

Distribution of Steroid like Compounds in Plant Flora

Authors: Amrit Pal Singh and A.S.Sandhu.

Dr Amrit Pal Singh, MD (Alternative Medicine), Medical Executive. Dept of Natural Products India –Swift Ltd.

Dr A.S Sandhu, M.Sc (Botany), Dept of Natural Products, National Institute of Pharmaceutical Education & Research (NIPER), Mohali. India.

Address for correspondence:
Amrit Pal Singh
House No.2101, Phase-7
Mohali-160062
Email: amritpal2101@yahoo.com

Abstract

Medicinal herbs constitute an effective source of traditional (Ayurvedic, Unani and Homeopathy) and modern medicine. The plant is a biosynthetic laboratory, not only for chemical compounds, but also a multitude of compounds like glycosides, alkaloids etc. These exert physiological and therapeutic effect. The compounds that are responsible for medicinal property of the drug are usually secondary metabolites. Alkaloids, glycosides, neutral principles, resins, oleoresins, sesquiterpene lactones are some of the common active constituents of medicinal herbs. The article reviews distribution of steroid like compounds and their pharmacological importance.

¹The practice of medicinal herbs for treating the diseases is very well known from ancient times. There are number of synthetic medicines which have been derived from medicinal herbs. Digoxin, Aspirin, Reserpine, Ephedrine, Quinine, Vincristine, Vinblastine, Taxol, Artemisinin, Hypericin, Silymarin are some noteworthy examples and their mechanism of action is beyond doubt as far as efficacy is concerned. Number of studies is available to show their effectiveness. These are regarded as active constituents of the herbs and are present in standardized form in the herbal extracts, if not isolated as single entity.

In addition to the alkaloids, glycosides, resins, oleo-resins, aromatic & volatile oils, neutral principles etc, a number of other compounds are also known to exist in plant flora which are responsible for curative action of the herbs, although are relatively less known compounds. Recently some light has been thrown on steroid like compounds present in number of medicinal herbs. Chemically the compounds are known as sterols and are considered to be derivatives of the steroids. They resemble in structure with steroids and modern clinical studies have supported their role as anti-inflammatory and analgesic agents.

²*Beta -sitosterol* is the most commonly studied sterol compound isolated from number of medicinal herbs and it has shown effectiveness in reducing serum cholesterol levels. ³Modern

studies have indicated the usefulness of *beta-sitosterol* in benign prostate hypertrophy and the compound has been detected in *Serenoa Repens* commonly known as Saw Palmetto. ⁴The medicinal herb has been traditionally used in treating prostate symptoms the clinical trials have shown promise in stages 1 & 2 in reducing difficulties associated with BPH but it has nothing to do with enlarged size of the gland. In addition the medicinal herb is known to contain sterols including *beta sitosterol-3-o-glycosides*, *beta-sitosterol-3-o-glycosides*, *beta-sitosterol-fatty acid esters* and their *glycosides*.

^{5,6,7} *Disogenin* is another compound present in number of herbs like *Hedichyum spicatum*, *Trigonella foenum- graecum*, *Pueraria tuberosa* & *Dioscorea villosa*. Oral contraceptives & sex hormones are derived from *Disogenin*. It is extracted from medicinal herbs as well as prepared commercially. Due to wide the distribution of the compound in above herbs, they have been used in various types of sexual disorders like impotency. ⁸*Ruscogenins* are other compounds present in *Yucca liliaceae* that are used in treating pain and inflammation of arthritis and rheumatism. *Yucca filamentosa* is other known species, which contains *Ruscogenin* as active principle. ^{9,10}*Ruscogenins* are also present in *Ruscus aculeatus* and in animal tests; there was increase in venous tone and an electrolyte-like reaction on the cell wall of the capillaries.

Smilax officinalis is medicinal herb that is known to contain steroid like compounds-*saponin glycosides* and according to some researchers actually the herb contains male hormones. ¹¹It also has been used in herbal medicine as an anti-inflammatory agent in curing arthritis and rheumatism. *Rubus idaeus*, commonly called as raspberry, is also known to contain such type of compounds.

¹² *Phyto-estrogens* are group of pharmacologically active compounds present in *Asparagus officinalis* where they are known as *Asparagosides A, B, D, F, G, H \$I* [16]. Although the herb finds application in female sexual disorders but effectiveness for the claimed application has not been sufficiently documented. ¹³In *Asparagus adscendens*, active compounds are called *Shatavarins I-4* and in clinical studies they shown estrogen like activity. According to Mitchell Deborah these phyto-estrogens inhibit the conversion of testosterone to dihydrotestosterone, thereby increasing the count of testosterone in the body. Co- incidentally the role of the herb has been described in old texts of Ayurveda as sexual tonic. Coriander sativum [commonly known as fennel] also contains phyto- estrogens and has shown promise in treating premenstrual syndrome. Some glycosides on hydrolysis produce aglycones like gitogenin and tigogenin, which also are being used in steroid synthesis.

¹⁴ *Balsamdendron commiphora mukul* commonly known as Guggul contains special group of compounds called *Guggulsterones*, which range from E to Z. ^{15,16,17}They are known as active principle of the herb and accounts for the use of the herb in hyperlipidemia and arthritis. ¹⁸*Withania somnifera* commonly known as Ashwagandha contain pharmacologically active compounds called *Withanolides*, which are considered to be responsible for various applications of the herb as adaptogen and immunomodulator. ¹⁹*Withaferin-A* is the most important group of *Withanolide* and has shown promise as potent anti cancer agent. ²⁰The *Withanolides* are basically steroid lactones and various types have been isolated.

