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Review Article

STUDIES ON THE NUMEROUS MEDICINAL UTILITIES OF THE PLANT *URGINEA INDICA*: A COMPREHENSIVE OVERVIEW

JUNMONI NATH[a*]

[a]**Department of Pharmaceutics, Girijananda Chowdhury Institute of Pharmaceutical Sciences, Azara, Guwahati 781017**
Email: junmoninath2014@gmail.com

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ABSTRACT

Urginea indica, is an essential indigenous plant belonging to the family Liliaceae found in all parts of India on rocky and hilly areas. It is commonly known as Indian squill, True squill or Sea onion and popularly known as Bon Pollundu. A methodical literature survey from various scientific databases such as PubMed, Scopus, Web of science and Google Scholar was conducted and it has been reported that the plant, mainly its bulb contains varieties of bioactive constituents such as flavonoids, phytosterols, phenols, saponins, alkaloids, proteins, carbohydrates, steroids and tannins. The bulb and the rhizome also contains calcium, iron, commercial compounds, such as Bufadienolides, Quercetin, Allose, Mindererus spirit, Tartronic acid and Paraldehyde, which have a variety of health functional properties. Various scientific studies have proven that the plant has anticancer, antidiabetic, anthelmintic, analgesic, antibacterial, antifungal, anti-angiogenic, anti-arthritic, antioxidant, anti-inflammatory, spasmodic and cardiac stimulant activities. It also finds its use as an analgesic and in wound healing. Thus, the current review gives a comprehensive overview of the various medicinal activity of the plant *Urginea indica*.

Keywords: *Urginea indica*, Bioactive constituents, Flavonoids, Antioxidant

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INTRODUCTION

Urginea indica belonging to the family liliaceae, is a glabrous herb with polytypic genus consisting of about 99 species all over the world, 9 occurring in India [1]. It is commonly called as Indian Squill or Sea onion and locally known as jungli piyaz [2]. It is a small plant growing up to a height of 45 to 60 cm [3]. In Ayurveda, *Urginea indica* is commonly known as Bon Pollundu and has find its use both in pharmaceutical as well as in agricultural sector [4]. Among the different parts of the plant, the bulb has been reported to have immense significant value mainly as antidiabetic, antioxidant, anticancer, dyspepsia, cardiac stimulant, in hypertension, arterio-sclerosis, in treatment of edema, dropsy, asthma, rheumatism, gout, allergies, wound healing and to treat various other disorders [5]. The other actions accredited to *U. indica* are expectorant, anthelmintic, stomachic, purgative, digestive, diuretic, in rheumatism, scabies, skin diseases, internal pain and leprosy [6]. Various chemical constituents like tannins, phenols, alkaloids, flavonoids are present in all parts of the plant, whereas steroids are solely present in the bulb [7]. Also, the bulb contains glycosides, carbohydrates, resins, quinones and saponins [8].

Here in this review, a comprehensive overview of the various medicinal activity of the plant *Urginea indica* has been listed.

MATERIALS AND METHODS

A thorough literature survey of the plant *U. indica* was carried out from different scientific databases such as Scopus, PubMed, Google Scholar and Web of Science. For the online literature survey, The terms "Indian squill", "*Urginea indica*", "*Drimia indica*", "Ban Palandu", "*Scilla indica*" and "Kolkanda" were searched for the online literature survey. A number of book chapters, articles, web pages were obtained from online sources. This review consists of a comprehensive collection of the various literatures on the therapeutic activity of *Urginea indica*.

Plant description

Urginea indica is a perennial herb having fibrous roots. The roots proceeds from the base of the bulb (pear-shaped and conical) and are about six to ten inches in length. The bulbs had transparent outer scales, resembling the size of a big onion, comprising fleshy coats that are orange-brown or papery red in colour, encircling each other fully, is engrossed in the sand by three fourth. Leaves having smooth-edged grow from the bulbs in the shape of a rosette about 1–2.5 cm wide and 15–30 cm long. The flowers blossom in the month of April and May. A long, stiff, smooth succulent flower rises from the middle of the leaves with a high of about one to three feet, having close spike of whitish flowers, which stand on purplish peduncle [9, 10].

