Therapeutic Utility, Constituents and Toxicity of Some Medicinal Plants: A Review

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ABSTRACT. Man has always made use of flora to alleviate suffering and disease. This review presents information on the various therapeutic applications of plants used in traditional medicine, their active principles and observed side effects in animals and human beings. We also focus on the gaps in our knowledge about plant toxicoses that require scientific investigations and offer some logical conclusions.

There is a growing awareness by scientific and medical communities of the importance of medicinal plants in the health care systems of many developing countries. Scientific projects have been launched to explain the curative phenomena associated with traditional herbal remedies and to identify simple technology that could produce drugs and therapeutic agents at a low cost to alleviate suffering and disease. Plants contain a number of chemical constituents and are employed for different medicinal purposes; however, over-dosage of plant products containing medicinal compounds may cause toxic reactions when introduced into animals or human beings.

CARTIOVASCULAR AND NERVOUS ACTIVITY

Rauvolfia vomitoria (Apocynaceae) contains the hypotensive alkaloids rauromonine, reserpine and reserpinine (1,2). The alkaloid reserpine possesses hypotensive effects in cases of hypertension and sedative and tranquillizing effects, but it is not hypnotic (3). It has been suggested that the alkaloid acts through the central nervous system as an anti-metabolite of serotonin and catecholamines, decreasing considerably the serotonin contents of the nerve centers. This explains why next to its use as a hypotensive agent in arterial hypertension reserpine is currently used as a tranquillizer in anxiety states and in psychosis with hallucinations and delirium (2,4).

The root of Cryptolepis sanguinolenta (Periploaceae) contains a quinoline-derived indole alkaloid, cryptolepine, which has a marked hypothermic effect and induces prolonged and important vasodilatation causing marked and durable hypotension (5-7).

Morinda lucida (Rubiaceae) contains tannins, methylenanthraquinones, and a heteroside, morindin. It is used for the treatment and prevention of hypertension and its cerebral complications (8,9).

The seeds of Pergularia daemia (Asclepiadaceae) contain uzarigenin, coroglaucignin, calactin, calotropin, other cardenolides, and a bitter resin, pergularin, and have a cardiotoxic action (10,11). It has been suggested that the plant seed action on the uterus is similar to that of pituitrin and is not inhibited by progesterone (12,13).

Many cultivated plants, such as Citrus limonum, C. decumana and C. aurantium (Rutaceae), are extensively used for promoting vascular resistance (vitamin-P action) due to their content of citroflavanoids, mixtures of hesperidioside, naringoside and eriodictyoside (13,14). The peel also contains essential oils and vitamin C. Citroflavanoids control the permeability of blood vessels by decreasing the porosity of their walls and thus improving the exchange of liquids and the diffusion of proteins. They are used in the treatment of varicose veins, hemorrhoids and edema (15,16).

Lawsonia inermis (Lythraceae) contains Lawsonone, a 2-hydroxy-1,4-naphthoquinone, resin and hennatin. It has slight vitamin-K action and powerful bactericidal effects comparable to those of penicillin and sulphonamides (17,18).

Certain plant species, such as Strophanthus hispidus, S. gracilis and S. gratus (Apocynaceae), are important cardiotonics by virtue of their content of steroid heteroside. Strophanthin and ouabain were isolated and used in the treatment of cardiac insufficiencies in preference to digitalis when a more rapid action was required (19,20). The toxicity of ouabain in dogs is characterized by hypertension, tachycardia and heart arrest (2).

Anti-arrhythmic agents or cardiac depressants are present in some species of plants in the families Papaveraceae, Rutaceae and Apocynaceae. For example, Argemone mexicana (Papaveraceae) is an important African plant and is used by Nigerians and Senegalese for its diuretic, sedative and chologagogic properties (21). The seeds have a cannabis-like effect, and the plant juice and flowers are famous for their narcotic properties (1,22). Numerous alkaloids, such as berberine, protopine, corypine, chelerythrine, sanguinarine and argemone, were isolated from different parts of the plant (1,23). Berberine is relatively non-toxic to cats and dogs and has a depressant and vasodilating action on the heart and is a hypnotic and sedative for convulsions and spasmodic conditions (24,25).

