Review Article

Traditional Uses of *Allium* L. Species from North East India with Special Reference to their Pharmacological Activities

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ABSTRACT

Use of the members of the genus *Allium* L. in Northeast India is quite significant from the perspective of ethnopharmacology. The pharmacological aspect of the genus *Allium* L. have been clinically evaluated since long due to its typical flavour and ethnomedicinal importance. The plants posses a number of chemical constituents like sulphur, allicin etc. that are responsible for certain biological activities of pharmacological importance including anticancer activity. Several species of *Allium* L. have been reported from northeast India having ethnobotanical uses and are very popular among the ethnic groups either as spice/vegetables or in folk medicine. Considering the importance of the plants in this region a thorough review of literature was undertaken to prepare a consolidated account of ethnobotany and pharmacological activities of the species occurring in northeast India.

Keywords: *Allium* L., traditional use, pharmacological activities.

INTRODUCTION

Allium L. is the largest genus under the family Alliaceae with more than 700 species that are perennial plants with underground storage organs consisting of bulbs or rhizomes[1]. Besides commonly known garlic and onion, many others like leek, scallion, shallot, wild garlic etc. are widely grown for their culinary use and folklore medicine[2]. It is the characterisitic powerful and unusual flavour of this genus with their possible nutritional and medicinal values for which they have been attracting the attention of many of the plant physiologist, chemist, nutritionist and researchers working on phytoremedies worldwide[3].

Majority of species of *Allium* L. are native to the Northern Hemisphere mainly in Asia. A few species are native to Africa and Central and South America[1]. North east India is one of the areas with rich biodiversity in India. It includes the states *viz.,* Assam, Manipur, Mizoram, Nagaland, Meghalaya, Tripura, Arunachal Pradesh and Sikkim. The warm tropical climate of this

region provides the suitable habitat for a wide diversity of both cultivated and wild edible species of *Allium*. The ethnic groups of the region have a treasure of traditional and ethnobotanical knowledge on plants and different ethnic groups inhabiting in the region have been using one or the other species for culinary purposes or as medicine for curing a number of ailments. Most of the species are used as spices and condiments either in dry or in fresh form for preparing almost all the traditional recipes. They even act as a supplementary food at the time of scarcity. The genus includes some commercially important plants with variable phytoconstituents.

Almost all parts of different species of *Allium* L. are used in different parts of North eastern states. The pattern of use of the species varies form region to region and among different ethnic people living here. They use them either as vegetable, famine food or as medicine against certain diseases. These are listed below.

See Table No. 1.

Pharmacological Activities of the Allium L. species

Plants of the genus *Allium* L. shows a wide range of pharmacological activities. A brief overview of the activities of the concerned species has been presented below.

Antidiabetic activity

The tissue extract of seedling parts and callus of *Allium cepa* L. were tested for their antidiabetic activity by feeding them to diabetic rats. During the test the callus culture showed much higher antidiabetic activity as compared to natural bulbs of onion showing callus as a significant alternative source for the isolation of antidiabetic compounds[46]. *A. ascalonicum* L. and *A. sativum* L. were found to have a hypoglycaemic influence on the fructose induced insulin resistant rats[47]. The antidiabetic activity of *A. sativum* L. showed that garlic treated rats had 57% less serum glucose, 40% lower serum cholesterol levels and 35% lower triglycerides compared to the streptozotocin induced diabetic rats. Urinary protein levels in garlic treated diabetic rats were also 50% lower compared to the diabetic controls[48]. Bulb juice of *A. ascalonicum* L. was found to increase the gonadol index amd sperm quality in streptozotocin induced diabetic mice[49].

Antibacterial activity

Freshly prepared infusion of garlic cloves possessed high antibacterial activity against penicillin[50]. The study on the antibacterial activity of *A. cepa* L. extract on *Streptococcus mutans* and *S. sovrinus*, the main causal bacteria for dental carries and *Porphyromonas gingivalis* and *Prevotella intermedia*, the main causal bacteria of adult periodontitis showed that the extract possessed an effect on all the test bacterial strains and the effects were bactericidal against cultured and resting bacterial cells. In the culture medium the activity of the extract was stable even after 48 hours[51]. *A. ascalonicum* L. showed antibacterial activity against *Mycobacterium tuberculosis*[52]. *A. wallichii* Kunth and *A. sativum* L. showed broad spectrum antibacterial activity against human pathogenic microorganisms viz. *Salmonella typhi*, *S. paratyphis*, *Pseudomonas* spp., *Staphylococcus aureus*, *Klebsiella pneumonia*, *Enterococcus faecalis* and *Klebsiella oxytoca*[53]. Crude methanol extract of leaf of *A. ascalonicum* L. showed antibacterial activity against 5 strains of *Helicobacter pylori* [54]. *A. sativum* L. showed antibacterial activity against *Mycobacterium tuberculosis*[55].

