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Ethnopharmacological review of *Ximenia americana* and *Lindera communis*

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ABSTRACT

The genus *Ximenia americana* and *Lindera communis* belongs to the Olacaceae and lauraceae. *Ximenia americana* and *Lindera* plants are widely used in traditional medicine. Especially, the leaves, fruits and roots of Lindera plants and fruit of *Ximenia americana* stands out for Phytochemicals like alkaloids, anthraquinones, cardiac glycosides, flavonoids, glycosides, phenolic compounds, phlobatannins, quinones, saponins, tannins, and terpenoids – A universal viewpoint of their Role in Nutrition and Health being for the treatment of a range of disease. It is found mainly in tropical regions of Africa, India, New Zealand, Central America and South America, specially Africa and Brazil. Investigations in the past years showed that the constituents of *Ximenia americana and* Lindera communis have shown several biological activities such as, antimicrobial, antifungal, anticancer, antineoplastic, antitrypanosomal, antirheumatic, antioxidant, analgesic, moluscicide, pesticidal, also having hepatic and heamatological effects. We conclude the plant Ximenia Americana and lindera communis was potential medicinal value and important to elaborate the various pharmacological activities, still the numerous of traditional claim not scientifically proved.

Key words: *Ximenia americana, Lindera communis*, Phytochemical, Scientific studies

INTRODUCTION

Ever since ancient times, in search for rescue for their disease, the people looked for drugs in nature. The beginnings of the medicinal plants' use were instinctive, as is the case with animals.[1] In view of the fact that at the time there was not sufficient information either concerning the reasons for the illnesses or concerning which plant and how it could be utilized as a cure, everything was based on experience. In time, the reasons for the usage of specific medicinal plants for treatment of certain diseases were being discovered; thus, the medicinal plants' usage gradually abandoned the empiric framework and became founded on explicatory facts. Until the advent of iatrochemistry in 16th century, plants had been the source of treatment

and prophylaxis. Nonetheless, the decreasing efficacy of synthetic drugs and the increasing contraindications of their usage make the usage of natural drugs topical again.

Ethnopharmacology studies natural medicines derived from plants and other substances that have been traditionally used by groups of people to treat various human diseases. Rather than a discrete discipline whose practitioners share an intellectual vision and methodology, ethnopharmacology is an amalgam of perspectives, primarily those of pharmacology, pharmacognosy, anthropology, and botany. Contributions are also made by historians of science, clinicians, agronomists, biochemists, and researchers in veterinary medicine. The uniquely biocultural perspective on ethnopharmacology offered by medical anthropology underscores that health and healing are culturally constructed and socially negotiated. Local, including Western, knowledge both emerges from and undergirds the complex relations among people, ideologies and material cultures, plants and other species,the physical environment. All components of this process, and their sequencing and intersections, are relevant to ethnopharmacology. In this spirit, the definition of ethnopharmacology that frames this volume is: the study of indigenous medical systems that connects the ethnography of health and healing with the physiologic relevance of its medical practices [2]

The use of plants as medicinal agents to the treat of many diseases has been investigated for a long time since the antique civilizations. Several plants are used in traditional medicine against diseases as well as various types of medicinal values on the base the potential of their chemical constituents.

ETHNOBOTANICAL REVIEW OF *XIMENIA AMERICANA* AND *LINDERA COMMUNIS*

Figure 1: Root, Stem and Leaves

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Figure 2: Leaves stems and Fruits

Scientific Classification of Ximenia *americana*

Binomial Name: Ximenia Americana

Kingdom: Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Eudicots

Order: Santalales

Family: Olacaceae

Genus: *Ximenia*

Species: ***X. americana***

Botanical Description

Ximenia americana, commonly known as tallow wood, hog plum, yellow plum, sea lemon, or pi'ut (Chamorro), is bush-forming shrub/small tree; a species from the Ximenia genus in the Olacaceae family. It is commonly found in woodlands native to the tropics in Africa, Asia, America and Australia, and grows to a height of 7m (23 feet). Its leaves are borne on spur shoots and have a spear-like to oval shape. The flowers and fruit of *X. americana* are aromatic and small. Flowering mainly occurs during the dry season, however, the maturing and ripening of the flowers and fruits occur throughout the year and are not affected by climatic conditions [3]