Fig. 1: *Urginea indica*

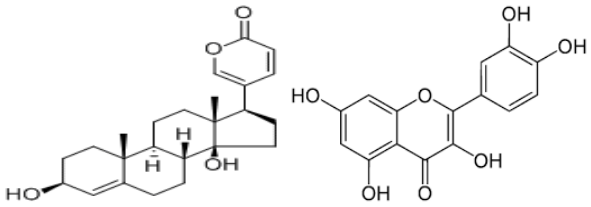
Phytochemicals

The main active constituents of *Urginea indica* are the steroidal glycosides. A number of steroidal glycosides are present in *Urginea indica*, among which Scillaren A and proscillaridin A are found in the highest concentration in the bulb [11]. From the blub, plenty of phytochemicals were extracted, which were found to be potentially bioactive. Other elements found in the herb include steroids, esters,

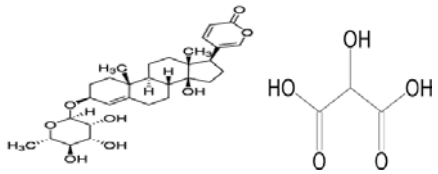
carbohydrates, flavonoids, saponins, antifungal glycoproteins and esters. The bulb also contains steroids which were used to cure psoriasis by the indigenous people [12, 13]. A total number of thirteen Bufadienolides were identified in both the roots and bulb [14]. *Urginea indica* has also been reported with a novel 29 kDa glycoprotein that has Antifungal acitivity [15]. 0ther compounds such as quercitin (found helpful in reducing the blood pressure of individuals), paraldehyde (used as a hypnotic and sedative), mindereru's spirit (helpful in perspirations), and tartronic acid (used as oxygen scavenger) were also recognized [16-18]. Listed below is a table showing the active compounds present in *Urginea indica* responsible for its activity [13, 19]:

Table 1: Compounds present in *U. indica* and the activity they are responsible for

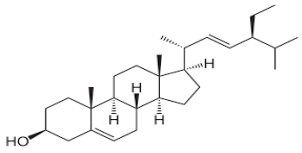
S. No.	Compounds	Activity responsible for
1	Glucose	Acetylcholinergic, Antihepatotoxic, Antiedemic, Antivaricose, Memory enhancer
2	Scillarenin	Anticarcinomic, Antirhinoviral, Cardiotonic, Pesticide
3	Mannose	Anticystic
4	Quercetin	Cancer preventive
5	Flavones	Anti-inflammatory



Scillarenin **Quercetin**



Proscillardin **Tartronic acid**



Stigmasterol

Fig. 2: Structures of some compunds found in *U. indica*

Pharmacological and therapeutic activity

The various pharmacological/therapeutic activity of the plant are listed below:

Antioxidant

Flavonoids, carotenoids, polyphenolics are some of the popular natural antioxidant substances reported in *Urginea indica.* A methanolic extract of the bulbs of *U. indica* at a concentration of 150 µg/ml showed antioxidant activity by DPPH assay. In this *in vitro* study, different concentrations of the methanolic extracts were taken ranging from 30 to 150 µg/ml. Here the extracts showed the varying percentage of activity i. e, from 98.10% to 99.14%. However, this report could not be considered to be operative enough as the doses showing antioxidant activity were too high, also to compare the DPPH radical scavenging activity; there was no positive control used [20]. In another *in vitro* study, the methanolic extract of *U. indica* showed antioxidant activity by DPPH assay. Different concentrations of 20, 40, 60, 80, 100 and 200 µg/ml of the extract were used to evaluate the DPPH radical scavenging activity. The IC50 value of the extract was found to be 51.87 µg/ml, which was comparable to the gallic acid IC50 value of 39.91 µg/ml [21].

Also, it was reported that the bulbs of *U. indica* have proanthocyanidin and phenolic substances that are responsible for its antioxidant and free radical scavenging activities [22]. Again, in another *in vitro* study, chloroform, ethyl acetate and methanol extracts of the bulbs were reported to have antioxidant activity. Different concentrations of 10, 20, 40, and 60 µg/ml of the extract were used to evaluate the DPPH free radical scavenging activity. The IC50 values of 24.98, 23.00, and 22.61 µg/ml were found, respectively where the methanol extract IC50 value was found to be alike to ascorbic acid (22.33 µg/ml). The study reported that methanolic extract has the highest activity, at 95.50%–97.57%, followed by chloroform (93.38%–95.91%) and ethyl acetate (86.40%–88.24%) [23].

