



Chemical constituents of wild onion *Urginea indica* Kunth

Liliaceae

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Abstract

Wild Onion *Urginea indica* provide health promoting phytochemicals, as well as nutrients. Onions are bitter to taste, they contains plenty of raphides in bulbs which acts as defensive mechanism. Wild onions are source of Vitamin E, C & K, potassium, dietary fibre & folic acid. They also contain calcium, iron & proteins, several healthy & commercial compounds, such as Bufadienolides, Quercetin, Allose, Mindererus spirit, Tartronic acid & Paraldehyde. These compounds have a variety of health functional properties, including anticancer and antimicrobial activities. They each have been shown to help neutralize the free radicals in the body, & protect the membranes of the body's cell from damage.

Key-Words: *Urginea indica*, Wild onion, Chemical constituents

Introduction

Quercetin: - being strong antioxidant delay or slow the oxidative damage to cells & tissue of the body. Studies have indicated that Quercetin helps to eliminate free radicals in the body, to inhibit low density lipoprotein, oxidation an important reaction in the arteriosclerosis & coronary disease to protect & regenerate vitamin E-a powerful antioxidant.

Wild onions contain very little Quercetin, so people stick to cultivated onions which contain 22.40 mg & 51.82 mg per medium sized onion (100 gram) Quercetin can withstand the heat of cooking as long as it is in low heat.

In the "Garuda Puran" the Sanskrit word palandu which means wild onion has been mentioned and great sages like Maharshi Atreya & Lord Dhanvantari have described the use of wild onions in detail. There is also a description of Kandarpa Varishya Vati, in which onions along with nutmeg, mace, cinnamon, clove & cardamom are combined with the seeds of *Mucuna Pruriens* (Kauncha beeja), taken daily in the morning and at bed time, it is good toner for the body as a whole.

The juice of the fresh bulb is very acrid & vesicating & much milder by desiccation. The juice irritates the skin when rubbed into it, & this is due to mechanical effect viz. to the presence of hard crystals of calcium oxalate, sharp pointed at each end. Crystals attain a length of 1 millimeter.

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Squill attract moisture from the air, & then becomes pliable & spoiled, on account of which squill & well as their powder, should always be kept in well closed vessels.

Urginea indica Kunth. commonly called as Indian squill, *Scilla indica* Roxb. *Drimia indica* Jesso. True onion, Sea onion. *Scilla* the classic name of the plant, is derived from a Greek word meaning to exite or disturb ; *Scilla maritima* was the name given by Linnaeus, but this was changed to *Urginea* an allusion to the Algerian tribe Ben urgin, near Boma, where stein hill, in 1834 examined this plant, removing its from the genus *Scilla*. But it now retains *Scilla* as its specific name.

Urginea indica bulbs is used in Arthritis, rheumatism, tumors, cancer, Edema, gout, Male sterility, Psoriasis, Chronic cough, Swellings, Pulmonary troubles, Cardiac stimulant, Incutaneous, & subcutaneous parasitic infection.

Geographical sources

It is found growing in sandy places, especially, the seacoast in most of the Mediterranean districts, being abundant in southern Spain, found in Portugal, Morocco, Algeria, Corsica, Southern France, Italy, Malta, Dalmatia, Greece, Syria, Canary island & the cape of good hope, India, Africa.

It is often grown under fig trees in the Italian Riviera, & grown in many botanical gardens, & it is stated recorded as cultivated plant in England in 1648 & in oxford botanical gardens.

It is a variable plant, bulb, leaves, differing greatly in size & color, which led to the formation of several

species, about twenty five species having been described. Two varieties of squill, termed, white & red squill identified by druggists.

Both varieties are mentioned by pling & other ancient writers: the white squill is mentioned in medieval literature, Red squill in the medical school of salerno.

In its home it is frequently used fresh, in other countries, it is directed by pharmacopoeias to dry & use it.

When fresh the bulb abounds in a viscid, acrid juice which causes inflammation in the skin this is because of Raphides action & it shows high medicinal activity. On drying, there is slight loss of medicinal activity.

When kept in a dry place, Squill retains its virtues for a long time, when powdered unless carefully preserved in a dried state its absorbs moisture & forms a hard mass & it has to be kept dry over quick lime.

