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Full Length Research Paper

Phytochemical screening of important secondary metabolites in some extracts of two Sudanese plants

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Secondary metabolites occurred in certain higher plants are becoming increasingly important in industry nowadays, particularly for producing natural drugs and botanical pesticides. In this research, different extracts of two indigenous plant species in Sudan were screened for their major constituents of secondary metabolites, applying chemical analytical means. These plants were; *Eucalyptus camaldulensis* (leaves and fruits) and *Ocimum basilicum* (leaves and seeds). Each plant part was extracted with water and two organic solvents (ethanol and petroleum ether) for isolating both the apolar and polar compounds. The water extracts revealed the presence of alkaloids and saponins in leaves of the two plants, flavonoids in the two parts of *O. basilicum* and flavones and amino acids in fruits of *C. camaldulensis*. The ethanol extracts showed flavonoids and triterpenoids in both plants, with flavones, sterols and amino acids in fruits of *C. camaldulensis*. However, petroleum ether extracts manifested only triterpenoids and sterols concentrated mainly in fruiting parts of both plants. The detected chemical groups proved the importance of the two plants from pesticidal point of view, and invites additional research for characterization of these chemicals and their proper evaluation in pests control.

Keywords: Extracts, Phytochemicals, Active ingredients, Sudan.

INTRODUCTION

Higher plants produce both primary and secondary chemical metabolites, the former being vitally important in normal development and reproduction of plants (Herbert, 1981; Duke, 1992). On the other hand, secondary metabolites are known to play important roles in plant survival as defense mechanisms against adverse biotic and abiotic conditions. They include several groups of chemicals with variable biological activities (Whitehead and Bowers, 1983; Schmutterer, 1990); hence represent untapped sources for unlimited applications in public life and industry. Plant ingredients also characterized by their diversified structural compounds which provide new models for synthetic chemicals.

Therefore, scientific research proved significant activities of different botanical natural products against various diseases of human beings, and pests and diseases of agriculture and public health. Accordingly, several herbal dugs and botanical pesticides were formulated from certain plant compounds in commercial forms. More than 2000 plant species were reported worldwide which have been shown to contain some activities as pest control agents. Fortunately, most of active plant species in the world were thought to be found in tropical countries (Whitehead and Bowers, 1983; Schmutterer, 1990; Siva *et al*., 2008). Since very few species were studied yet, extensive research works is needed to discover such rich source for proper utilization.

The Sudan is considered one of richest African countries in floral diversity which needs to be studied for

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their constituents of bioactive compounds. The literature available showed promising active plant species against different pests and diseases (Satti *et al*., 2010). Among such plants, two species, i.e., *Eucalyptus camaldulensis* "Ban" and *Ocimum basilicum* "Rehan", are widely grown in different parts of the country. The extracts of these plants showed potent pesticidal effects (Yousif and Satti, 2008), and the latter species is commonly being grown in houses and public parks as an ornamental and as a mosquito repellent herb. Nevertheless, very few studies were conducted regarding the chemical constituents of these plants. This research was therefore dealt with phytochemical analyses of *E. camaldulensis* and *O. basilicum*, using different botanical parts with different extracts. The study relied on conventional chemical analytical approach to attain this objective.

MATERIALS AND METHODS

Different botanical parts of two plant species, viz., *Eucalyptus camaldulensis* (leaves and fruits) and *Ocimum basilicum* (leaves and seeds) were investigated in this research to screen their major constituents of active secondary metabolites. All plant samples were freshly collected from Shambat area, Khartoum North, during August 2009. After being dried under shade, they crushed into fine powder using an electric Laboratory Blender (No. MAH/11/050/0117, by Remi Anupam Mixie Ltd.). Three extracts (water, ethanol and petroleum ether) were prepared from each plant part to ascertain their active chemical groups of polar and non polar components.

Phytochemical tests of the above extracts were performed through chemical reagents as described by Harbone (1973; 1983; 1988). Eight chemical groups were screened for each extract. The reagents prepared for testing seven groups of secondary metabolites were, Mayer's reagent (for alkaloids), Ninhydrin (amino acids), potassium hydroxide solution (flavonoids), concentrated hydrochloric acid plus magnesium (flavones), ferric chloride (tannins) and vanillin reagent (triterpenoids and sterols). The prescribed analytical procedures according to the formerly stated literature were followed. Accordingly, the appearance of certain colour or precipitate was taken as a presumptive evidence of chemical detection at the end of each testing process, based on characteristics of the different metabolites groups. However, the test of saponins was simply done by putting 10ml of aliquots from each extract in a test tube where 5ml of water were added. The tubes were closed with a cork and shaken vigorously. Formation of foam layer, honey comb in shapes, which remains for a minimum of 30 minutes, indicated the possible presence of saponins. The data were tabulated and compared among the different plant parts for each extract type.

