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Isodon rugosus as potential source of phyto-pharmacological agents: A review

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Abstract

This piece of writing is aimed to attract the concern of readers and researchers toward the natural bioactive compounds hidden in the depth of natural life. Plant based bioactive compounds have become first choice as a potential source of pharmacological agents. Families of bioactive compounds such as flavonoids, polyphenols, carotenoids, diterpenes, sterols and vitamins enlist the class of naturally occurring families of organic compounds that are widely utilized for the maintenance of natural life. Isodon rugosus is one of the richest plants of Lamiaceae family which contain plenty of biological active compounds. In this review we will focus on labeling and exploring the biological importance of Isodon rugosus. Isodon rugosus plays meaningful role by performing biological activities such as antibacterial, antioxidant, antifungal, anticancer, insecticidal, analgesic and ethnobotanical activities. The strong bioactive potential of Isodon rugosus may act as a key factor to researchers for doing further research work on entire plant to introduce it in pharmacological agents to make the life more sustainable.

Keywords: Isodon rugosus; bioactive compounds; pharmacological activities

Introduction

In the last two decades phytochemicals has become a deep concern for researchers to explore their bioactive potentials for advancement in pharmaceutical industry. These are derived especially from plants as a principal source of phytopharmaceutical agents [1].

Now a day's a number of plants remedies are being used in treatments for different disorder conditions [2]. With respect to World Health Organization report, about 75% of the total world population to be governed by plants based medicines [3]. About 70,000 plant species are used as medicinal sources worldwide [4]. According to assessment, about 34% of total plants found in Pakistan are medicinal plants [5].

Among these medicinal plants Isodon rugosus has become deep concern for Herbalists (Hakims) due its strong bioactivity against different diseased conditions of living body. So, to explore knowledge about such medicinal plants which show awesome capabilities in the field of pharmacology is very essential for development of the World. Family name of Isodon rugosus is Lamiaceae (Labiateae) having 250 genus and more than 3000 species [6, 7]. Basically, Isodon rugosus is flowering plant, flowers of this plants create a wonderful site for tourist from July to September and its seeds cultivate from August to October.

With reference to previous literature Isodon rugosus play a significant role in the field of medicine and pharmacology but its narrow use inspires the researchers and scholars to expand and explore its importance in terms of research articles as well as review articles. This review is aimed to label the bioactive importance of Isodon rugosus as -phytopharmacological agents.

Importance of Isodon rugosus

Isodon rugosus is a famous genus of his family because it comprises huge number of bioactive chemicals. Bark of this plant is found to be helpful to sack general body pain and treat dysentery ethnomedicinally [8]. Dried leaves of Isodon rugosus are useful to relieve toothache [9]. Leave extract of this plant in the form of liquid drops can be used for earache and effected skin [10]. The extract of this plant can be applied for gastric and abdominal pain [11]. Isodon rugosus has been proved to be supportive for treatment of several infections like microbial infections including viral, bacterial and fungal infections, blood pressure, pyrexia and rheumatism [12, 13]. Isodon rugosus play an impor-

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tant role in pharmacological activities such as hyporglycaemic, antidiarrheal and bronchodilator [14, 15]. Its seed powder and leave paste can be used on external wounds for blood clotting and helpful to remove mouth infection caused by fungus [16]. The specific preparation of this plant can be applied to treat infection that caused by oral fungus and also used as stimulant [8].

Bioactive constituents of Isodon rugosus

Extraction from different parts of Isodon rugosus with the help different solvents like methanol, ethanol and ether has been reported to attain bioactive constituents including essential oils. Some of the bioactive compounds like ?-tocopherol, ?-amyrin, sitostenone, stigmasterol acetate, totarol and totaradiol has been fractionated from ethanolic extract of Isodon rugosus by using chloroform [17].

