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Phytochemical Evaluation and uses of *Ximenia americana L* in Central Darfur

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ABSTRACT

Ximenia americana which belong to the family Olacaceae local people traditionally used plant parts such as bark, leaves, and fruits for the treatment of different human ailments and disorder. The study was conducted to find out the scientific translate and basis for the use of the plant. Chemical and biochemical constituents medicinally use of the extract were determined. The extract was active against different microbiological organisms were found. Results showed the presence of saponins, few alkaloids, tannins, flavonoids, terpenes, triterpenes sterols, and coumarins in all extracts. The present of different amount of anthrax-quinones, starch, general glycosides, and bitter principles. The study encourage those who believe in the traditional use of this plant by herbalists as a remedy and curing different ailments.

Keywords: *Ximenia americana*; Ethnobotany; Folk remedy; phytochemical.

INTRODUCTION

Ximenia americana is a tree which belong to the family Olecaceae is widely distributed in different regions of the Sudan. It is widely spread in the high land of Darfur (Jabal Marra, Radom); Blue Nile (Ingessena Hills); Kordofan (Nuba Mountains, Nuhud); Red Sea Hills (Erkwit). *X. americana* bark, fruit and leaves were used by nomads and different people as a traditional medicine for themselves and their animals [1,2]. The fruit is a rich is a very good source of vitamin C and contains hydrocyanic acid riproximin [3].

Ximenia americana L. (Olacaceae), has different names according to the where it found, it's known as 'wild plum', 'yellow plum' or sea Lemon. *Ximenia* is a semi-scan dent shrub or small tree with small elliptic leaves and whitish to yellowish-green flowers borne in small cymes. Although *X.americana* is a tropical plant but it's widespread throughout tropical and subtropical countries in Central and Southern America, Africa, India and Southeast Asia to Australia, New Zealand, and Pacific islands [4].

Now-a-days in developing countries scientist looking forward to find medicine with less or without side effects. Thus, up to 80% of the population use medicinal plants as remedies. WHO in 1978 notes that of 119 plant-derived pharmaceutical medicines, about 74% are used in modern medicines in ways that correlate directly with their traditional uses as plant medicines by native cultures.

The plant is a bushy and spiny shrub or small tree, 4-5 m high with open crown. The fruits are green but turn golden yellow or red when ripe according to its species. The fruit consumed when it turns yellow and it has a refreshing and acid taste [5]. The extract of the plant traditionally used to treat and remedy such diseases like skin infections, ulcer, leprosy, malaria and Trypanosoma congolense infection in mice. It was believed that the plant has anti-inflammatory action and antimicrobial activity and use to cure rheumatic pain [6].

This specie is widely used in traditional medicine of different countries to treat several human ailments. Different parts of the plant were prepared and used in medication toothaches, mumps and conjunctivitis in frontal applications in many African countries [7]. Scientist reported that a lot of medicinal uses of *Ximenia* treatments for headaches, toothaches, fevers, constipation, leprosy, infections of the eyes and ears. Human Ailments and disease were cured and remedy traditionally with *Ximenia americana* bark and leaves. Petroleum ether and methanol using cold extraction method (maceration) were used to extract such substances from *Ximenia* Bark [8].

An Ethno-botanical survey carried with plants used in African medicine it's found that a compound of *Ximenia* root extracts is an essential medicine to cure leprosy. The fruits which were rich of many nutritional compound and other Martials, as well as the leaves consumed as anthelmintic, active against worms and diarrhea [9].

Other studies showed that *X. americana* was used for inflammations in general for healing, urinary tract infection, diarrhea, anti-parasitic, mental illness, leprotic ulcers, antiseptic, diuretic, ovarian and prostatic inflammations, pains, bloodshed, itching, burning, gastritis, fracture, inflammation, analgesic, anti-pyretic, cancer, hepatoprotective, ulcers, skin infections, purgative backache, hemorrhage, rash, toothache, and menstrual colic [10]. The ordinary parts used are bark and leaves. Moreover, the forms used were infusion, decoction, tincture, syrup, and cataplasm [11]. In fact, the phytochemical agents in medicinal plants work together with nutrients found in vegetables, fruits and nuts might even slow the aging process, prevent the risk of or cure many diseases such as heart diseases, diabetics, high blood pressure, cancer, tuberculosis, cataracts and urinary tract infections [12,13].

The anti-inflammatory properties and their medicinal action were supported by the presence of tannins and flavonoids [14]. The use of ground green leaves or bark infusion of *Ximenia americana* directly against snake or scorpion bite is an effective method in some tropical countries [4]. The presence of chemical compounds such as alkaloids, glycosides, phenols, tannins, saponins and volatile oils explain the medicinal use of plant. The chemical analysis of *Ximenia caffra* leaf extract resulted in the identification of 10 polyphenol compounds, including phenolic acid and flavonoids. The use of UV detection is importantly lead to identification of the individual polyphenols. The exhibit antioxidant, anti-proliferation, and anti-inflammatory activities have been shown by the bioactive investigation of *X. caffra*. The inhibition of NF-kB activation and shared signal pathway between proliferation and inflammation, may supported by the molecular mechanism [15].