Antidiabetic

An antidiabetic study was conducted by Gupta *et al.* of the ethanolic extract of bulbs (*U. indica*) against streptozotocin-induced diabetes rats. Glibenclamide (10 mg/kg) was used as the standard drug. The extract was used as 750 mg/kg and 1.5 g/kg of body weight. Both the extract and the drug were used orally for a period of 14 d. Within 120 min of administration of the extract at the dose of 1.5 g/kg considerable decrease in the blood glucose levels was shown in the diabetic rats. Along with the reduction in the blood sugar level, total cholesterol and triglyceride levels were also found to reduce by the extract. Moreover, matched with the group of untreated rats, the levels of high-density lipoproteins were found to improve. The histopathological study revealed that the extract partially repaired the

damaged cellular population of pancreatic islets in rats. The results of the experiments suggested that ethanolic extracts of *U. indica* has significant antidiabetic effects on STZ-induced diabetic rats [24].

Anthelmintic

The bulbs of *U. indica* has been reported to treat helminthiasis, which is a macroparasitic disease. It is caused by the parasitic worms in humans and animals. In an in-vivo study, an aqueous extract obtained from the leaf, scape, and bulb of the plant was tested for anthelmintic activity against earthworm (Pheretima posthuma) due to its anatomical and physiological resemblance to human intestinal roundworm parasites. The extract, at the dose of 5 mg/ml, paralysis the earthworms at 41 min and death at 50 min. On the other hand, albendazole (5 mg/ml), a positive control in this study, showed paralysis at 92 min and the death of earthworms at 110 min. The above study revealed that the crude extract of the bulbs was highly effective against earthworms and was equally potent to albendazole at a similar concentration. On the basis of this study, it can be suggested that the active molecule/s of the plant certainly have a higher potential. However, this needs further advanced study to reach a final conclusion [25].

Antibacterial

U. indica has also been reported to have antimicrobial efficacy. In a study, it was found that the methanolic extracts obtained from the leaves, stem and roots were effective against different bacteria like S. aureus, E. coli, B. subtilis, A. niger, S. epidermidis, C. albicans and P. aeruginosa at a dose of 2 mg/20 µl. The standards used were Penicillin and streptomycin against bacteria and clotrimazole against fungi at 10 µg/20 µl. Among all the extracts obtained from different parts, the methanolic root extract revealed the highest activity, showing Inhibition Zone Diameter values of 15.06, 14.33, and 12.33 mm against B. cereus, S. epidermidis, and S. aureus, respectively [26].

Potent inhibitory action was reported by aqueous bulb extract of *U. indica* against gram-negative bacteria (Shigella flexneri, Pseudomonas aeruginosa and Vibrio cholerae), gram-positive bacteria (Bacillus brevis, B. subtilis, B. licheniformis and Streptococcus aureus) and fungus (Candida kruse), showing inhibition zone diameter (IZD) ranging between 19 and 28 mm at 200 µl [27].

Another study showed that the methanolic bulb extracts showed activity against Escherichia coli, Staphylococcus aureus, and P. aeruginosa, with an IZD range of 0.7–1.4 cm at 50, 100, and 150 mg/ml. The results were compared to levofloxacin at a concentration of 500 mg/disc, although this concentration looks to be too high for an *in vitro* study and may not be considered authentic, showing an IZD of 1.3 and 1.4 cm against P. aeruginosa and E. coli, respectively. In this study, pure methanol was used as a control. The results were correlated with its traditional use in wound healing [28].

Antifungal

U. indica also has been reported to have antifungal activity. A 29-kDa glycoprotein found in the bulbs of *U. indica* were shown to have antifungal activity against some plant pathogenic fungus-like, Rhizoctonia solani, Fusarium oxysporum, Alternaria tenuissima and Sclerotium rolfsii. The maximum inhibition was found against F. oxysporum at 10 µg/well [29]. In another study, protein chitinase present in the bulbs was reported to show activity against the plant pathogenic fungus R. solani and F. oxysporum [30].

