenes), betulin, phytosterol, essential oil

Leaves- lupeol (Triterpenes), ascorbic acid, nicotinic acid

Whole plant – botulin (Triterpenes), lupeol, stigmasterol (sterol), n-triacontane (Triterpenes), isoflavone glycoside, alkaloids B1 and B2, long-chain hydrocarbons (C27-35)

Aerial parts-lupeol, 3-methylnonacosane, 23-ethylcholesta -11(12), 23 (24)-dien-3 betaol, 25-oxo-hentriacontanyl acetate and methyl 8-n-hexyltetracosanoate.

Major-Fixed oil with linoleic acid and oleic acid as main constituting fatty acids

Others – palmitic, stearic, and myristic acids, polysaccharides (containing mainly D-xylose with minor quantities of D-glucose and traces of L-arabinose and D-mannose), xylose, uronic acid, histidine, lysine, phenyl alanine, Beta-sitosterol

TOXICOLOGY: No reported toxicity.

CONTROVERISES: Nil

THERAPEUTIC EVALUATION:

Clinical reports showed that this drug is effective in treating male infertility at therapeutic doses of the drug.

The seeds of the *Kokilaksha* plant can be used to treat infertility in men. The seeds act as an aphrodisiac. It can increase the levels of serum testosterone and sperm count.

Kokilaksha ksheeravasti is found to reduce the symptoms of rheumatoid arthritis considerably due to its anti-inflammatory property. It significantly reduces erythrocyte sedimentation rate (ESR) and improves haemoglobin content.

SUBSTITUTES AND ADULTERATION: Ruellia tuberosa L. seeds have been recently reported as an adulterant for *Hygrophila spinosa* seeds.[27]

PHENOLOGY: Flowering and Fruiting August – March

PART USED: Whole plant, seeds, root, leaf

POSOLOGY [1, 20]

Curna: 3 to 6 g, *Bhasma* -1-3 g, *Kashaya*-60ml

RESEARCH WORKS [1,28]

1. Diuretic activity: The alcoholic extract of *H. auriculata* (Schum.) Hiene at doses of 200 mg/kg showed a significant increase in the total urine volume and concentrations of Na^+, K^+, and Cl^- in the urine of the rats. This finding supports its traditional use as a diuretic.
2. Antifungal activity: The alcoholic extract of the whole plant inhibited the growth of pathogenic fungi in vitro viz. Tricho mentagrophytes, Tricho. Rubrum, Micro.gypsem, Epidermfloccosum and Candida albicans (Venitaraman & Radhakrishnan,1972)
3. Anti-inflammatory activity: Chloroform and alcoholic extracts of the leaves of *Hygrophila spinosa* evaluated for their anti-inflammatory effect in Wistar rats revealed a significant reduction in carrageenan-induced rat paw edema in a dose-dependent manner.

4. Antipyretic activity: Chloroform and alcohol extracts of *Hygrophila spinosa T Ander* leaves evaluated for their antipyretic activity on the basis of their effect on Brewer's yeast-induced pyrexia in rats at doses of 200 and 400 mg/kg showed significant antipyretic activity.
5. Hematopoietic activity: Hematopoietic activity of *H. spinosa* evaluated using cyclophosphamide-induced anemia in rats revealed chloroform extract of the leaves to significantly improve RBC and hemoglobin counts along with increased bone marrow cellularity.
6. Hepatoprotective activity: Hepatoprotective effect of aqueous extract of *H. spinosa* root in carbon tetrachloride-induced liver damage studied in albino rats showed an aqueous extract of the plant increased the liver enzyme levels.[104]
7. Antidiabetic activity: In 1989, the hypoglycemic activity of *H. auriculata* in human subjects was reported. Experimental studies too showed a significant reduction in the blood glucose levels, thiobarbituric acid reactive substances, and hydroperoxide in both liver and kidney on the use of ethanolic extracts from aerial parts of the plant. This study showed the antidiabetic activity along with potent antioxidant potential in diabetic conditions.
8. Anthelminthic activity: Alcohol extract of leaves of *H. spinosa* revealed significant anthelminthic activity.
9. Antibacterial activity: The in vitro antibacterial activity of petroleum ether, chloroform, alcohol, and aqueous extracts of leaves of *H. spinosa* evaluated showed a significant increase in the zone of inhibition for *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, and *Pseudomonas aeruginosa*. This finding confirms its traditional use in bacterial infection.
10. Analgesic activity: The petroleum ether, chloroform, alcohol, and aqueous extracts of leaves of H. *spinosa* showed analgesic activity by central as well as peripheral mechanisms.
11. Antimotility activity in Diarrhea and Dysentery: The petroleum ether, chloroform, alcohol, and aqueous leaf extracts of *Hygrophila spinosa* at a dose of 200 and 400 mg/kg showed a dose-dependent decrease in the distance traveled by charcoal meal through the gastrointestinal tract. This supports its traditional role in the treatment of diarrhea and dysentery.
12. Antioxidant activity: Various *in vitro* and *in vivo* antioxidant activities carried out on different extracts of different parts of *H. spinosa revealed its potent antioxidant activity*.
13. Anti-tumor activity: Petroleum ether extract of *Hygrophila spinosa* was reported to show anti-tumor activity by significantly suppressing the tumor fluid volume and increasing the life span of EAC/S-180 bearing mice in a day-dependent manner. Hydro-alcoholic extract of *Hygrophila spinosa* on DMBA-induced mammary tumor was also reported to show significant antitumor activity.

DISCUSSION

The whole plant of *Kokilaksha* is recommended for therapeutic efficacy as per the classical texts of *Ayurveda*. It is a seasonal plant classified under the category of herbs. An added advantage of this is that the use of the whole plant will not cause an ecological imbalance as it is found growing as a weed. Though the drug has been given a lot of importance as a single herb in the treatment of *Vatarakta*; it is not expensive as it grows wildly like a weed hence serving the purpose of it being a cost-effective drug. As it is an abundantly available and cost-effective drug there are no concerns of adulteration and substitution present in consideration with this medicinal plant.

CONCLUSION

The surge in *Ayurvedic* medicinal plants the world over is evident in the soaring demand for alternate systems of medicine. They have become a subject of extensive research owing to the multiple therapeutic properties possessed. *Kokilaksha (Hygrophila Spinosa* T Ander.) a common drug has references in the classical texts of *Samhita* and *Nighantu kala*. The drug finds no reference in the *Veda kala.* It is available easily, abundantly, and grows like a weed on the

banks of a paddy field. The plant has been reported to have multiple pharmacological activities like anti-inflammatory, diuretic, hepatoprotective, haemopoietic, etc. *Kokilaksha* is thus a very important indigenous medicinal plant that requires further study to explore the traditionally claimed unexplored activities so as to utilize this plant in the best possible way.

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Source of Support: Nil
Conflict of Interest: None Declared

How to cite this URL: Anisha E.P. & Pradeep Seema: A Comprehensive Review on Kokilaksha (Hygrophila Spinosa T Ander). International Ayurvedic Medical Journal {online} 2022 {cited July 2022} Available from: http://www.iamj.in/posts/images/upload/1892_1902.pdf