A special group of compounds called cardioactive steroids [better known as cardiac glycosides] deserves special mention. *Digitalis purpurea*, *Stropanthus gratus* and *Urginea indica* are reputed remedies as cardiac tonics. Clinically they find application in congestive cardiac failure. All of them contain steroid saponins as active constituents. ²¹*Calotropis procera* is known to

contain cardioactive glycoside *calotropine*, which has shown an antitumor effect in vitro on human epidermoid carcinoma cells of the rhinopharynx. Besides it also acts as expectorant and diuretic.

²²In Homeopathic system of medicine, *Convallaria majalis* is a reputed remedy in various heart diseases. It also contains cardioactive steroid glycosides, which vary in the herb according to geographical source, and main active constituents are *convalloside*, *convallatoxin* and *convallatoxol*. In clinical studies they have shown positive inotropic effect on the myocardium and it lowers the elevated left ventricular pressure as well pathologically raised venous pressure.

From above it can be concluded that that sterol compounds are less known for their medicinal importance. Some of them have been isolated and researchers are studying hard to find their exact mode of action. In future a number of compounds can be expected from the sterols that can provide us with life saving drugs. The only need of the hour is to investigate the compounds with open mind so that maximum benefit can be withdrawn from them.

References

1. Wasik J. The truth about herbal supplements. Consumer's Digest. July/August 1999: 75-76,78-79.
2. Brunzell J D, Austin MA 1989 Plasma triglyceride levels and coronary disease. New England Journal of Medicine 320: 1273.
3. Berges RR, Windeler J, Trampisch HJ, Senge Th, [1995] Randomized, placebo- controlled, double-blind clinical trial of beta sitosterol in patients with benign prostatic hyperplasia. Lancet 345: 1529-1532.
4. Ravenna L et al., Effects of the lipidosterolic extract of *Serenoa repens* on human prostatic cell lines. In: Prostate 29[4]: 219-230.1996.
5. Bohlmann MB et al.,(1974) Phytochemistry. 13:1513.
6. Sood AR et al., (1976) Phytochemistry 15:351.
7. Prasad AVK, Kapil RS, et al (1986). Synthesis of 3-o-methylanhydrotuberosin. Indian Journal of Chemistry. Section B Organic Chemistry Including Medicinal Chemistry 25(4): 407-408.
8. Madaus G, Lehrbuch der Biologischen Arzneimittel, Bde 1-3,Nachdruck, Georg Olms Verlag Hildesheim 1979.
9. Dunaouou CH et al., Triterpenes and sterols from *Ruscus aculeatus* .in: PM 62(2): 189-190. 1997.
10. AdamekB, Drozdizk M, SamochowiecL, WojcicikiJ, Clinical effect of buckwheat herb, *Ruscus* extracted troxertium on retinopathy and lipids in diabetic patients. In: Phytotherapy Res 10[8]: 659-662. 1996.
11. Drogen, Springer Verlag Berlin, Heidelberg, New York, 1992-1994.
12. Shao T et al., Steroidal saponins from *Asparagus officinalis* and their cytotoxicity activity. In: PM 63(3): 258-262. 1997.
13. Duke 1992 A: Duke, James A.1992. Handbook of phytochemical constituents of GRASherbs and other economic plants. Boca Raton, FL. CRC Press.
14. Roy, S.K. et al. (1989) TLC Separation and Quantitative Determination of Guggulsterones. Indian J. Pharma. Sc., Nov-Dec.: 251-253.
15. Satyavati, G.V. (1988). Gum guggul (*Commiphora mukul*)-The success story of an ancient insight leading to a modern discovery. Ind. J. Med. Res. 87: 327.
16. Agarwal RC, et al. Clinical Trial of Gugulipid - A New Hypolipidemic Agent of Plant Origin in Primary Hyperlipidemia. *Indian J Med. Res.* 84:626-634, 1986 Dec.
17. Duwiejua M, Zeitlin IJ, Waterman PG, Chapman J, Mhango GJ, and GJ Provan. Anti-inflammatory Activity of Resins from Some Species of the Plant Family Burseraceae. *Planta Medica.* 59(1): 12-6, 1993 Feb.

18. Bhakare, H. A., R. R. Khotpal, et al. (1993). Lipid composition of *Withania somnifera*, *Phoenix sylvestris* and *Indigofera ennealphylla* seeds of central India. *Journal of Food Science and Technology* 30(5): 382-384.
19. Devi PU Akagi K Ostapenko V Tanaka Y Sugahara T Withaferin A: a new radiosensitizer from the Indian medicinal plant *Withania somnifera*. In: *Int J Radiat Biol* (1996 Feb) 69(2): 193-7. *International Journal of Radiation Biology*.
20. A Kazutoshi SHIBATA, B and Kaoru UMEHARA B. Cell Differentiation Inducing Steroids from *Withania somnifera* L. (DUN.). *Chem. Pharm. Bull.* 47(11), 1646-1649, November 1999.
21. Hansel R, Keller K, Rimpler H, Schneider G [Hrs.], *Hagers Handbuch der Pharmazeutischen Praxis*, and 5.Aufl. Bde4-6.
22. Wagner H, Wiesenauer M, *Phytotherapy, Phytopharma Homeopathy*, Fischer –Verlag, Stuttgart, Jena, New York 1995.