The chemical constituents of squill are imperfectly known. Merek in 1879 separated the three bitter glucosidal substances. Scillitoxin, Scilliperin & Scillin. The first two are amorphous & act upon the heart, Scillin is crystalline & causes numbing & vomiting other constitutes are mucilaginous & saccharine matter, a peculiar carbohydrate named *Sinistrin*, an *Inulin* like substance which yields *laevulose* on being boiled with dilute acid. The name Sinistrin in 1834 first proposed by *Macguart* for Inulin.

Calcium oxalate is also present in bundles of long, acicular crystals which easily penetrate the skin when the bulbs are handled & cause intense irritation sometimes eruption, if a piece of fresh squill is rubbed on the skin.

The chemistry of squills is not worked out fully. Most of the glucosides described have only been prepared in an amorphous condition with uncertain chemical identity.

Medicinal uses

Indian squill was valued as a medicine in early classic times, being official in all pharmacopoeias. Oxymell of squill, used for coughs was invented by Pythagoras who lived in 6th century before birth of Christ. Theophrastus in 3rd century mentioned Indian squill, epimenides, a greek have made much use of it.

Homer referred it as sea onion, pling & dioscorides was acquainted with it & introduced the method of making vinegar of squills, compounds of squill with honey was administered by Arabian Physicians of the middle ages, introduced the drug into European medicine which is still in use. It is largely used for its stimulating expectorant & diuretic properties & is also a cardiac tonic, it has also been given as an emetic in whooping cough.

It forms a powerful stimulant of the urinary organs. (A pill containing 1 grain each of squill, digitalis & calomel is popularly known as iriemeyer's pill) The extract of bulb also shows hypoglycaemic & anti cancer activity.

It also contains various flavonoids including Quercetin & kaempferol polyglycosides, sinistrin, mucilage & calcium oxalate (Ghami, 2003) Fresh squill yields two glycosides Scillaren-A Scillaren-B. Squill also contains dextrose, starch, albuminous bodies, volatile oil, mineral salts.

The peculiar active principles of squill have been investigated by many chemists E. Merck by an unpublished process; obtained amorphous, brown Scillitoxin insoluble in water & ether soluble in alcohol, and crystalline yellow scillin, not easily soluble in water.

It is a glucosid, yielding upon hydrolysis dextrose butyric acid & iso-propyl-alcohol. A glutinous carbohydrate ($C_6H_{10}O_5$) resembling dextrin-exists in squill in large quantity. It was called sinistrin by schmiedeberg (1879). It differes from dextrin in being laevo rotatory & upon hydrolysis yielding chiefly laevulose & other sugars.

In large doses, squill is dangerous, it can not be safely used in any doses, unless combined with opium.

In small doses it stimulates all of the secretory organs, relieve irritation of the Mucous surfaces & check excessive secretions. It acts better in general & passive dropsies than in local dropsies & in those of asthemic character. Dropsies of cardiac origin are relieved by it. it may be used in all cases where no inflammation is present, & there is over action of the kidneys.

It acts favourably where there is a dry harsh skin, parched tongue, feavered lips & contraction of features.

In cardiac dropsy, when the hearts action is feeble & the pulse is weak & rapid, 2 grains of squill may be given in a fluid drachm of infusion of digitalis 3 times a day. As an expectorant it will be found useful in chronic catarrh, humid asthma, pneumonia phthisis, winter cough & other chronic bronchial ailments.

Dose of the powder as a diuretic & expectorant from 1 to 3 grains as an Emetic, 6 to 12 grains of the syrup 1 or 2 fluid drachms tincture 1 to 20 drops.

Wild onion *Urginea indica* are carminative, melt the phlegm & oil extracted from them is volatile.

Onions has several medicinal uses described by various authors as remedy or cure for different ailments.

In rheumatism, asthma, as a deobustrbent, prescribed for dropsy, skin diseases, bronchitis, renal calculi, leprosy, scabies, headaches & disease of the nose (bulb) aids in removing any obstructions to secretion or excretion & expectorant, cardiac stimulant

emmenagogue (bulb) & cyanogenic (plant) anthelmitic, alexiteric.

Wild Onion compound Quercetin linked to lower blood pressure by an average of five millimeters of mercury, indicates new research led to significant reductions in the blood pressure high intake of Quercetin & other flavonoids from onion & other food has been shown to decrease risk of atherosclerosis in an epidemiologic study in the united states.