Alpha Tocopherol

Alpha tocopherol belongs to the family of vitamin E. It contains benzo dihydropyran ring and a hydroxyl group which reduce the free radicals by donation of hydrogen atom [18]. The hydrophobic nature of the side chain of the ?-tocopherol helps it to penetrate into biological membranes. It is fat soluble bioactive compound that is widely found in seed, nut, leaf, and essential oil of the plant materials [19]. Alpha tocopherol has taken much attention due to its antioxidant, antimalarial, anticancer as well as ant thrombolytic activities [19].

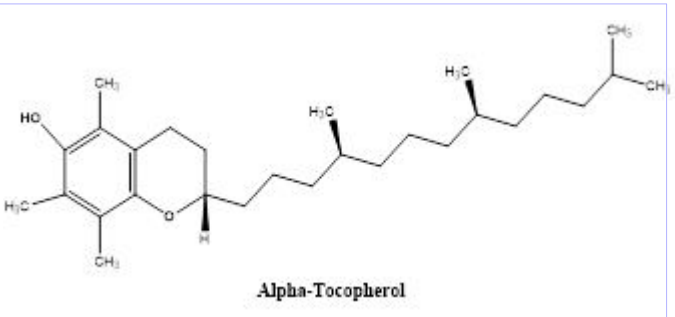

Figure 1 Alfa- Tocopherol

Beta Amyrin

Beta amyrin enlisted to the class of naturally occurring triterpenes. This pentacyclic structure of triterphenol is commonly scattered in natural life and isolated from the different parts of the plant material [20]. Oleanolic acid act as a precursor for the biosynthesis of ?-amyrin in plants [20]. Bundle of studies proved that ?-amyrin exhibits antioxidant, antibacterial, antinociceptive and anti-inflammatory activities [21].

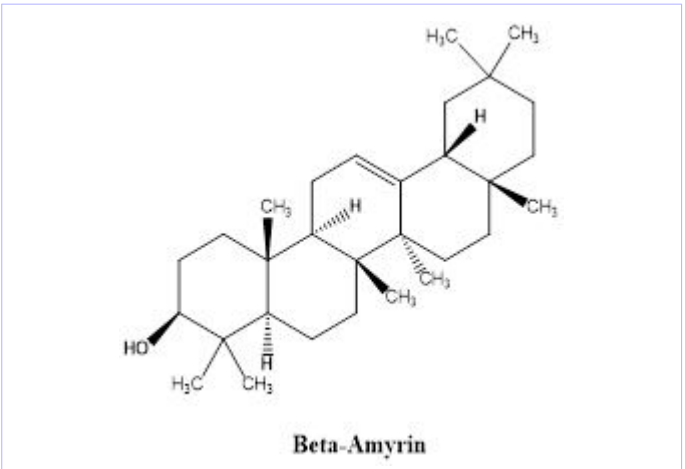

Figure 2 Beta-Amyrin

Sitostenone

It belongs to the family of sterols. Sitostenone is a constituent of one of the most widely used species such as Quassia amara wood which is utilized in the field of food and pharmaceutical industry [22]. Antioxidant, antibacterial, ant inflammatory, and anticancer activities of sitostenone indicates to researchers and scientists to search and explore further hidden potential of sitostenone [23].

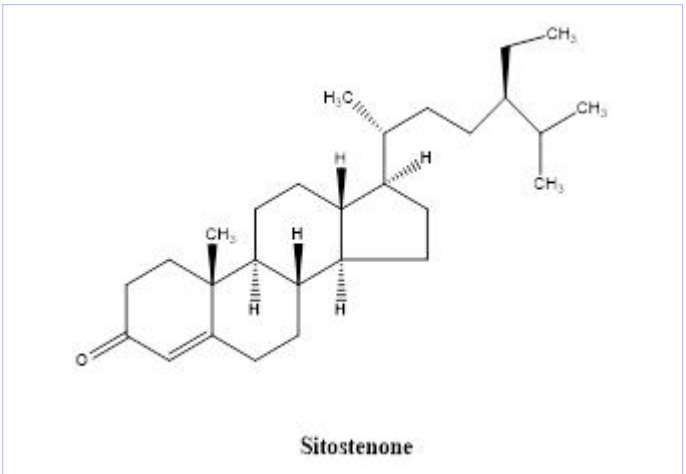

Figure 3 Sitostenone

Stigmasterol acetate

Stigmasterol acetate is a salt of stigmasterol which belongs to the sterol family commonly known as phytosterol. This unsaturated phytosterol is found in the plant oils such as rape seed, soybean and caliber bean [24]. Stigmasterol is extensively used in food industry as food additives to increase the sterol con-

