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Ethnopharmacological attributes of *Polygala senega* Linn.

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Abstract

India has about 45000 plant species, many of them claimed to possess medicinal properties. Medicinal herbs act as a potential source of therapeutic aid and it play significant role in health system all over the world for both humans and animals. *Polygala senega* Linn is species of a flowering plant in the Polygalaceae Family .The plant has been referred to as a marvel plant because every part of it has been found to be of medicinal magnitude. The present paper aims to review various plant species of *Polygala* from Indian origin and their constituents, which have been used in the traditional system of medicine to exhibit Hypoglycemic, Anticancer, CNS depressant, Hypolipidaemic and Antifungal activity.

Key-Words: *Polygala senega* , Hypoglycemic , Anticancer activity

Introduction

Herbal medicine is the oldest health care known to a mankind. An herb has been used to all cultures thought out history. It is an integral part of development of civilization primitive man observed and appreciated the great diversity of plants available to him. They observed that about 74% of 119 plant-derived pharmaceutical medicine are used in modern medicine.(1) It also estimated that 5 billion people (90% of the world population) presently used herbal medicine for health care for people. (2) Over 100 of year herbal medicine are derived from medicinal plants minerals and organic matter is still the main stay of about 75-80% of the world population for health care marketed .and gaining popularity in developed and developing countries. (3) Herbs have medicinal properties due to presence of different action principles like alkaloid, volatile oil, essential oil, glycoside resin, oleoresins, steroids, tannins, terpenes and phenols. (4). Medicinal plant research pursued with several goods like the development of low cost therapeutic compound and discovery of prototypic drugs (7). In the last few years there is an exponential growth in the field of herbal medicine because of their natural origin, easy availability, efficacy, safety and less side effects. With efficient to cure age related disorder like memory loss, Osteoporosis, immune disorder, etc, For which no modern medicine is available (5,6) *Polygala senega* is also play a wide role in herbal and allopathic medicines. It is a perpetual herb with many stems able to 50 cm tall. Stems are usually unbranched.

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But some old foliage can have branch stems. A mature plant has stems upward from hard woody rootstock that spread horizontally. The lance shaped leaves are alternately arranged. They are mainly grown in summer season at India, and complete their life cycle in 4-5 month self pollination. (7,8)

Synonyms: snake root, polygala, rattle snake, var. latifolia (Japan) .

Taxonomical class

Kingdom	:	Planate
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Subclass	:	Rosids
Order	:	Fabales
Family	;	Polygalaceae
Genus	:	Polygala
Species	:	*senega*

Macroscopial character

Color :Dark brown ,purplish yellow.
Odour :Charecteristic odour of methyl salicylate
Taste : Sweet and then acrid
Size :5-20 cm. Dia 30-100cm
Appearance : A large knotty crown with a long tapering root normally curved twisted. Having two or more large branches.
Fracture : Short bark in splintery in the wood.

Geographical source & distribution

The root has economic value so it is cultivated on a small scale particularly in India, Japan, Canada and Brazil. Until the 1960.India is the second largest exporter of the product. (31) But the root was collected from the wild, most come from Saskatchewan and Manitoba. It is still wild harvested today and three quarters of the world supply is taken from the wilds of the inner take region of Manitoba native peoples

provide most of the labor digging roots and selling them to drug company. (10)

Plant description

Polygala senega is a perpetual herb with many stems able to 50 cm tall. Stems are usually unbranched. But some old foliage can have branch stems. A mature plant has stems upward from hard woody rootstock that spread horizontally. The lance shaped leaves are alternately arranged (11).The lower leaves are arranged and scale like the inflorescence spike of rounded white or greenish flowers. The fruit is covering with two hairy black seed (12). It's taste like winter green and very pungent. There are two root morphs a northern morphs growing in Canada which are towards minnesta has longer root upto 15 cm long by 1.2 cm wide with dark brown and sometime purplish toward the top. The southern morph found in the south eastern united state that has smaller yellow brown roots. It also grows in Paris. Due to wet short time and river back habitat it can grows in thin rocky areas usually in calcareous soils and due to distributed habitat it may grow in roadsides. (11).

Growth and development

Polygala senega is a pioneer species can be found in flowering thought-out the year in ever wet climate. In summer season they complete their life cycle in 4-5 month self pollination probably occurs in all species although the flowers of majority are attractive to insect and adaption to pollinating insect occur (13).