MATERIALS AND METHODS

The fruits and aerial parts of *X. americana* were collected randomly from surrounded area of Nertete a part of Jabal Mara, Central Darfur State.

The leaves were washed with tap water and then air dried at room temperature in the Laboratory. The dried leaves ground into powder form using a clean mortar and pestle. The leaves were air dried at room temperature, crushed and then subjected to hydro distillation through a conventional Clevenger-type apparatus for 2 h.

The shade-dried leaves powder was used for chemical analysis. Physicochemical analysis was determined according to the standard procedures of Indian Pharmacopoeia. Preliminary phytochemical screening of the leaf drug carried out according to the standard methods.

To obtain a stock concentration of 10% (v/v) we use two grams of each extract of the two plants dissolved in 20 ml of their own mother solvents. The extracts obtained from the dissolved materials were subjected to phytochemical screening to determine the secondary metabolites. The phytochemicals screening were to conformation of lavonoids, alkaloids, steroids, saponins, reducing sugars and tannins.

AOAC methodology was used to analysis of chemical and physical properties of seed oil of *X. americana*. Density was determined picno metrically according to AOAC. Refractive index was determined at 25°C with a Carl Zeiss Abbè refract meter. Viscosity was determined with Brookfield Rheometer, DV-III, PR57429, and USA.

Seeds obtained by breaking down the fruit into two parts. To get the pulp of *X. americana* fruits were released from its seed coat. The pulp dried at room temperature. A weighted sample of the dry crushed seeds extracted with hot petroleum ether at 40°C-60°C with Kjeldahl Apparatus. The solvent in the combined extracts was removed by rotary evaporator to obtain the pure seed oil.

RESULTS AND DISCUSSION

Data present in Table 1 revealed that *Ximenia americana* was very rich with some pharmaceutical properties. Physicochemical Analysis of ash values used to determine the quality and purity of the crude drugs. Methodology procedure given in Indian Pharmacopoeia used to determine the different ash values such as total ash and acid insoluble ash. Alcohol soluble and water-soluble extractive value was also determined as per procedure given in Indian Pharmacopoeia. *Ximenia americana* is a one of the valuable wild edible plant in the world. In different countries, *X. Americana* was utilized as food, medicine, an essential oil source, and the industrial component to other essential products [1].

Table 1: Metabolic compounds identified in the phytochemical characterization of *X. americana* (XaAE) aqueous extract

Constituent	Leave extract			Stem bark extract			Root extract		
	Methanol	**Ethanol**	**Water**	**Methanol**	**Ethanol**	**Water**	**Methanol**	**Ethanol**	**Water**
Alkaloids	-	-	-	+	+	+	-	-	-
Glycosides	-	-	-	+	+	-	-	-	-
Cardiac	-	+	+	+	+	-	-	-	-
Flavonoids	+	+	+	+	+	+	-	-	-

Saponins	-	+	+	+	+	+	+	-	-
Steroids		-	-	-	+	-	+	-	-
Tannins	+	+	+	+	+	+	-	-	-
Quinones	-	-	+	+	+	-	-	-	-
Terpenes	+	+	-	+	+	+			

Scientist demonstrate that *Ximenia americana* extract, fractions and XM-Catechin produce anti-nociceptive and anti-inflammatory responses [16]. Antimicrobial and antifungal activities were found in the crude extracts of *X. americana*. The crude aqueous and methanolic extracts from different parts (leaves, root, stem and stem bark) of the plant were subjected to phytochemical screening and from the test carried out. It was observed that the secondary metabolites contained were saponins, flavonoids, tannins, terpenoids, sterols, quinones, alkaloids, cyanogenetic glycosides, cardiac glycosides and carbohydrates in the form of sugars and soluble starch [17,18].

Preliminary phytochemical analysis (Table 1) the dried powder leaf material was extracted with methanol, ethanol and aqueous successively in a Soxhlet apparatus. The extracts filtered while hot and concentrated under reduced pressure. The particle and percentage yields of the extracts were calculated. The concentrated extracts of the leaves subjected to qualitative chemical test for the identification of various active Constituents. The investigation revealed the presence of Alkaloids, Steroids, Sugars, Saponins, Tannins, and Terpenoids in methanol extract. Steroids in traces, absence of Terpenoids in ethanol and aqueous extract. The previous results are same with the finding of [19] who said alkaloids and anthraquinones were not present in the extracts. In *X. americana*, flavonoids, steroids, tannins and reducing sugars were found in the methanolic extract while the aqueous extract revealed the presence of alkaloids, saponins and tannins. This use could explain with the presence of chemical compounds such as alkaloids, glycosides, phenols, tannins, saponins [20] and volatile oil.