The chemistry of the squill & its constituents have been reviewed by Stoll (1937) & by Fieser & Fieser (1959). Earlier pharmacologists divided the components of squill into scillaren A & Scillaren B. Scillaren A is composed of an aglycone rhamnose & glucose. Scillaren has a double bond in the glycone. Removal of the rhamnose & glucose from scillaren A produces the aglycones. Scillaren B is a mixture of cardiac glycosides was more effective in its diuretic & natriuretic action than digoxin.

The sap of leaves & bulbs of *Urginea* species are irritating to the skin ; some species produce such marked topical stinging & itching effects that they are used by young xhosa boys during pain – Eudurance games, indicating the presence of bufadienolides.

Bufadienolides containing plants are used as *anthelmintics*, for bronchial asthma, heart conditions, fevers & during pregnancy (Hutchings & Terblanche, 1989).

Ethnomedicinal plant traders in *nelspruit* sell *U. lydenburgensis* under the name masi xabane & isiklenama. Glycosides are usually compounds of plant origin, they are made up of one or more sugars combined with an alcohol, or a complex molecule such as a steroid nucleus.

Since these compounds occur in nature combined with various sugars they have been given the general term of cardiac glycosides. Lyon & Degraff (1967) estimate that more than 400 cardiac glycosides have been found in nature. It is of interest to speculate that in these many cardiac glycosides there may be one or more that are superior to digitalis.

It is the purpose of the present review to focus attention on one of these cardiac glycosides – squill & its chemical constituents.

There is very little clinical use of squill & its constituents in this country, although these preparations are used abroad. The last description of the drug in the U.S. Pharmacopoeia appeared in 1972 ; in the National Formulary in 1960. New & Non official remedies 1952 contains description of Scillaren, Scillaren A & B₁ and Urginin for internal use in treating asthma & itching of skin. A swazi traditional medical practitioner from nelspruit reportedly alleviated “body pains” (possibly

rheumatism) by washing the whole body with a solution prepared by soaking the finally chopped bulbs in water.

U. epigea known as lukhovu to the swati of Swaziland who use it as a soap & for treating back ache (Dlamini, 1981) to the north west in sekhukhuneland smoke from the smoldering bulbs of *U. epigea* is inhaled to relieve headaches (Dyer, 1947).

The most abundant anthocyanin found in the squill varieties examined, was cyanidine 3-monoglucoside, Tetraploids were found to contain Pelargonidin glycoside.

Among the bulbs not exposed to light, the greatest content of anthocyanins was present in the tetraploids. The hexaploids contained no appreciable anthocyanins. Anthocyanins did not appear on the leaves in appreciable quantities, except in the plants grown in the darkness, coinciding with the decrease in chlorophyll content.

Squill has been used from a very early period. The ancient Greek physicians prescribed it with vinegar & honey almost in the same manner as it is used at present. The composition of the drug, first efficiently studied by Merck in 1878, is very complex. The chief constituent is Scillitoxin, bitter and intensely substance Scilliplain is also physiologically active. The bulb contains plenty of Mucilage & a considerable quantity of an irritant resin.

Thirteen bufadienolides were isolated by means of FAB-MS-H-NMR & 13C-NMR studies by Krenn et al 1987. The compounds were structurally elucidated as

- 1) Scillarenin
- 2) Scilliphaeosidin
- 3) Scillarenin -3-O-a-L-rhamnoside
- 4) Scilliphaeosidin-3-o-a-L-rhamnoside
- 5) Gamabufotalin-3-o-d-L-rhamnoside
- 6) 11a-hydroxyscilliglaucosidin-3-o-a-L-rhamnoside
- 7) Scillarenin 3-o-a-L-2¹, 3¹-diacetyl-rhamnoside-4¹-β-D-glucoside
- 8) Scillarenin -3-o-a-L-rhamnosido-4¹-β-D-glucosido-3¹¹-β-D-glucoside
- 9) Scillarenin-3-o-a-L-2¹, 3¹-diacetyl-rhamnosideo-4¹-β-D-glucosido-3¹¹-β-D-glucoside

10) Scillarenin-3-o-a-L-2¹-3¹-diacetyl rhamnosido-4¹-β-D-glucosido-4¹¹-β-D-glucoside.