Ecology

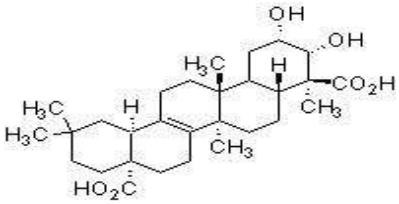
The herbaceous polygala species are sun loving and grow in open woodland often grassland. In contrast to shrubby species they are restricted under growth of rain forest (14).

Growth pattern and germination

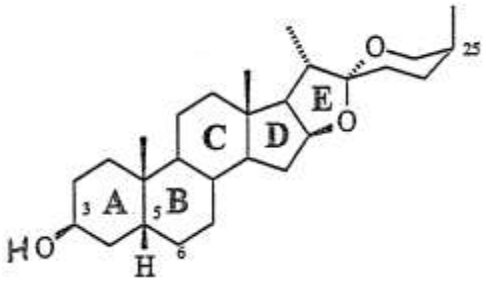
Polygala senega is a pioneer species can be found in flowering thought-out India. When the seeds coat is removed or deeply scarified, germination reaches 70-100% respectively suggesting the presence of a germination inhibitor in the seed coat(14) .Washing the seeds in running water for 10 days results 60% germination maximu occurs in 25-28oC. The Diffused daylight gives better result in continuous light (15) The Dark period and red light stimulates germination of scarified seeds more than other wavelength .The optimum Ph for germination was 6.5 and gibberellic acid is effective in breaking the dormancy of both sacrified and untreated seeds at rates of 100% and 70% respectively. Zieba R.(1996) has observed that *Polygala senega*is more productive then *Polygala tenuifolia*. It grows well in thin rocky areas usually in calcareous soil, but due to distributed habitat it may grow in roadsides..(16,17).

Major chemical constituents

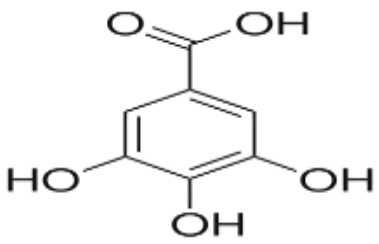
Polygala senega contains two saponin glycoside (Figure 1) which are triterpenoid in nature. They contain senegin (4%) and polygalic acid (5.5%). Senegin on hydrolysis gives senegenin and senegenic acid and presenegin. It has been also reported that senega contains other derived form of presenegin called seneginII.The sweet taste of drug is due to polygalitol (1,6-anhydrosorbitol). The odor of drug is due to small amount of methyl salicylate which is formed as a result of brakedown of some unknown glycoside. Senega also contain fixed oil and sterol, but it does not contain starch.(31) *Polygala senega* contains salicylic acid and its methyl esters 0.1-0.2% hydroxyl cinnamic acid (example : caffeic acid , ferucil acid sinapic acid) free from esterified with sapponins (18). It also contain Carbohydrates, Arabinose, fructose sucrose, saccharoses, reffinose, melibiose,1,5anhydro _dilucitol and D_glucitol derivative (19). Paper trisaccharide, mucilage pectin aseries of oligosaccharide esters, senegosesA-o, containing acetic acid, benzoic acid *trans* and *cis* ferulic acid moietieslinked to glucose and fructose(20).The esterifying acids are 3,4,5 trimethoxyl cinnamic acid ,P_hydroxybenzoic acid ,sinapic and ferulic acid (22). It has a complex mixture of bidesmoidic triterpene saponin (6_10%) based on the aglycone presenegin. The total senegin mixture to be preffered to as senegin. The saponin of polygala senega var latifolia are glucosides of presenegin with tetra penta or hexa glucosyl groups linked at c-28 and including 4-methoxy cinnamoyl ,fucosyl resulting in eand Z-cinnamoyl isomer of each saponin(9-11).Senegin was first saponin to be characterized and were E isomer P. tenufolia contain a similar properties named onjisaponinA-G (24,25). A no. of xanthenes have been isolated from p.tenuifolia including 4-c (B-Dapiofuronosyl-(1-6) B-Dglucopyranosyl) 1,3,6 trihydroxy & methoxyxanthones(22).



