Original article

Phytochemical Screening of *Euphorbia abyssinica, E. polyacantha* And *Jatropha glauca* from the Red Sea State- Sudan

Zeinab Abdallatif Saleh[1], Ragaa Satti Mohmmed Abadi[2] and AlawiaAbdalla Elawad[2*]

[1] *Faculty of Education-Red Sea University,* [2] *Faculty of Science and Technology-Al Neelain University*

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Abstract

This research was under taken to investigate the presence of various secondary metabolites in the stems, seeds and latex/sap of *Euphorbia abyssinica, E. polyacantha* and *Jatropha glauca* from the family Euphrobiaceae. The chemical analyses were carried out in alcohol and aqueous extracts using standard analytical methods. Quantitative analysis of saponin and alkaloids using standard chemical protocols were carried out. Preliminary phytochemical screening revealed presence of alkaloids, cardenolides, saponins, 2- deoxysugars, sterols (saturated and unsaturated), tannins, flavonoids, coumarins and carbohydrates in the studied plants. Quantitative analysis resulted in the presence of 20% saponin in both stem and seeds of *Euphorbia polyacantha, Jatropha glauca* contains 20.20% saponin in seeds and 26.30% in the sap. 60% of alkaloids are present in *Euphorbia polyacantha* latex.

[*]**Corresponding author**: alawiaelawad@gmail.com

Introduction

Plants are capable of synthesizing an overwhelming variety of small organic molecules called secondary metabolites (Sarker *et al*., 2005) they attracted interest because of their biological activity. On the other hand, the primary metabolites exert their biological effect within the cell or organism that is responsible for their production (Hanson, 2003). The secondary metabolites are not important for the plant growth and development but they are required for the interaction of plants with the environment (Kuchan and Dixon, 2005). In general, there are many classes of secondary metabolites in the different organs of the plants.

Euphorbiaceae Marc.-Berti, is a large family of flowering plants with about 300 genera and 7500 species (Watson Dallwtz, 1992), it occurs mainly in the tropics. It consists of a wide variety of vegetative forms, most species are herbs, but some especially those in tropics are shrubs or trees. A

number of plants of the family are of considerable economic importance. In medicine, some species of the family proved as effective cure against different diseases (Mwine and Van Damme, 2011). The milky sap or latex in the family is suggested to contain a wide variety of chemical compounds; some of them are toxic and potentially carcinogenic with irritating properties. The family is represented in Sudan flora with 126 species (Andrews, 1952).

Euphobia L. is a very large and diverse genus, with about 2,000 species; it ranges from small annual plants to large trees. The genus is primarily found in the tropical and subtropical regions of Africa and the Americas; it has many species in non-tropical areas such as the Middle East, South Africa, and southern United State of America (Watson and Dallwtz, 1992). Euphorbias from the deserts of Southern Africa and Madagascar have evolved morphological characteristics and forms similar to cacti. Some are used as ornamentals because of their beautiful forms. The plants share the feature of having a cyathium inflorescence. Some species of *Euphorbia* have been used in folk medicine over centuries. 33 species had been recorded in Sudan (Andrews, 1952). Elawad (1995) reported 14 species from the Red Sea State. *Euphobia abyssinica* J. F. Gmel. is a succulent leafless, thorny tree, with thickened, photosynthetic stem. The plant is found in South Sudan**,** Eritrea, Ethiopia**,** Somalia and Sudan (Darfur and Red Sea States). It is the most widely grown cactiform euphorbia that dominated the rocky hill slopes of Erkowit. It extends from the low hills and assumes pure stands in a well-defined zone below the hill tops and plateaux (Kassas, 1956). The plant is used as firewood, timber (roofing, matches, boxes, sticks, local tables, wooden saddles) and live fence (Bein*et al.*, 1996). Polyphenols, saponins, phytosteroides cardiac glycosides, tannins and alkaloids have been detected in the phytochemical analysis of *E. abyssinica* and it is confirmed that the plant contains antibacterial and antiparasitic constituents (Mengiste *et al.*, 2009). The latex of *E. abyssinica* is a source of natural growth regulator (Negussie*et al.*, 2009). A new hydroxy unsaturated fatty acid, 8(R)-hydroxy-dec-3(E)-en-oic acid which displayed reasonable antifungal activities towards different fungi was detected from the latex of the plant (EL- Fikya *et al*., 2008). *E. polyacantha* Boiss. is a succulent spiny leafless shrub or a small candelabra- shaped tree, branching from the base. It is reported in Egypt**,** Eritrea**,** Ethiopia, Saudi Arabia and Sudan (in the plains outside Erkowit) in sandy stony places. The plant is used as ornamental, soil conservation**,** insecticide and live fence in Eritrea; the latex is used in traditional medicine (Bein *et al.*, 1996). In Sudan, latex is used for the treatment of snake bite in traditional medicine. Phytochemical investigation on the stem of *E. polyacantha* reported a new anthraquinone with three known compounds (ELhassan*et.al.,*2015).