11) Scillarenin-3-o-a-L-2¹, 3¹-diacetyl rhamnosido-4¹-β-D-glucosido-4¹¹-β-D-glucoside.

12) Scilliphaeosidin-3-o-a-L-rhamnosido-4¹-β-D-glucosido-3¹¹-β-D-glucoside.

13) Scilliphaeosidin-3-o-d-L-rhamnosido-4¹-β-D-glucosido-4¹¹-β¹-D-glucoside

Quantification of Bufadienolides in different cytotypes of *U. indica* in both roots & bulbs were made by Sumitha Jha & Sen (1983).

Kopp et al 1996 isolated forty one bufadienolides from the bulbs of *U. maritima* from Egypt.

Phytosterols identified in roots, bulbs & leaves of diploid, triploid, tetraploid and hexaploid cytotypes of *U. indica* by gas liquid chromatography, such as stigmasterol, campesterol & sitosterol, Sumitha Jha and Sumitha Sen (1981).

Isolation and Characterization of a 29KDa glycoprotein with antifungal activity from bulbs of *urginea indica* (Sandhya Shenoy et al 2006) and also anti-angiogenic and proapoptotic activity a novel glycoprotein from *u.indica* is mediated by NF-KB and caspase activated Dorase in ascites tumors model by Deepak et al 2003.

A detailed review on bio-systematics studies of Medicinal plant *urginea indica* has been made by Shiva Kameshwari Et al (2012).

The Chemical composition of onion (Edible) is compared with wild onion & given as under

Nutritive value per 100 gm of onion

Particulars	Edible (dehydrated) onion cultivated (%)	Non Edible (dehydrated) wild onion (%)
Moisture	4.6	6.16%
Protein (g) (kjelda) Total protein	10.6	8.36%
Fat g	0.8	0.32%
Minerals (g)	3.5	-
Carbohydrate	74.1	66.25%

(g)		
Energy (K Cal)	-	301.32 Kca/100 gm
Calcium (mg)	300.0	0.99%/80 mg
Phosphorus (mg)	290.0	0.13%
Iron (mg)	2.0	230 mg
Carotene (mg)	-	-
Vitamin C (mg)	147.0	-
Magnesium (mg)	-	0.12% / 22 mg
Sodium (mg)	40.0	65 mg
Potassium	1000	120 mg
Copper (mg)	-	0.16 mg
Manganese (mg)	-	0.14 mg
Molybdenum (mg)	-	-
Zinc (mg)	-	0.38 mg
Fibre content	6.4	12.30%
Calorific value	-	3503 cal / gm
Acid value	-	7.23
Total ash	-	6.61%
Ph (5% solution)	-	4.68

Mineral Contents in *U. indica*

Silica	290 mg
Alumina	585 mg
Iron	230 mg
Calcium	80 mg
Magnesium	22 mg
Sodium	65 mg
Potassium	120 mg
Copper	0.16 mg
Manganese	0.14 mg
Zinc	0.38 mg

Therapeutic uses

1. Skin disorders.
2. Anti-inflammatory
3. Worm infestation
4. Diaorrhea
5. Ascites
6. Cardiac disorders
7. Reduce inflammation, in cardiac disorders.
8. Chronic rhinitis
9. Chronic cough (Dried slices)
10. Chronic pulmonary disorders
11. Respiratory diseases
12. Makes heart stronger
13. Renal failure
14. Chronic renal failure
15. Amenorrhea
16. Dysmenorrhoea
17. Itching
18. Useful in cancer

Formulations

Used as syrup & tincture.

Dosage Choorna (powder)
 100 to 200 Milligrams
 Panak – 30 to 60 drops
 Surasatav – 5 to 30 drops

Ayurvedic Properties

1. Guna (Properties) – Tikshan, Laghu
2. Rasa (Taste) – Katu, Tikt
3. Vipak (Metabolism) – Katu
4. Virya (Potency) ushan
5. Prabhav (Impact) Hridya

GC MS analysis in *Urginea indica*: [Petroleum Ether Extract]