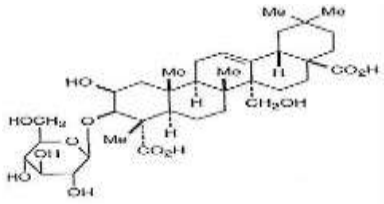
Triterpenoid saponin



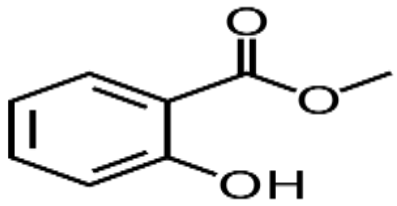
Sapogenin



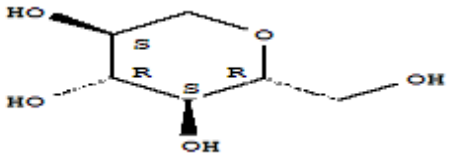
Phenolic acid



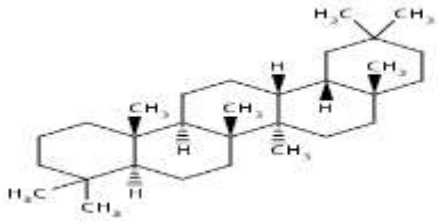
Polygalic acid



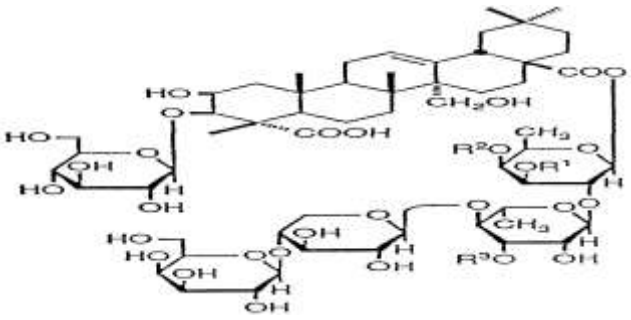
Methyl salicylate



Polygalitol



Senegin III



Senegin I

Traditional claims

Polygala senega is a pioneer species relatively high in bioactive secondary compound and are important for variety of functions is economically used as a source of fat resin sterol and saponins. Senega snakeroot was utilized by a senega Indians in treatment of rattlesnake bite.(1)The root is ground into powder and used in various patent medicine particularly in cough medicine as a stimulant expectorant it is present in same prescription drug used in treatment of bronchitis and asthama.senega plant is therapeutic used in Anti-cancer, Anti-dote, CNS depressant, Expectorant, Bronchiol asthama, snakebite, Pneumonia Anti-fungal.(31) Seneca snake root is also used in veterinary medicine aside from its side effects on respiratory system. It promotes perspiration and urination.(32)

Ethanopharmacological claims

Hypoglycemic activity

Yohikawa M. *et al.(*1995) has explained the significant hypoglycemic effects on rats SeneginII (2.5mg/kg), intraperitonially reduced blood glucose concentration in normal rats . The ethanolic extract of it has been reported to useful in cancer treatment.(42). Senegin II AND E, Z- senega-saponins a and b have significant hypoglycaemic effects in rodents (38) seneginII (2.5mg/kg ,intraperitonially reduced blood glucose concentration in normal mice from 220mg/dl to 131 mg/ dl 4 hours after administration and also significantly lowered blood glucose concentration in mice from 434mg/dl to 142mg/dl under similar test condition ($p<0.001$,compared with control, for both studies).(23). In glucose tolerance test in rats, administration of E,Z-senegasaponin a and b (100mg/kg ,orally resulted in glucose concentration of 107-123mg/ml after 30 minute compared with 156mg?ml in control animals ($p<0.001$) (31,43).

Anticancer activity

Boerickie W. (1976) has explored the chemotherapy of lung cancer. The treatment of lung cancer recommended intake of alternative medicine of *Polygala senega*. (28) The ethanolic extract of it has been reported to useful in cancer treatment. Surgical resection or radio systemic chemotherapy is the main lines off treatment recurrence is quite stage of lung cancer combined is only 15% .therefore another approach that focuses on the prevention of lung cancer is gained ground although the cessation of tobacco smoking is important for lung cancer(31) .An alternative and novel approach for the treatment of lung cancer recommended intake of alternative medicine *Polygala senega* (polygalaceae) ethanolic extract of polygala senegaa has been reported to useful in cancer.(32).

CNS depressant activity

Carretero M. *et al*. (1986) has observed the CNS depressant activity of *Polygala senega* methanolic extract The sleep time of mice is increased 30-40 minute as compared with chlorpromazine hydrochloride. A methanolic extract of *Polygala senega* has induced sleep.(45). CNS depressant properties in mice (example reduction in spontaneous activity inhibition of amphetamine stimulation, poyention of barbiturate –induced sleeping time, and decrease in rectal temperature)have been documented for polygala senega (32) similar properties have been reported for polygala tenuifolia and have been attributed of the saponin constituents. Amethanolic extract of P.tenuifolia various fraction and pure onjisaponins B, F and G prolonged hexobarbital sleeping time in mice. Onjisaponin F produced sleep times in mice of 33 and 35 minutes for chlorpromazine hydrochloride (2mg/kg).(31,45).