RESULTS AND DISCUSSION

The results of phytochemical constituents of water extracted parts of the two studied plant species (*Eucalyptus camaldulensis* and *Ocimum basilicum*) were recorded in Table (1). Wide range of polar chemical classes were found distributed at variable levels in the different plant parts. Such extracts revealed dominantly the occurrence of alkaloids and saponins mostly in the leaves. Flavonoids were detected in both parts of *O. Basilicum*, whereas flavones and amino acids were found in fruits of *E. Camaldulensis*.

Table (2) reveals the analytical results of the same previous plant samples when extracted with ethanol. Similar to what have been shown in water extracts, flavonoids were found in both parts of *O. Basilicum*, whereas flavones and amino acids in fruits of *E. Camaldulensis*. Contrarily, alkaloids and saponins were not observed from ethanol extracts. However, the detected triterpenoids in both plants may be some sort of saponins linked to triterpenes through their sugar moieties (Price *et al*., 1987).

Table (3) shows the results of phytochemical screening regarding apolar extracts of the samples obtained through the petroleum ether solvent. All the studied samples revealed the presence of triterpenes, while sterols and flavonoids were recorded in fruiting parts. The other chemical groups were not found depending on their high polarities.

The overall results explained that alkaloids, saponins, flavonoids, flavones and amico acids were the main compounds that can be extracted from the two plants using the water and ethanol, whereas triterpenoids and steroids were the dominant extractives through the petroleum ether. All the foregoing compounds were differently distributed among the two plant species and their parts used. Based on this study all the eigh tested chemical groups were obtained in both plants, except only the tannins.

Phillipson (1989) stated that a brief review of biologically active natural products has shown that the plant kingdom is still capable of producing substances which may give rise to new drugs or pesticides. Therefore, the current findings revealed the richness of the two plants in different groups of active compounds that need to be studied for different applications. It is clear that the chemical composition was different from one part to another in the same plant, as it also differed according to the kind of extracting solvents. As reported by Harbone (1984), petroleum ether and hexane solvents were used for the extraction of non polar compounds such as triterpenes and sterols, while alcohol for polar constituents (e.g., alkaloid and flavonoids).

Very meagre literature is available on phytochemical screening of active plants especially when concerning the indigenous flora. Al Magbool (1981) investigated the Sudanese Rehan, *O. Basilicum*, and found that the main

Table (1). Phytochemical constituents of water extracts of different botanical parts of two plant species, during August 2009.

Plant species	Part	Chemical groups							
		Am	Sa	Al	Fl	Fn	Tn	St	Tr
Eucalyptus camaldulensis	Leaves	-	+	+	-	-	-	-	-
	Fruits	+	-	-	-	+	-	-	-
Ocimum basilicum	Leaves	-	+	+	+	-	-	-	-
	Seeds	-	-	-	+	-	-	-	+

(+) present, (-) non present.
Amino acids (Am), saponins (Sa), alkaloids (Al), flavonoids (Fl), flavones (Fn), tannins (Tn), sterols (St) and triterpenes (Tr).

Table (2). Phytochemical constituents of ethanol extracts of different botanical parts of two plant species, during August 2009.

Plant species	Part	Chemical groups							
		Am	Sa	Al	Fl	Fn	Tn	St	Tr
Eucalyptus camaldulensis	Leaves	-	-	-	+	-	-	-	-
	Fruits	+	-	-	-	+	-	+	+
Ocimum basilicum	Leaves	-	-	-	+	-	-	-	+
	Seeds	-	-	-	+	-	-	-	+

(+) present, (-) non present
Amino-acids (Am), saponins (Sa), alkaloids (Al), flavonoids (Fl), flavones (Fn), tannins (Tn), sterols (St) and triterpenes (Tr).

Table (3). Phytochemical constituents of petroleum ether extracts of different botanical parts of two plant species, during August 2009.

Plant species	Part	Chemical groups							
		Am	Sa	Al	Fl	Fn	Tn	St	Tr
Eucalyptus camaldulensis	Leaves	-	-	-	-	-	-	-	+
	Fruits	-	-	-	+	-	-	+	+
Ocimum basilicum	Leaves	-	-	-	-	-	-	-	+
	Seeds	-	-	-	-	-	-	+	+

(+) present, (-) non present
Amino-acids (Am), saponins (Sa), alkaloids (Al), flavonoids (Fl), flavones (Fn), tannins (Tn), sterols (St) and triterpenes (Tr).

components of the essential oils were methyl alcohol linalool, methyl eugenol and cineole. The recorded results were also in conformity with some exotic literature on the subject. Debella *et al*. (2008) reported the presence of saponins, alkaloids, glycosides and polyphenols as major components in water extracts of some plants. Gunther (1961) fractionated the essential oil of *Ocimum basilicum* and separated 64 fractions of 24 components; linalool (54%) was the main component. Bower *et al*. (1976) isolated two compounds with highly potent juvenile hormone activity from oil of *O. basilicum*. Generally, the leaves of *O. basilicum* have been used to protect against mosquitoes bites in South Africa and against termites before planting (Malaka, 1972). The leaves water extract of this plant induced 100% mortality of *Trogoderma granarium* 3rd instar larvae, 18 days post treatments (Yousif and Satti, 2008).