tent [24]. It also used as a reducer towards cardiovascular diseases. Stigmasterol proved himself to a potent antioxidant, antimicrobial, antidiabetic, insecticides, antitumor and antimutagen potential [25].

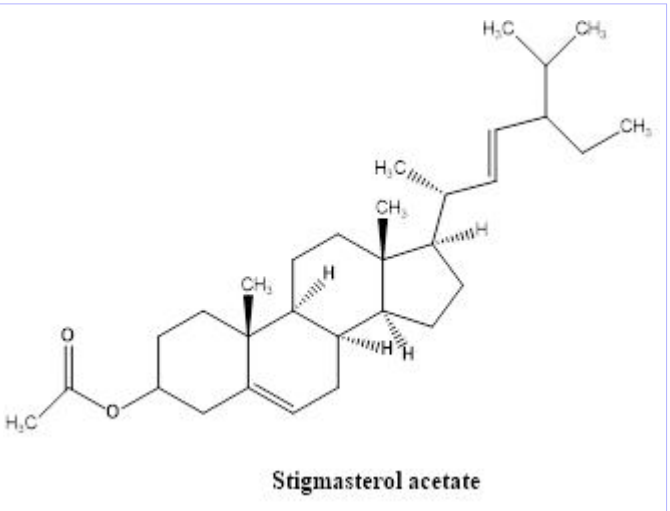

Figure 4 Stigmasterol acetate

Totarol

Totarol associated to the diterpene family that is naturally produced as bioactive compound in plant material. It was firstly isolated from Podocarous totara heartwood a New Zealand yew tree [26]. It is commonly used for the indication of the quality of the juniper berry-based sprits [26]. Totarol is also used in traditional medicines as antibacterial and antifungal agents for curing of fever, venereal diseases, coughs, asthma and cholera [27].

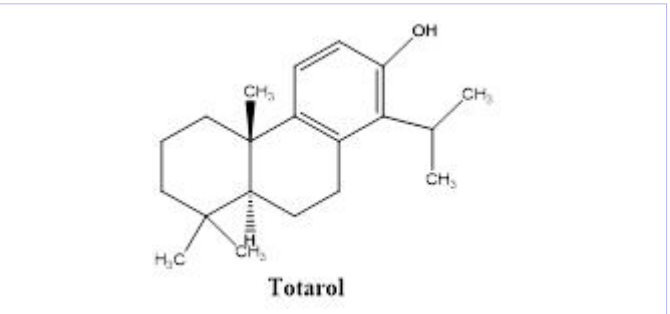

Figure 5 Totarol

Totaradiol

Totaradiol is well known antioxidant related to diterpene family [28]. It is found in majority of terrestrial plants and isolated by using fractionation with the help of chemical methods. Totaradiol proved himself as potent antioxidant by performing extraordinary results against DPPH, ABTS, FRAP, NADPH and ?-carotene linoleic based antioxidant assays [28].