Jatropha L. is a genus of leafy shrubs and trees. Andrews (1952) found 8 species in Sudan including 3 from the Red Sea State. *Jatropha glauca*Vahl is a little-branched shrub. It occurs in Sudan (Red Sea and Kordofan), Egypt, Eritrea, Ethiopia**,** Saudi Arabia**,** Somalia and Yemen**.** It is found in the western plains of the Red Sea Hills; in the transition between the semi-desert and the unique hill vegetation. It is common in the deep sandy moist creek (khor) beds (Barbour, 1961 and Elawad, 1995). It is used in traditional medicine to treat constipation, ear ache and as an astringent (Schmelzer *et al.,* 2008). The fatty acids composition of *J. Glauca* seed oil reported the presence of palmitic, stearic, archidic, oleic and linoleic acids (Albasha *et al.,* 2015a).

The selection of *Euphorbia abyssinica, E. polyacantha*and *Jatropha glauca*for phytochemical screening is based on their common occurrence in the study area and economic importance.

Materials and Methods

Plants material used in this study were collected from Erkowit, Gebeit and Sinkat (Sinkat locality-Red Sea State-Sudan). The seeds and stems were shade dried at ambient temperature and then ground in a grinder. The latex of *Euphobia* spp. and sap of *Jatropha glauca* were obtained by

incision of the aerial parts of the plant in sterilized dry containers.

Preparation of extracts

Alcohol and aqueous extracts of plants were prepared by maceration extraction method. 5 gm. of dried finely powdered (seeds, stem,) or 5 ml. of latex and sap were added to 300 ml distilled water or ethanol for 72 hours till the extraction was completed, filtered and stored in clean dry containers.

Preliminary Phytochemical screening

The aqueous and ethanolic extracts obtained from plants were subjected to qualitative chemical tests in order to detect the presence of various chemical constituents. Major secondary metabolites classes such as flavonoids, saponin, tannins, steroids, , alkaloids and coumarins were screened according to the reference method of Harborne *et al.* (1984).

Quantitative analysis

Is based upon the preliminary phytochemical test quantitative determinations of phyto-constituents (saponin and alkaloids) were carried out. The powdered plant materials were used. Weight and yield% were determined and quantified by standard procedures. Saponin was determined using Obadoni and Ochuko method (2001). Alkaloids were determined using Harborne method (1973).

Results and Discussion

Preliminary Phytochemical screening

Phytochemicals of the stems and seeds of the three species such as alkaloids, cardenolides, unsaturated sterols and 2 deoxy sugars are strongly detected; while saponin, coumarins, tannins and flavonoids, were moderately present. Cyanidin is weakly present in ethanolic extracts of *Jatropha glauca* stem and *Euphorbia polyacantha*. Carbohydrates are present in all parts of *E. polyacantha*. Negative results are recorded for indicating the absence of leucoanthoyanins (Table 1). However the detected levels of phytochemicals in alcoholic extracts are considerably more compared to aqueous extracts. However the detected levels of phytochemicals in alcoholic extracts are considerably more compared to aqueous extracts.

No previous studies in the stems of the plants under investigation are available. Phytochemical screening of *Jatropha glauca* seeds is in agreement with the finding of Albasha *et al.* (2015b) who reported the presence of saponin, flavonoids and steroids; absence of alkaloids in the present study may be attributed to the fluctuations in the environment conditions or the plant age as mentioned by Smith (1976), or the different methods used.

Phytochemicals in *Euphobia* spp. latex and *Jatropha glauca* sap are relatively less than stems and seeds. While alkaloids and 2.Deoxy sugars were detected in all species extracts the other tested parameters vary in presence and levels between medium and weak (Table 2). Phenolic compounds are relatively weak. It is clear that phytochemicals in *Jatropha glauca* sap are rich compared to the *Euphobia* spp. *Abyssinica* revealed the presence of high level of deoxy sugars, and alkaloid as reported by Mengiste *et al*. (2014). *Jatropha glauca* sap contains high levels of the tested phyto-constituents than the *Euphorbia* spp. These may be responsible for better antioxidant properties in *J. Glauca* which may be of importance in drug discovery process.

Quantitative analysis

The primary phytochemical screening revealed the presence of appreciable quantity of alkaloids and saponin; based on this result these parameters are selected for quantitative analysis.