Essential and volatile oils from *Eucalyptus* spp. and *O. basilicum* showed mortality and repellent activities against some mosquito species (Tunc *et al*., 2000). Bashir (1996) who used thirteen fractions of the oil of *Eucalyptus camaldulensis* has obtained the same results. Kumar and Dutta (1987) also reported insecticidal and repellent effects from this plant. Pallson and Jaenson (1999) and Tunc *et al*. (2000) found that smoke of various parts of *Eucalyptus* species reduce the number of mosquitoes indoor. Smoke of leaves and fumigation of essential oil vapours distillation from *E. camaldulensis*

showed 69 – 72 % repellency against biting mosquitoes in West Africa.

CONCLUSION

The adopted chemical approach of phytochemical analysis seemed to be reasonable for this preliminary screening, and gave comparative information about the main classes of secondary metabolites among the studied plants. Since these phytochemical classes generally contain diversified active compounds, hence more advanced analysis is important to be characterized and bioassayed as natural pesticides.

REFERENCES

Al Magbool AIZ (1981). Monoterpenes and Metabolic Fate of Epoxide. M.Sc. Thesis, University of Khartoum, Sudan.

Bashir I (1996). Phytochemical Studies and Allopathic Effect of Volatile Oil of *Eucalyptus camaldulensis*. M.Sc. Thesis, University of Khartoum, Sudan.

Bower WS, Ohta T, Cleers JS, Marsella PA (1976). Discovery of insect anti juvenile hormones in plants. J. Science, 193: 543 – 547.

Debella PB, Chavan SR, Renapukar DM (2008). Larvicidal activities of aqueous extracts of nineteen Indian plants against two mosquito species, *Aedes albopictus* and *Culex quinquefasciatus*. Pesticides, 16(2): 7–10.

Duke JA (1992). Handbook of phytochemical constituents of GRAS herbs and other economical plants. CRC Press, London/UK. 302pp.

Gunther E (1961). The essential oils. Van Nostr and Company inc. Vol. 3, 433 pp.

Harbone JB (1973). Phytochemical Methods, Chapman and Hall; London: 183 – 195.

Harbone JB (1983). Phytochemicals methods 2nd ed. Academic Press, London.

Harbone JB (1984). Plant Chemo-systematic, Academic Press, London.

Harbone JB (1988). Phytochemical Methods: A Guide to Modern Technique of Plant Analysis, 3rd Edition. London: Chapman and Hall.

Herbert RB (1981). The biosynthesis of secondary metabolites. Chapman and Hall Ltd., London, New York/USA. 178pp.

Kumar A, Dutta G (1987). Indigenous plant oil as larvicidal agent against *Anopheles arabiensis* mosquitoes. Indian Current Science, 56(18): 959 – 960.

Malaka SLO (1972). Some measures applied in control of termites in part of Nigeria. Nigerian Entomologist Magazine 2: 137–141.

Pallson K, Jaenson T (1999). Plant products used as mosquito repellent. In Guinea Bissau, West Africa. Acta Tropica, 72(1): 39–52.

Phillipson JD (1989). Biological active compounds from higher plants. J. of Pesti. Sci., 27: 223–231.

Price KR, Johnson IT, Fenwick GR (1987). The chemistry and biological significance of saponins in foods and feeding stuffs. C R Food Sci. Nutr., 26: 127–135.

Satti AA, Hashim HA, Nasr OE (2010). Biologically active chemicals with pesticidal properties in some Sudanese plants. Journal of International Environmental Application and Science, 5(5): 767–780.

Schmutterer H (1990). Properties and potential of natural pesticides from the neem tree, *Azadirachta indica*. Annual Review of Entomology, 35: 271–297.

Siva N, Ganesan S, Banumathy N, Muthuchelian R (2008). Antifungal effect of leaf extract of some medicinal plants against *Fusarium oxysporum* causing wilt disease of *Solanum melongena* L. Ethnobotanical leaflets, 12: 156 –163.

Tunc I, Berger B, Erler F, Dagli F (2000). Ovicidal activity of essential oils from five plants against two stored product insects. J. Stored Product Res. 36(2): 161–168.

Whitehead DL, Bowers WS (1983). Natural products for innovative pest management (Current Themes in Tropical Science), 1st ed. Oxford, New York, Pergamon Press. 550pp.

Yousif EAA, Satti AA (2008). The insecticidal potentialities of aqueous extracts from some indigenous flora of the Sudan. First African Congress on Pesticides and Toxicology Sciences, 8–11 November 2008, Gezira University, Wadmedani, Sudan.