Hepatoprotective activity

The hepatopprotective activity of aquatic and alcoholic extract of *A. cepa* L. was evaluated in CCl_4 and paracetamol

induced hepatic injury in rats. It was studied by estimating the serum levels of serum glutamic oxalo acetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), alkaline phosphatise (ALP), direct and total bilirubin. It showed significant reduction of CCl_4 and paracetamol induced elevated serum enzyme and pigment level[56].

Wound healing activity

A. sativum L. was used as anticeptic to heal wounds during world war II [57]. The alcoholic extract of tubers of *A. cepa* L. was found to have better wound healing activity in excision, incision and dead space wound models in albino rats. It was due to free radical scavenging action and the antibacterial property of the phytoconstituents (*viz*. Tannins and Flavonoids) that fastens the process of wound healing[58].

Anthelmintic activity

The crude extract of *A. cepa* L. bulb showed strong anthelmintic activity on *Pheretima posthuma* (earthworm)[59].

Antioxidant activity

Antioxidant activity of *A. fistulosum* L., *A. tuberosum* Rottl. ex Spreng. and *A. sativum* L. were reported from liposome model[60]. The unutilized outer layers of the red variety of *A. cepa* L. was found to be a rich source of quercetin (5110µg/g) with high antioxidant activity. Total phenolic compounds were estimated by HPLC and LC-MS/MS methods[61]. The stem distillate from freeze dried *A. cepa* L. was found to exhibit moderate antioxidant activity in a malonaldehyde/gas chromatography assay and thiobarbituric acid assay[62]. *A. rubellum* auct. non Bieb. was also reported to have antioxidant activity[63]. Stem extract of *A. sativum* L. and *A. fistulosum* L. showed highest antioxidant activity[64].

Anti-inflammatory activity

The stem distillate from freeze dried *A. cepa* L. was reported to exhibit anti-inflammatory activity with a dose related response in lipoxygenase inhibitor screening assay[62]. The methanolic extract of *A. stracheyi* Baker leaves showed significant reduction in inflammation i.e. 61% (100mg/kg) ($P<0.5$) as compared to standard drug diclofenac sodium suspension in 0.1% Tween80 (10mg/kg body weight)[65].

Analgesic activity

The methanolic extract of *A. stracheyi* Baker leaves showed highest analgesic potential i.e. 64.62% (100mg/kg) as compared to Aspirin 68.62% at 25mg/kg body weight[65].

Antimicrobial activity

A. sativum L. extracts exhibit antimicrobial activity against *Staphylococcus aureus*. The stem extract of *A. fistulosum* L. was more active against *Bacillus sublilis*[64]. *A. ascalonicum* L. showed antimicrobial activity against some food borne pathogenic bacteria[66].

Cytotoxic and anti-tumour activity

Epidemiologic and laboratory studies suggests that *Allium* vegetables and garlic constituents have antitumor effects[67]. Porrigenins A & B, novel cytotoxic and antiproliferatic sapogenins were isolated from *A. porrum* L.[68]. Cytotoxic saponins were also isolated from the bulbs of *A. porrum* L.[69]. Garlic juice was reported to inhibit cancer growth in human mammary (MCF 7), endometrial, colon (HT-29), and in experimented animal model due to the presence of allicin and some organosulphur compounds[70-75]. Isoliquiritigenin and lauogenin isolated with the saponins from the bulbs of *A. chinense* G. Don. showed antitumor promoting activity[76]. In vitro

cytotoxicities against human cancer cells and *in vivo* antitumour activities of the thiosulfinates extracted from *A. tuberosum* Roth.ex Spreng were investigated. The thiosulfinates inhibit the proliferation of cancer cells via apoptosis and have antitumour activities[77]. Methanolic extracts from *A. rubellum* auct. non. Bieb. were screened in vitro for cytotoxic activity on MCF 7(human breast epithelium) cell line[78]. Methanolic extract of *A. wallichii* Kunth and *A. sativum* L. samples were evaluated for lethality to brine shrimp larvae. LC_{50} values were calculated by using this brine shrimp lethality test. The LC_{50} value for *A. wallichii* Kunth was found 64.714ppm while for *A. sativum* L. it was found to be 172.48ppm[53]. Bulb extract of *A. ascalonicum* L. showed cytotoxic activity on cancer cell lines[79]. Leaf extract of *A. cepa* L. showed anticancer activity against some selected cancer cells-cervical cell line and leukemic cell lines[80].