Inhibition of alcohol absorption

Yohikawa M *et al*.(1995) Has explained the inhibitory effects on alcohol absorption in rats. E, Z-senegasaponin (100mg/kg) administer orally to rats 1 hour after given 20% aqueous Ethanol. 5ml/kg reduced blood alcohol concentration after one hour from 0.5- 0.2mg/ ml. (29,31). E,Z-senegasaponin a and b from p.senega var .latifolia have potent inhibitory effects on alcohol absorption in rats. E,Z-senegasaponin aor b (100mg/kg) administered orally to rats 1 hour after 20% aqueous ethanol (5ml/kg) reduced blood alcohol concentration after one hour 0.5mg/ml to0.02mg/ml.(10) Under similar test conditions, E,Zsenegin II administration led to blood ethanol concentration of 0.009mg/ml.(33).

Hypolipidaemic activity

Masuda M. et al. (1996) has explained the hypolipidemic activity of *Polygala senega* methanolic extract. 5mg/kg intraperitonial dose of polygala senega methanolic extract decrease the triglyceride concentration in blood of mice. Seven hour after administration of an n-butanol fraction of a methanolic extract of polygala senega var.latifolia containing senegin II (5mg/kg).intraperitoneally (40),The mean standard deviation blood triglyceride concentration was 65mg/100ml,compared with 152mg/ml in control animals ($p<0.005$) under the similar test condition. Pure senegin II at a dose of 5mg/kgwas also reported to lower triglyceride concentration in mice (23 31).

Antiviral, Antifungal, and Antibacterial activity

Hamburger M. et al. (1984) also reported the antiviral activity of aqueous extract of *Polygala senega*. Guinea

pig serum taken 2 hours after administration of lyophilized aqueous extract of p.tenuifolia *(600mg* intraperitoneally) inhibited the growth of herpes simplex virus type 1 (HSV1) in verocell. An unspecified senegin from p.senega produced a 34% inhibition of influenza virus (A2/japan 305) at a concentration of 12.5 microgram/ml .An ethanolic extract of p.senega has been reported to inhibit growth of fungi (46, 31) .Polygala erioptera and p.peniculata have exhibited molluscicidial activity and p.paniculata is reported to posses antifungal activity.(17)Hamburger M. et a. (1984) has been reported the antifungal activity of polygala senega. A n-buatanolic fraction of polygala senega contains onjisaponin (100mg/ml) inhibit the cyclic adenosine monophosphate .it shows the antifungal activities on rats.(34,46).

Snakebite

Tyler V. E. (19870 has explained the in vitro test sterol. It has been found to display a large array of Pharmacological properties and, it inhibits the anti-inflammatory of activity snakebite by alcoholic extract of *Polygala senega* on dogs. It also inhibit the poison of snake bite.

Anti-ulcer activity

Yamahara J. et al. (1975) has been reported 50% methanolic extract of *Polygala senega* shows the antiulcer activity. Intragastric administration of 50% methanolic extract of *Polygala senega* root (2mg/kg body weight) .Inhibited stress induced gastric ulcer in rats.

Expectorant activity

BoydE.M.et al. (1946) has investigated in vitro Expectorant activity. Intragastric administration of a fluid extract of radix senegae (0.1-10 ml /kg) body weight enhance the production of respiratory tract fluid decererebrate or anesthetized animals(39).Misawa M. et al (1980) has showed the Expectorant activity of *Polygala senega* root administration of a syrup to anasthesized dogs. It increased the volume of respiratory tract fluid within 5-30 min. (P>0.001)after 2 hours, thefluid volume in the treatment group was 0.001ml. in control animals treated with saline.(36). The expectorant activity of crude drug is due to the constituents' saponin, which produce local irritation of the mucous membrane of throat and respiratory tract. This irritation stimulates and increases in bronchial secretion. The diluting mucous reducing the surface tension its viscosity in oral administration of fluid. Extract of Polygala senega was shown to reduce the viscosity of mucous in patients with bronchitis (31,40).

Side effect and toxicity

Saponin of *Polygala senega* are generally regarded as irritant to the gastrointestinal mucosa ,and irritant properties have been documented for senega plant and for related senega species (51) Large doses of senega are reported to cause vomiting and purging.(47)

Conclusion

In the present comprehensive review, we reffered primary and secondary data to compile the information based on taxonomy, origin, distribution, and pharmacological claims on *Polygala senega.* (Linn).Traditionally the plant used widely for the treatment of various ailment sbut scientifical few of them was screened out. Thus the scientific studies should be conducted to investigate the unexploited potential of *Polygala senega* (Linn).

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