Allium sativum, Garlic (Lilaceae) contains allicin, a hypotensive dialkyl disulfide oxide, and is used as an anti-diabetic agent and for its bacteriostatic action (21,26,27).

Solanum nigrum and Withania somnifera, both of the family Solanaceae, have anti-neuralgic...
and slight narcotic actions due to their content of the alkaloids solanine and witha-
somoningine. In West Africa and India, the berries of S nigrum
are used in the treatment of fever, diarrhea and eye diseases, and the leaves or their
decocations are diuretic with anti-epileptic actions. The juice is said to be diuretic
and emmenagogic in addition to being useful in local application to painful swellings,
abscesses and ulcers (1,21,29).

In some African countries, including the Sudan, Datura species such as D stramonium,
D metel and D inoxia (Solanaceae) are used in native beer, "palm wine or "Sudanese
merrisa" to add a narcotic or stupefying effect, and the decocction of the seeds is
used as a remedy for ocular conditions due to the presence of the parasympathetic alka-
loids, atropine, hyosamine and hyoscymamine (30,31). The alkaloids cause pronounced
mydriasis due to paralysis of the circular muscles of the eye and were added to asthma
powders and sea sickness and anti-chronic bronchitis preparations (2,32). The toxicity of D stramonium to young ruminants has been
described (33).

The use of plants for producing central nervous system stimulation is well known and
is attributed to the presence of active constituents, such as caffeine, theobromine and
theophylline in Cola nitida and C acuminata (Sterculiaceae), camphor in Osimum canum
(Labiatae), and the alkaloids dihydropistodermidine in Dioscorea dumetorum (Dioscoreaceae)
and ellipticine and strychnine in the logan-
aceous Strychnos spinosa (3,34,35).

ANTI-BACTERIAL, ANTI-PROTOZOAL AND
ANTI-MYCOTIC ACTIVITY

A concise summary of the anti-bacterial, anti-protozoal and anti-fungal plants has
been written (2). The major compounds in these plants are phenols from Anacardium occi-
dentale (Anacardiaceae), quinones from Drosophila indica (Drosoraceae), acids from
Acacia farnesiana (Mimosaceae), alkaloids from Argemone mexicana (Papaveraceae), fla-
vanoids from Canascora decussta (Gentianaceae), terpenoids from Borreda verticillata (Rubia-
ceae), and respectivly (13,28). The toxicity of D stramonium to young ruminants has also been
described (33).

The anti-fungal and anti-bacterial properties of Cassia species towards Aspergillus
niger, Aflavus, Trichophyton mentagrophytes, Penicillium chrysogenum, Staphylococcus aureu-
sum, Streplococcus pyogenes and Vibrio cholerae has been reported (36-40). The toxic effects of C seanna, C italicca and C occidentalis in small ruminants has also been
described (41-43).

ANTHELMINTIC ACTIVITY

Oliver-Beever (2) have a brief account of West African medicinal plants that can destroy
helminth parasites through lysis; for example, those containing proteolytic enzymes
like bromelain from Ananas comosus (Bromeli-
aceae), calotropin from Calotropis procera,
and papain from Carica papaya (Caricaceae)
can digest worms. The same author also indi-
cated that other plants act specifically on
estodes; for example, those containing cu-
cubitene from Cucurbita pepo (Cucurbitaceae),
saponins from Opilia celtidifolia (Opilie-
aceae), and embelin from Embelia schimperi (Myrsinaceae).

ESTROGENIC ACTIVITY

A number of medicinal plants--Phoenix
dactylyfera (Palmae), Triticum aestivum
(Gramineae), Phasmeolus vulgaris (Fabaceae),
and Cyperus esculentus (Cyperaceae)--contain
estrone and 17a estradiol (44-46).