However, X. americana Linn. is the most common, being native to Australia and Asia where is commonly known as Yellow Plum or Sea Lemon. The plant is characterized as a small tree spinose feet tall, gray or reddish bark, with leaves small, simple, alternate, of bright green color and with a strong smell of almonds. The flowers are yellowish-white, curved and aromatic. Fruit are yellow-orange, aromatic, measuring 1.5 to 2.0 cm in diameter, surrounding a single seed and have a pleasant plum-like flavor (Matos, 2007). In Asia, the young leaves are consumed as a vegetable, however, the leaves also contain cyanide and need to be thoroughly cooked, and

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should not be eaten in large amounts. *X*. americana, commonly called "ameixa do mato", "ameixa de espinho" and "ameixa da Bahia", is widely distributed in northeast Brazil.

Distribution and habitat

Ximenia americana is mainly found in the tropics, ranging from Africa, India and southeast Asia, to New Zealand, Pacific Islands, West Indies, Central, North and South America. It is especially common in Africa and South America. [4] It is not domesticated so it is only found occurring in the wild. [5]

It is found in many habitats, predominantly in semi-arid bushlands and in dry and moist woodlands, sandy open woodlands, dry hilly areas, coastal bushlands, countrysides, shrub savannahs, forest lands and along watercourses such as riverbanks and stony slopes. *X. americana* occurs in altitudes up to 2000 m (6562 ft) and where mean annual rainfall is more than 500 mm. It grows on many soil types such as clay soils, clay muddy, silt sandy; however, it is mostly observed growing on poor and dry soil. It can also absorb nutrients and water from other plant species through its roots, however, it does not use this method as its mode of survival.

Traditional medicinal value

Ximenia americana has been reported to be used to treat a large number of diseases by traditional healers; the main diseases being measles, malaria, skin infections, sexually transmitted diseases, diarrhea, muscle cramps and lung abscesses.[6] A tea obtained from its barks has been used in popular medicine as cicatrizing, adstringent and as an agent against excessive menstruation. As a powder, it treats stomach ulcers and the seeds are purgative [7]. The leaves and twigs are mainly used as a treatment for colds and fevers, as laxatives and an eye lotion, and as a mouthwash to prevent toothaches and throat infections, however, the traditional healers reported excess salivation as a sign of the toxicity when used to treat oral diseases. The leaves are used to treat headaches, angina and as are used as an antidote to poisons. The roots of *Ximenia americana* are used as a treatment multitude of diseases such as skin problems, headaches, leprosy, hemorrhoids, sexually transmitted diseases, sleeping sicknesses and guinea worms. The bark, usually used in powdered or decocted form, is used to treat skin ulcers, placed on the head for headaches, and placed in bath water for sick babies. The fruit is eaten in excess to treat any cases of vermifuge and constipation. Studies have also shown that *X. americana*'s extracts from bark, roots and leaves have been reported to be used to treat urinary tract infections, inflammation, burning, gastritis and cancer. The main ways these parts of *X. americana* are prepared are either by infusion, decoction, syrup, cataplasm, and/or tincture. [8]

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ETHNOBOTANICAL REVIEW OF LINDERA COMMUNIS

Binomial Name: Lindera communis hemsl

Figure 3: Leaves

Figure 3: Fruit

Botanical Description

Tree to 10 m, 0.3 m dbh. Branchlets reddish or blackish brown with dense golden or black pubescence. Leaves deciduous, alternate, 5–10 × 2–3.5 cm, oblong to oblanceolate, thick, papery, upper surface greenish brown and glabrous, lower surface with yellowish brown tomentum, four to six lateral veins on each side of the midrib, margins entire, apex caudate to acuminate; petiole 0.5–0.6 cm long, pubescent below. Inflorescence clusters axillary, with five to six flowers and four bracts. Flowers yellowish green, tepals six, slightly pubescent outside; staminate flowers with nine fertile stamens; pistillate flowers smaller, with nine staminodes. Fruit ellipsoidal to globose, deep red, 0.8 × 0.5 cm. Flowering April, fruiting October to November (Taiwan). Liao 1996b.