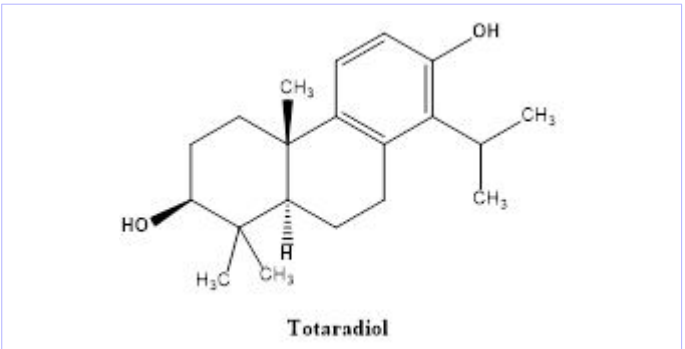

Figure 6 Totaradiol

Alpha Copaene

Alpha copaene is a tricyclic sesquiterpene that is typically found in essential oils of the plant material. It is quite famous due to its antioxidant, anticarcinogenic, hepatoprotective, anti-inflammatory, antigenotoxic, cytotoxic and cytogenotoxic activities [29].

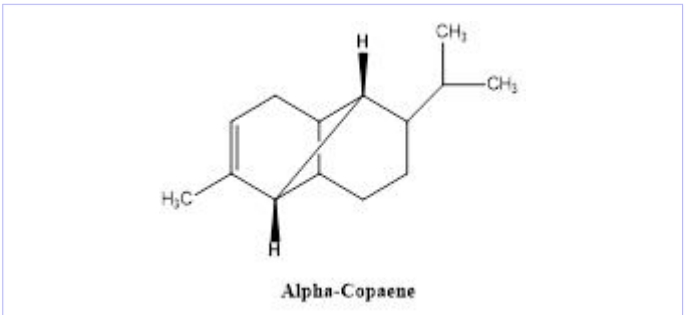

Figure 7 Alpha-Copaene

Bioactive potential of *Isodon rugosus*

Antibacterial activity

Those compounds which have potential to kill or to slow down the growth of bacteria are generally known as antibacterial compounds [30, 31]. Zeb et al. [32] have utilized Isodon rugosus extract in different solvents like water, ethyl acetate, chloroform, ethanol, normal hexane and flavonoids against eight different bacterial strains including Escherichia coli (739), Klebsiella pneumoniae (700603), Pseudomonas aeruginosa (27853), Enterococcus faecalis (29212), Proteus mirabilis (13315), Staphylococcus aureus (29213), Bacillus cereus and Salmonella typhi and

concluded flavonoid and ethyl acetate based Isodon rugosus extracts have high antibacterial activity towards all the selected bacterial strains. Essential oil extracted from Isodon rugosus which contains some bioactive compounds such as ?-copaene, ?-cubebene, aphanamol, cannabinol and calamenene has also been efficient antibacterial assay against five bacterial strains like Clavibactor, Escherichia coli ATCC 739, Staphylococcus aureus ATCC6538, Bacillus cereus, Xanthomonas [33]. Abdur Rauf and his team also subjected Isodon rugosus based extract in methanol, ethyl acetate, chloroform and n-hexane against six different bacterial and concluded ethyl acetate based extract exhibit comparatively good activity against these bacterial strains [34].

Antioxidant activity

The compounds which have ability to delay or inhibit the oxidation process of organic matter or other organisms are classified as antioxidants [35, 36]. Antioxidants are widely utilized to prevent wide range of disorders as well as preservatives in cosmetic and food products [35]. Methanol based extract of aerial parts of Isodon rugosus has been employed as antioxidant against 2,2-diphenyl-1-picrylhydrazyl (DPPH) at 0.5 mg/mL concentration and showed 41.26 $\pm$ 0.2% scavenging activity which was compatible with antioxidant activity of ascorbic acid [15]. Abdul Sadiq et al. [37] reported that the oil extracted from Isodon rugosus perform extremally well with scavenging activity about 63.67 $\pm$ 1.20% against 2,2-diphenyl-1-picrylhydrazyl (DPPH) at 1000 μg/mL and 64.33 $\pm$ 0.88 % against 2,2-azinobis [3-ethylbenzthiazolin]-6-sulfonic acid (ABTS). Chloroform, ethyl acetate and flavonoid based Isodon rugosus extracts were also proved good scavenging activities against 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2-azinobis [3-ethylbenzthiazolin]-6-sulfonic acid (ABTS) and H2O2 [38].