GALACTAGOGIC ACTIVITY

Some plants can act as galactagogues for
women and cows. Those containing the glyco-
side aucubin from Verbena officinalis (Ver-
benaceae), dihydroacetone from Sarcostemma
viminale (Asclepiadaceae) and the hydroxy-
benzoic ester agnuside from the verbenaceous
plant Vitex agnus castus (1,47) are examples.

EFFECTS ON THYROID GLAND

Certain plants can reduce hyperactivity
of the thyroid gland. Some of these are those containing the glycoside of 1,5-vinyl-
2-thio-oxazolidone from Brassica oleracea and
B napa (Cruciferae), arachidose and glycosides from Aracbus hypogea (Fabaceae),
and thiocyanates from llinamarin in the
ephorbiaceous plant, Manihot esculenta,
Cassava (48-51).

In Asia Neem seed oil is used as a repel-
ent against insect pests in animal sheds in
form of a fumigant or smear on wooden
fences (59), as an anthelmintic and parasiti-
cide for scabies, ringworm and other skin
conditions, and in the treatment of rheuma-
tism and malaria (60-62). The A indica bark
product decoction is used in the treatment
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Pains (63). The major active principles in Neem seeds are azadirachtin, veepahol, iso-veepahol, nimbin, nimbidin and gedunin (64-68).

Brown Hisex chicks fed Azadirachta indica fruits or leaves at 5 or 10% of the basic ration for 4 w developed yellow discoloration of the shanks and combs, depressions in body weight gain and efficiency of food utilization, hepaticomegaly, increased serum lactic dehydrogenase, aspartate transaminase, alkaline phosphatase and uric acid concentrations, and decreased total serum protein levels (69).

The fruit of Balanites aegyptiaca (Balanitesaceae), locally known as Higlig tree or Lake lobe, is used as a purgative in native medicines and as a remedy for colds in Chad. The fruit and bark are a fish poison and molluscicide in Tanganyika and the oil is used as a remedy for syphilis and sleeping sickness in Uganda (1,70). Abu El Futuh (71) reported the healing of lesions caused by cutaneous native infections, and decreased total serum protein concentration, hepaticomegaly, increased serum lactic dehydrogenase, aspartate transaminase, levels of B aegyptiaca kernel saponin given by different routes of administration to chicks was isolated from the stem wood of Daegyptiaca and stem wood of D aegyptiaca and will likely be on to collected and manufactured in the Sudan following the topical application of Balanites saponins in the form of a cream.

Dawidar and Fayez (72) and Varshney and Vyas (73) investigated the saponin content of the fruit pulp, seed kernel, root wood and stem wood of B aegyptiaca and B roxburghii and were able to isolate a number of Diosgenin saponins in a pure state. In addition to the balanitins A, B, C, D and E being isolated from the fruit pulp, balanitins F and G were isolated from the seed, and balanitins 1 was isolated from the stem wood. A detailed description of the effects of B aegyptiaca kernel saponin given by different routes of administration to chicks was reported by Nakhla, Mohamed, Abu El Futuh and Adam (74).

The biological activity of Cassia italica, a member of the family Caesalpinaceae, is comparable to that of the medicinal Cassia species, such as C senna, C alata, Cocculus robbins and also as an eye lotion and remedy for skin conditions (38,40,75,76). The medicinal Cassia species contain rhein, aloe- emodin, the chrysophanic acid anther, free kaempferol, physcion, a-3-sitosterol and a xanthone (1,2,32).

CONCLUSIONS

The knowledge of the properties of medicinal plants has likely been passed on to natives by their elders or is based on experience. Efforts could be constructively exerted to make Third World countries self-supporting by encouraging the production, collection and manufacture of local medicina. However, many cases of poisoning by medicinal plants result from incorrect dosage because, in general, there is no standardized dosage system in traditional medical practice. Some plants used in folk medicine have such narrow therapeutic indices that their use is dangerous and should be carefully researched.

REFERENCES
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Pesticide Coordinator Report, Washington, DC

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