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Distribution CHINA: Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Shaanxi, Sichuan, Yunnan, Zhejiang; INDIA: Assam; JAPAN: Ryukyu Is.; MYANMAR; TAIWAN; VIETNAM.

Habitat Broadleaved forest to elevations of 2300 m asl.

The leaves are occasionally used as a condiment. The dried, powdered leaves and twigs are added to rice bouillon for flavour. Edible oil is obtained from the seed [9]

PHYTOCHEMICAL REVIEW OF *XIMENIA AMERICANA AND LINDERA COMMUNIS*

Fatty acids and glycerides are abundantly available in *X.americana*. Further classes of chemical compounds found in X. americana includes alkaloids, anthraquinones, cardiac glycosides, flavonoids, glycosides, phenolic compounds, phlobatannins, quinones, saponins, tannins, and terpenoids. Leaves collected from *X. americana* in southern Niger were found to be rich in calcium, iron, magnesium, and manganese content. Linolenate was also detected in the leaves, along with high levels of palmitate. Hydrocyanic acid was identified in the fruit along with high levels of vitamin C content, of which the green ones had 74% more vitamin C than the matured, yellow ones. The seed of the fruit contains cyanide derivatives and high levels of riproximin were noted in the fruit kernels. The seed oil was observed to contain the compounds ximenic, linolenic, linoleic, and stearic acids along with smaller amounts of lumequic, ximenynic acid, arachidonic, erucic, and nervonic acids and a variety of other compounds. The volatile oil of the leaves was observed to be consisted of benzaldehyde (63.5%), hydroxybenzyl cyanide (13%) and isophorone (3.5%).

The *X. Americana and Lindera communis* examined [10] and the stem ethanolic extract afforded steroids (stigmasterol and sitosterol), triterpenoids (betulinic acid, oleanolic acid, 28-O-(-D-glucopyranosyl) oleanolic acid, 3-oxo-oleanolic acid, 3β–hydroxycicloart-24(*E*)-ene-26-oic acid and sesquiterpenoids (furanoic and widdrane type). A large number of sesquiterpenes are constituents of essential oils of higher plants and seem to intervene in the pharmacological properties attributed to these volatile fractions [11]. It has been clarified that the biological activities of the liverworths are due to terpenoids and lipophilic aromatic compounds [12]Steroids and triterpenes with therapeutic interest are a group of secondary metabolites of outstanding importance [13]. In all, 341 secondary metabolites have been isolated and identified from Lindera plants thus far. These constituents are of seven types, namely, sesquiterpenoids, alkaloids, butanolides, lucidones, flavonoids, phenylpropanoids, and others. Of these, sesquiterpenoids and alkaloids are the dominant constituents. Considerable recent work strongly indicates the great potential of the triterpenoids as source of use medicinal [14]

SCIENTIFIC REPORT OF *XIMENIA AMERICANA*

Spjut, R. W. & Perdue Jr., R. E. proved, anti-tumour activity by using *in-vitro* MTT assay against non-small lung cancer cell lines (A549 & NCI-H460). Total flavonoids content of aqueous extract was also determined to assess their corresponding effect on antioxidant capacity of plant. Phytochemical analysis showed that each solvent extracts contained broad spectrum of secondary metabolites, phenolic compounds, flavonoids, tannins and glycosides and also aqueous extract exhibited the highest flavonoids content and the significant antioxidant capacity

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based on the test performed. In case antiproliferative assay aqueous extract shown very good cytotoxic activity by inhibiting the growth in both cell lines. IC50 value found to be 229.20 µg and 338.30 µg for A549 and NCI-H460 respectively. The present study revealed that aqueous leaf extract of *X. americana* leaves contain broad spectrum of bioactive compounds. Results confirm that aqueous extract exhibited high antioxidant activity and flavonoids content. In MTT assay it shown significant antiproliferative activity against both non-small cell lung cancer cell lines. Further study requires purification, Characterization and structural elucidation of flavoind compounds in aqueous extract and its pharmacological studies in animal models i.e. *In-vivo* study which that may help in the development of new novel drug. [15]