Hemagglutinating activity

A mannose-binding protein isolated from two different cultivars of *A. tuberosum* L. exhibited hemagglutinating activity toward rabbit erythrocytes[81].

Antifungal activity

A. sativum L. showed antifungal properities[82]. Antifungal activity of *A. schoenoprasum* L. and *A. tuberosum* Rottl.ex Spreng. against *Botrytis cinerea* was examined and proved[83]. *A. cepa* L., *A. porum* L., *A. ascalonicum* L. and *A. schoenoprasum* L. showed antifungal activity against Aspergillus species[84]. A hydroalcoholic extract of *A. fistulossum* L. showed antifungal activity against some phytopathogenic fungi[85]. Fresh extract of *A. ascalonicum* L. showed antifungal activity against some yeast, dermatophytes and some saprophytic fungi[86].

Hemolytic activity

Phytochemical screening of the leaf extracts of *A. stracheyi* Baker showed the presence of alkaloids, saponins, phytosterols, phenolics, flavonoids and fixed oil. The extracts were tested for their hemolytic property with three different contractions. The butanol extract showed maximum amount of hemolysis[87].

Anxiolytic activity

Phytochemical screening of the aerial part *A. ascalonicum* L. revealed the presence of alkaloids, tannins, glycosides, anthraquinones, phlobatannins and flavonoids, that are found to be responsible for the anxiolytic and sedative activity[88].

Antiviral activity

A fructan that acts as an antiinfluenza A virus substance was isolated from hot water extract of green leafy part of *A. fistulosum* L.[90]

Cardioprotective activity

Steroids of *A. chinense* G. Don. prevents cardiac injuries induced by oxidative stress[91].

CONCLUSION

It can be concluded from the comprehensive literature study of the species that the *Allium* L. species growing in this region are tremendous source of medicinally and economically important plnats. They are widely and very popularly used as vegetables and spice. Also their potentialities against certain disease are proved experimentally during past years. The genus shows powerful anticancer activity with biologically active compounds like Allicin and other sulphur compounds which also give them the peculiar spicy odour. More than the anticancer it also possess antimicrobial, antifungal, hemolytic,

anxyolytic, cardioprotective, antiviral, analgesic, anti-inflammatory, antioxidant, anthelmentic and antidiabetic activities. Thus there is a terrific scope for the use of the phytoconstituents of *Allium* L. species clinically and commercially. For this further scientific and practical exploration with sustainable conservation of the locally available species are necessary to get therapeutic efficacy.

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Table 1. Traditional uses of *Allium* L. species in N. E. India

Name of the species	Local name(s)	Part(s) used	Indications	Edible use	State(s)	Reference
Allium sativum L.	Nohoru (Ass)	Bulb	Leucorrhoea		Assam	4
	Naharu (Ass)	Bulb	Roundworms		Assam	5
	Shyamfhrengufu (Di)	Bulb	High blood pressure	Vegetable	Assam	6
			Diabetes		Assam	7
	Naharu (Ass)	Bulb	Back ache, Lumbago, used as poultice		Assam	8
			Diabetes, Blood pressure, Gastritis disorders		Assam	9
	Naharu (Ass)		Flatulence		Assam	10
	Purunvar (Hm)	Bulb	Gastro-intestinal problem		Assam	11
		Bulb	Menstrual abnormalities		Assam	12
	Naharu (Ass)	Bulb	Cough and bronchitis		Assam	13
	Naharu (Ass)	Rhizomatous stem	Asthma		Assam	14
	Lashun (Ass)	Bulb	Lung congestion, Cough, Bronchitis		Assam	15
	Rasun (Ass)	Bulb	Body ache		Assam	16
	Thingkh (Ch)	Bulb	Injuries to remove pus	Vegetable	Assam	17
	Kampunc talab (Mish)	Bulb	Fever		Assam	18
	Naharu (Ass)	Bulb	Indigestion of domestic animals		Assam	19
	Nohoru (Ass)	Bulb		Mod pitha	Assam	20
	Naharu (Ass)	Bulb	Cough		Assam	21
	Kumpun talap (Mish)	Bulb	Cough		Assam	22
	Naharu(Ass)	rhizome	Allergy		Assam	23
	Rasun, Rynsun (Pn)	Bulb, cloves	Hypertension, Influenza	Spice	Meghalaya	24
	Losun (A)	Stem	Lung disorder	Vegetable	Arunachal Pradesh	25
	Chong, cult (Mo)	Leaves and	Bone fracture		Arunachal	26