Anticancer activity

Cancer is a dangerous disease, World Health Organization (WHO 2018) repot reveled that about 8 million peoples are expired per year due to cancer [39]. The most widely used methods of treatment of cancer including chemotherapy which have several types of side effects and sometimes act as secondary disorder agent in human body are not reliable for sustainable life [40]. Due to this problem investigation anticancer agents are to be great need of the pharmacological World. With reference to Isodon rugosus the methanolic extract of its roots which contains 1-O-?-D-glucopyranosyl-7?,13 ?-dihydroxyabieta-8(9)-en-11-one (Rugosodon1) and 7?,20-epoxy-1?,6?,7,14-tetrahydroxy-kaur-16-en-15-one (Rugosodon 2) had been subjected to cytotoxic screening of three human cancer cell lines (NCI-H460, HeLa and MCF-7) and found not to be significant in results [41]. Sponins based extract of Isodon rugosus had been performed highest cytotoxic activity against brine shrimps about 92.23 $\pm$ 1.1 % at the concentration of 1000 μg/mL [42].

Antifungal activity

The agents which show their activity to destroy or delay the production of fungus is referred to antifungal agents. Antifungal compounds sometimes called fungicides. Methanolic extract of Isodon rugosus with isolated fractions of different solvents like n-hexane, chloroform and ethyl acetate was reported to perform extremely well against reduction in growth of Aspargillius flavus, Aspergillius niger, Trichoderma, Harzianum and Fausarium Oxysporum [43].

Insecticidal activity

In the face of the gorgeous insecticidal potential of phytochemicals and the plentiful scientific literature recording the bioactivity of plant extracts against insect and pests, there still remain few predictions for pharmacological development of advance biological products. About six thousand plants are identified which have potential to kill insects and various of these plants are utilized by agriculturalists in developing countries [44]. Additionally, few of these plants has been screened for insecticidal activity, out of which Isodon rugosus is at meaningful place [45]. Saira Khan et al. reported that butanol-based extract of Isodon rugosus has showed 100% insecticidal mortality against different insects like pea aphids of Acyrthosiphon pisum (Hemiptera), fruit flies of Drosophila melanogaster (Diptera), red flour beetles of Tribolium castaneum (Coleoptera), and armyworms of Spodoptera exigua (Lepidoptera) [46].

Analgesic activity

Analgesic compounds are those who has ability to relieve pain by acting in the Central Nervous System (CNS) without changing consciousness [47]. Analgesic potentials of Isodon rugosus based extracts in different solvent fraction were also reported using acetic acid induced writhing, hot plate test, and formalin induced paw licking test, in acetic acid induced writhing chloroform fraction (exhibited 53% analgesia while formalin test displayed 61% inhibition at phase-I and 45% at phase-II respectively at a dose of 100 mg/kg [17].

Ethnobotanical activity

Bioevaluation of medicinal plants in whole World is a recent activity and the documentation of ethnobotanical plant knowledge and its applications are ongoing [48–51]. Ethnobotanical activities of Isodon rugosus is depicted in Table 1.

Table 1 Ethnobotanical activities of Isodonrugosus

Part of plant	Ethnobotanical Activity	Reference
Leaves	Dried leaves for toothache	[9, 52]
Shoots and seeds	Skin infection, blood purifier	[11, 53]
Leaves	As stimulant, carminative, flatulence fever and mouth infection	[54]
Leaves	Antidote for snakebite and insect bite, eye drop	[55]
Leaves	Abdominal pain	

Conclusion

Bioactive compounds isolated from Isodon rugosus make clear profile about its application as potential source of phytopharmacological agents. Isodon rugosus can be entered to the list of high impact medicinal plants due to its antibacterial, antioxidant, antifungal, anticancer, insecticidal, analgesic and ethnobotanical activities. This potential of Isodon rugosus is crying to utilize it in pharmaceutical applications. Furthermore, a quite message is forwarded to researchers to explore more research work about the pharmacological profile of Isodon rugosus to make it more representative.

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