Anti-inflammatory and analgesic

In an in-vitro study, the ethanolic bulb extract of *U. indica* was administered in Swiss albino rats to evaluate its anti-inflammatory and analgesic activities. The ethanolic extract used was fractionated from the methanol extract of oven-dried material, was used at an oral dose of 1.5 g/kg showed significant anti-inflammatory activity against carrageenan-induced oedema in rats, having a range of inhibition between 18.68% and 29.78% at 1–4 h when compared to the untreated control. On the other hand, the standard drug (ibuprofen) inhibited oedema at an oral dose of 6 mg/kg by a range between 23.07% and 41.84% 1–4 h post-treatment. With a similar oral dose, i.e., 1.5 g/kg, the extract also exhibited analgesic activity in rats using a hot plate assay. The hot plate pain perception in rats was raised for up to 3 sec by the extract compared to the untreated rats, whereas ibuprofen with an oral dose of 6 mg/kg showed pain perception for 11 sec till 4 h [31].

Anticancer

Methanolic extract of *Urginea indica* (MEUI) was reported to have anticancer activity against Ehrlich Ascites Carcinoma (EAC) cells in swiss albino mice. Swiss albino mice were inoculated with EAC cells and the reduction ability of EAC cells was observed by Rudimentary assessment of Methanolic extract of *Urginea indica*. The reduction of average tumor weight was measured to find out anti-cancer efficacy of MEUI. This study revealed significant weight variation at 4X doses of MEUI indicating loss of tumor weight. The weight variation study of tumour by MEUI showed a 47.66 % decrease at 2x dose and 65.10% decrease in weight at 4x doses in total ascites fluid weight versus control, which was statistically highly significant ($p=0.003$). After 30 d of observation, no mice survived in the control group, whereas 3 mice were alive in the group treated by MEUI at 2x dose and 5 mice were alive in the group treated with MEUI at 4x dose. This study showed that MEUI has anticancer activity [32].

Bronchodilator and cardiac stimulant

An aqueous ethanol extract of the bulb was studied in rabbit tracheal and guinea pig atrial preparations. The extract inhibited contractions induced by carbachol (1 µM) and K+(80 mmol) in rabbit tracheae, similarly to dicyclomine. The results suggested the presence of Ca2+-channel blocking and anticholinergic mechanisms of the extract. The extract (0.01–1 mg/ml) increased the force of guinea pig atrial contractions without affecting their rate. This effect was perhaps mediated through the combined mechanism of an anticholinergic and Ca2+antagonist accompanied by an inotropic effect. This *in vitro* report gave an idea about the possible role of *U. indica* bulbs in bronchial diseases such as asthma and bronchitis. However, further studies with *in vivo*/clinical models are warranted before its use as a bronchodilator. Its purified fraction(s) or constituent(s) should be used to improve its efficacy and also to reduce dose sizes [33].

Other medicinal use

U. indica has also find its use in milder cases of heart insufficiency and also for diminished kidney capacity. An inulin like substance named Sinistrin is extracted from squill for use as a marker in diagnosis of renal problems [34]. The extract of *U. indica* has also proved effective in muscle pain and developed as an analgesic [35]. Studies has also reported larvicidal action of *Urginea indica* against Aedes larvae causing dengue fever. The lypholised aqueous extract of 400 µl showed 100% mortality of the larvae within fifteen hours [13]. Again, local application of dichloromethane extract obtained from the bulbs of *U. indica* also showed trauma healing activity in rats with skin trauma [36].

CONCLUSION

This study concludes that various extracts of *U. indica,* mainly the extracts of the bulb have shown significant anthelmintic, antibacterial, antifungal, anticancer, antioxidant, antidiabetic, bronchodilator, anti-inflammatory, analgesic, and wound healing activities in different *in vitro* and *in vivo* models due to the presence of various bioactive compounds and can be a potential source of new useful drug. Although the plant has been used in Ayurveda for many years, no clinical studies are performed on this plant. Hence, there is quiet a decent possibility for upcoming research based on clinical trials of this plant.

However, *Urginea indica* is favorable for further studies of bioactive compounds and isolation of a new drug. The plant species needs immediate protection, propagation and conservation as it is under the threatened category.

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Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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