Table (1). Phytochemical screening of stem and seeds of, *Euphobia abyssinica (E.a.) E. polycantha* (*E.p.)* and *Jatropha glauca (J. g.)* in different solvents

	E.a.	*E.p.*	*J. g.*	*E.a.*	*E .p*	*J. g.*	*E.a*	*E.p*	*J.g*	*E.a*	*E. p*	*J. g.*
	stem						seed					
	Water			Ethanol			Water			Ethanol		
Cardenolipides	+++	+	+++	+	+	+++	++	+++	++	++	+++	+++
2.Deoxy Sugars	++	+++	+++	++	++	+++	+++	++	+	++	++	++
Alkaloids	++	++	++	++	++	++	++	++	++	++	++	++
Saponin	+	+++	++	-	++	+	+	+	+++	+	-	+
Tannins	+	++	++	+	++	+	+++	+	-	+++	-	-
Unsaturated Sterols	+	+	+	+++	++	++	++	++	++	+	+	+
Saturated Sterols	+	++	-	++	++	+	-	++	-	-	+	
Carbohydrates	-	+	-	-	++	-	-	++	-	-	+	-
Coumarins	+	++	-	++	+	+++	+	-	+++	-	+	++
Flavonols	-	-	+	+	+	++	-	+	++	-	+	+
Flavones	-	-	-	++	+	-	-	+	-	-	+	-
leucoanthoyanins	-	-	-	-	-	-	-	-	-	-	-	-
cyanidin	-	-	-	-	-	+	-	-	-	-	+	-

Key: +++ Strong, ++ Medium, + Weak, – Negative

Table (2). Phytochemical screening of *E. abyssinica* (E. a.) and *E. polyacantha* (E. p.) latex, and *Jatropha glauca* (J. g.) sap in different solvent.

Test	*E. a.*	*E. p.*	*J. g*	*E. a.*	*E. p.*	*J. g*
	Water			Ethanol		
Saturated sterols	+	-	+	-	++	+
Unsaturated sterols	++	-	++	++	-	++
Saponin	-	-	+++	-	-	++
2.Deoxy sugars	++	+	++	++	+	+
Cardenolides	+++	-	-	-	-	++
Cyanidin	-	-	-	-	-	++
Flavonols	-	-	-	-	-	+
Flavones	+	-	++	-	-	++
Leucoanthoyanins	-	-	+	-	-	-
Tannins	-	-	++	-	-	+
Alkaloids	++	+++	++	++	++	++
Coumarins	-	-	+	-	-	-
Carbohydrates	-	+	+	-	+	+

Key: +++ Strong ++ Medium + Weak – Negative

Saponin

Determination of saponin amount in aqueous extracts of *Jatropha glauca* and *Euphorbia polyacantha.* Table (4),

revealed the presence of high level (20%) in the seeds of the studied plants. Stem of *E. polyacantha* contains (20%) of saponin. Sap of *Jatropha glauca* score the highest level (26.3%). From the available literature no previous attempts have been carried out to determine saponin in the studied species.

Alkaloids

Euphorbia polyacantha latex contained high percentage of akaloids which is about 60% as shown in table (4). Alkaloids have been associated with medicinal uses for centuries and they have a wide range of pharmacological activities including antimicrobial and antimalarial. Many alkaloids are used in medicine, usually in the form of salts (Meyers, 2001).

Table (3). Weight, yield percentages and properties of crude saponin in aqueous extract of seeds and stem of *Euphorbia polyacantha* (*E. p.*) and *Jatropha glauca* (*J. g.*); and sap of (*J. g.*).

Compound	Parts	Weight (gm)	Yield percent		Consistency	
			J. g.	*E. p.*	*J. g.*	*E. p.*
Saponin	Seeds	1.01	20.2	-	Yellow powder	-
		1	-	20	-	White powder
	Stem	1	-	20	-	Brown powder
	Sap	1.3	26.3	-	Red powder	-

Table (4). Weight, yield percentages and properties of crude alkaloid in aqueous extract of *Euphorbia polyacantha* latex

Compound	Weight (gm)	Yield percent	Consistency
Alkaloid	3	60	White yellowish powder

Conclusion

From the study it can be concluded that**:**

- Extracts of the studied species showed remarkable phyto-constituents and promising results.
- Investigations of phytochemicals indicated that various parts showed significant levels of alkaloids, cardenolides and deoxysugars.
- The results support the traditional use of *Euphorbiaceae* as an effective herbal cure remedies**.**
- *Jatropha glauca* sap contains high levels of the tested phyto-constituents than the *Euphorbia sp.*

Recommendations

It can be recommended that *Euporbia abyssinica*, *E. polyacantha* and *Jatropha glauca* could be a potential source of active principles which may help to discover new chemical classes of drugs that could serve as selective agents for the maintenance of health. This study recommends running further studies to identify the active constituents, as well as to verify the biological activities of these plants.

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