Parts used in Plant	Compound with highest peak	% Area
Bulbs Acid hydrolysed	2 – Furancarboxaldehyde, 5-hydroxymethyl –ss 2-Furaldehyde, 5-Hydroxyethyl –ss 5-Hydroxy methyl furfural, ss hydroxyl methyl	28.88%

	furfurss ole	
Roots acid hydrolysed	Pentanoic acid, 4-oxomethyl ester or methyl levulinic	62.76%
Volatile oil of bulbs	2-Butanone, 3-Hydroxy or Acetoin 2.3-Butanediol (R – (R,R)) - & Butane -2.3-diol or 2.3 –Dihydroxy butane	20.5% 25.4%
Volatile oil of roots	Ammonium acetate ss Acetic acid, ammonium salts mindereru's spirits Acetic acid Ethylic Acid Methane Carboxylic acid, Vinegar acid	47.23%
Acid hydrolysed leaves (Gorur)	Pentanoic acid, 4-oxy methyl ester or Levulinic acid, Methyl Ester D-Allose & Beta-D Allose or Hexose	32.01% 34.09%
Acid Hydrolysed leaves (shimoga)	Pentanoic acid, 4-oxy methyl ester or Levulinic acid, Levulinic acid	33.83%

Pharmacology

1. It suppresses vatta, Kapha & pitta
2. Used in worm infestation
3. Cardiac tonic
4. Anti inflammatory
5. Cough expectorant
6. Diuretic
7. Seductive
8. Anti-carcinogenic

Toxicology

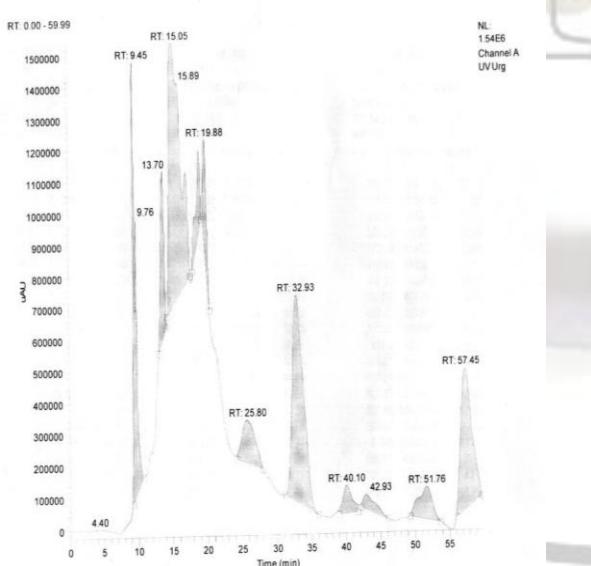
The toxicity of squills has recently been ascribed to a single, bitter, non-nitrogenous glucoside, to which the name scillitin is given causes vomiting & diaorrhea when taken orally.

Active ingredients & its chemistry

Name of the compound	Formula
Sitosterol	C ₂₉ H ₅₀ O
Stigmasterol	C ₂₉ H ₄₈ O
Campeterol	C ₂₈ H ₄₈ O
Octacosanoic acid	C ₂₈ H ₅₆ O ₂
Scillarenin	C ₂₄ H ₃₂ O ₄
5-6-dimethoxy – 3-4-	C ₃₀ H ₃₆ O ₁₇

dioxymethylene- 7-0- (6" - β -D-glucopyranosyl - β -D-glucopyranosyl) flavanone)	
5-4-dihydroxy-3-0-x-L-rhamnopyranosyl-6-glucopyranosyl-7-0- (6-para-coumaroyl- β -D-glucopyranosyl)	C ₄₂ H ₄₆ O ₂₂
5.4-dihydroxy-3-0-(2- β -glucopyranosyl-x-L-rhamnopyranosyl)-6-C-glucopyranosyl-7-0-(6-para-coumaroyl- β -D-glucopyranosyl)	C ₄₂ H ₅₆ O ₂₇
Scillaren A	C ₁₂ H ₂₁ O ₉
Scillicyanosidin	
Hydenburgenin	
Bufadienolides - 6 β -acetoxy-3 β , 8 β , 14 β , trihydroxy-12-oxobufa-4, 20, 22-trienolide	
Bufadienolides-14 β -hydroxybufa-3, 5, 20, 22-tetraenolide	
Bufadienolides – Riparianin	

Purified petroleum ether extract is subjected to HPLC & highest peak has been obtained at a retention time 15.05.



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