		rhizomes			Pradesh	
	Jilap (Me)	Bulb	Stomach bloating		Arunachal Pradesh	27
	Jilap (Me)	Leaves, tubers		leaves as vegetable and tubers as spice	Arunachal Pradesh	28
	Ziva (Ng)	Bulb	Cough		Nagaland	29
	Garlic/ lashing (Sn)	Bulb	Cough and cold, High blood pressure, Indigestion and to promote the flow of urine		Nagaland	30
	Lasung, garlic (Ao)	Corm/bulb	Constipation, Hypertension, Chest pain, Back pain and sore throat		Nagaland	31
	Chanam(Mon)	Bulb	Paralysis, Rheumatic complaints, Muscular pains, Piles, Worm diseases		Manipur	32
A. chinense G.Don	Mwjngphang (Di), Tlang purun (Hm), Newgi tingdra (Ze)	Leaf/ inflorescence		vegetable and spice	Assam	33
	Rynsun china (Kh)	Bulb		Spice	Meghalaya	24
	Salang(Di)	Bulb	Constipation		Assam	34
A. hookeri Thw.	Tlang purun (Hm), Tingdra(Ze)	Whole plant			Assam	33
	Ja-ud (Kh)	Leaf		Leaves eaten raw as salad with boiled potatoes and dry fish or used for flavouring curry	Meghalaya	24
	Lahun (Ny)	Bulb	Cough and cold, Wound healing, Skin diseases		Arunachal Pradesh	35
		Bulb	Cough, Cold, Skin diseases and wounds.		Arunachal Pradesh	36
	Lam, cult (Mon)	Leaves & rhizome	Skin disease, Bone fracture		Arunachal Pradesh	26
		Bulb	Jaundice		Arunachal	37

					Pradesh	
	Zhiva (Ng)	Roots & leaves	Massaging and anthelmintic		Nagaland	30
	Maroi-napakpi(Mon)	Whole plant	Blood pressure, Stomach ulcer		Manipur	32
	Maroi-napakpi(Mon)	Rhizome		vegetable	Manipur	39
A. cepa L.	Piyaj (Ass)	Bulb	As stimulant		Assam	13
	Piyaj (Ass)	Bulb	Insect bites		Assam	19
	Purunsen (Hm)	Bulb	Menstrual trouble		Assam	11
	Piat (Ja) Samphrang (Di)	Bulb	Eye disease or Evil eye		Assam	38
	Piaz(Ass)	Bulb	Fever with cold		Assam	40
	Upiat (Kh)	Bulb	Promotes flow of urine and used as depurative	Spice	Meghalaya	24
	Chouck (R)	Bulb	Eye wart		Tripura	41
		Bulb	Eye pain		Arunachal Pradesh	36
A. rubellum auct. Non Bieb.	Alomana (Idm)	Leaves		Vegetable	Arunachal Pradesh	42
A. porrum L.	Repjee (Ng)	Leaves	Influenza,Fungal infection	Vegetable	Nagaland	43
A. ascalonicum L.	Rupchi (Ao)	Leaves	Wounds of injured animals, Anthelmintic		Nagaland	31
A. tuberosum Rottl.ex Spreng.	Jyllung, jinglang, yelling (Kh)	Bulb		Eaten raw	Meghalaya	24
A. wallichii Kunth	Dung-dunge	Whole plant		Vegetable	Sikkim	44
A. caesium Schrenk	-	-		Vegetable	Sikkim	44
A. scheonoprasum L.	-	-		Vegetable	Manipur	45

Figure 1. Inflorescence of *A. cepa* L

Figure 2. Tubers of *A. hookeri* Thw L

Figure 3. *A. fistulosum* L.

Figure 4. *A. fistulosum* L.

Figure 5. *A. tuberosum Rottl. ex Spreng*

Figure 6. *A. chinense G. Don.*