The qualitative phytochemical analysis showed a broad spectrum of bioactive compounds such as alkaloids, terpenoids, flavonoids, phenols, tannins, and glycosides. Similar observation on phytochemical screening showed presence of alkaloids, flavonoids, saponins, cardiac glycosides, phenolic and terpenoids in the extract [21]. It found that the aqueous crude extract contains 23.0090 ± 0.04129 mg of phenol and 53.47 ± 0.88059 mg of flavonoids content [22]. Qualitative phytochemical screening showed presence of alkaloids, flavonoids, saponins, cardiac glycosides, phenolic and terpenoids in the extract. The antimicrobial activity tests of the plant extracts on *Escherichia coli, Staphylococcus aureus, Salmonella spp* and *Candida albicans* showed that ethanol extracts had inhibitory activity on *S. arueus* only. Water extract showed inhibitory activity on *E. coli* and *S. aureus* but did not inhibit the growth of *Candida albicans* and *Salmonella spp* [23]. Phytochemical screening of the methanolic and aqueous extract of the bark showed that they both had flavonoids, anthraquinone, saponins, terpenes and tannin. The aqueous and methanolic extract appears to show some potential activity against *T. congolense* (Figure 1) [24-30].

It has reported that roots used in treatment of leprosy, syphilis, dysentery, and wounds. The root has been cited as a remedy used for hepatic, respiratory, circulatory, urinary and digestive disorders as well as having analgesic, anti-inflammatory, anti-tumor, anti-depressive and wound-healing properties. The root extracts have significantly ($p<0.05$) higher content of all phytochemical constituents determined. In recent study, results confirm that aqueous extract exhibited high antioxidant activity and flavonoids content. In MTT assay it shown significant anti-proliferative activity against both non-small cell lung cancer cell lines. Studies with extracts obtained from *X. americana* reveal that this species has an inhibitory capacity over bacterial growth.

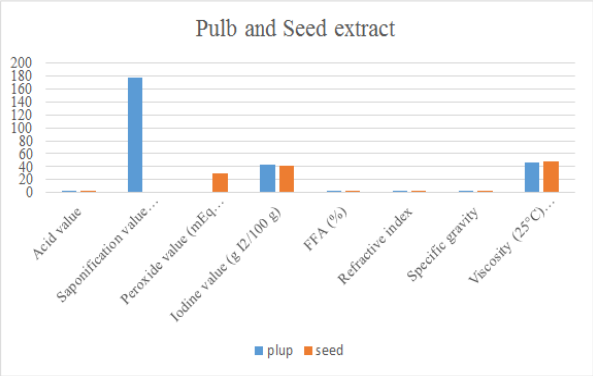

Figure 1. Physicochemical properties of the oil extracted from *X. americana* pulp and seed.

The physical and chemical properties of the oil of *X. americana* are shown in Table 2. The oil recovered from 589.75 gm of seeds of *X. americana* is 302.77 gm which is equivalent to Yield 51.34% oil content on seed weight basis. The oil was yellow in color, odorless and tasteless liquid. The viscosity data of *X. americana* seeds oil are given in Figure 1. The viscosity of the oil and its temperature dependence in the range 25-70°C suggested a potential industrial application of the oil as lubricating base stock. At 70°C the reduction in viscosity of the oil marked by over 80% of its value at 25°C. Thus, judging from the IV of the oil from *Ximenia americana* and its yield, the seed appears to be a viable source of oil for paint formulation. In addition, since the whole seed is edible, the oil may be a good source of poly unsaturated for human nutrition. Fresh seeds of *Ximenia americana* presented high levels of protein and oil. *Ximenia americana* oil is a potential economic resource for local communities and could provide important opportunities in increasing family income.

The dominant unsaturated fatty acid found in red *X. americana* flesh was oleic acid (26.29%), and the main saturated fatty acid detected was palmitic acid (29.78%) (Figure 2). The seed also had high un-saturated fatty acid which was elaidic acid, (84.32%) (Table 2) [31,32].

Table 2. *X. americana* seeds oil properties.

Item	**Description**
Color	Yellow
Odor	Odorless
Taste	Tasteless liquid
State	Liquid
Solubility	Freely soluble
Boiling Point	157°C
Density	0.9376 g/ml
Viscosity 25°C	227.58

Viscosity 70°C	42
Refractive index	1.477
Acid value	0.2805
Ester value	9.82
Iodine value	47.59
Peroxide value	30
Saponification value	11.43
Ratio value	35009

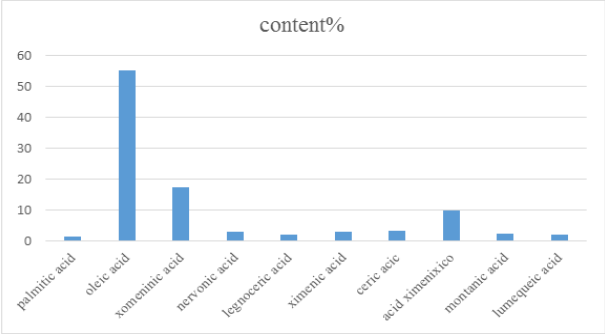

Figure 2: Fatty acid identification

CONCLUSION

Ximenia americana fruits, stem bark, roots and leaves possess antimicrobial activity. This can explain the rationale for the use of the plant in treating infections in traditional medicine. The plant could be a veritable and cheaper substitute for conventional drugs since the plant is easily obtainable and the extract can made *via* a simple process of maceration or infusion. In spite of the multipurpose use of *X. americana* it is locally vulnerable from a number of resource degradation factors.

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