Geyid *et al.* studied, **Antimicrobial and antifungal activities** to evaluate the scientific basis for the use of numerous plants species used to treat diseases of infectious origin, crude extracts of these plants were investigated. The antimicrobial activity of the extracts of the various parts of the investigated plants such as roots, leaves, seeds, stem barks and fruits, appears to be due to the presence of secondary metabolites such polyphenols, triterpenes, sterols, saponins, tannins, alkaloids, glycosides and polysaccharides [16]

Soro, T. Y et al and Siddaiah, M. et al proved Analgesic activity of the aqueous extract of stem bark of *X. american* has analgesic properties that justify its use popular in countries such as Tanzania, Senegal, Zimbawe and Nigeria. The extract of *Ximenia mericana* in doses containing 10 to 100 mg/kg P.C, inhibits contractions of the abdomen with analgesic effects comparable to those of phenylbutazone. In fact, at doses of 100 mg /kg P.C, phenylbutazone causes an inhibition of pain in 45.2±2%. The percentage of inhibition by extract of *X. ameriacana* is 61.1±% in the same concentration. These properties are probably due to the presence of flavonoids and saponins, detected in the extract. The analgesic activity of the methanol extract of *X. americana* leaf was investigated in chemical models of nociception in mice. The extract at doses of 200, 400 and 600 mg/kg i.p. produced an inhibition of 54.13, 63.74, and 66.4% respectively, of the abdominal writhes induced by acetic acid in mice. In the formalin test, the administration of 200, 400 and 600 mg/kg i.p. had no effects in the first phase (0 to 5 min) but produced a dose dependent analgesic effect on the second phase (15 to 40 min) with inhibitions of the licking time of 29.3, 47.8 and 59.8%, respectively. These observations suggested that methanol extract of *X.americana* leaf possesses analgesic activity [17, 18].

Soro, T. Y.; syudied Antipyretic activity of bark of stem of *X. americana* has been used in West Africa for the treatment of pain and fever. To verify this second property, the treatment of rats in hyperthermia with *Ximenia americana* stem bark aqueous and with beer yeast was compared to those obtained with lysine acetylsalicylate (Aspegic). The study showed an antipyretic action of the extract. Moreover, the toxicological study of the stem extract indicated a LD50 of 237.5 mg/kg P.C according to the classification of Diezi this plant is relatively toxic. The experiments show that the properties of *X. americana* could due to the presence of saponosides, as show by screening tests performed in this study. These results justified the use of *X. americana* in traditional cure of fever treatment. [17]

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Maikai, V. A. et al proved the in vitro antitrypanosomal activity of methanolic and aqueous extracts of stem bark of *Ximenia americana* was evaluated on Trypanosoma congolense. Blood obtained from a high infected mice with *T. congolense* (10(7) was incubated with methanolic and aqueous extracts at 20, 10 and 5 mg/ml and Diminal(R) (diminazene aceturate) at 200, 100 and 50 μg/ml in a 96 micro plate. The results revealed that methanol and aqueous extracts had activity at 20 and 40 mg/ml however, the methanolic extracts were more active than aqueous extracts at 10 and 5 mg/ml. Phytochemical screening of the methanolic and aqueous extracts of the bark showed that they both had flavonoids, anthraquinones, saponins, terpenes and tannins. The aqueous and methanolic extracts appears to show some potential activity against *T. congolense* [19].

James, D. B et al was conducted Hepatic and heamatological effects from the leaves, stem bark and root aqueous extract of *X. americana* with albino rats. The results of this work shows that the extracts significantly ($P<0.05$) increasing the level of serum alanine transaminase (ALT) and aspartate transaminase (AST), results indicative of hepatocellular damage. The result also shows that the root has the ability to impair albumin synthesis as observed by the decrease of level of serum albumin. The weight of the animal showed a significant ($P<0.05$) reduction on administering the leaves extract as compared to the control and the others extracts. This reduction might be due to poor intake and utilization of food by the animals in the leaves extract group. The significantly ($P<0.05$) higher content of hydrogen cyanide, saponins, and oxalates in the root extracts indicates that the root extracts may be more toxic. Hydrogen cyanide is known to cause gastrointestinal inflammation and inhibition of cellular respiration. Saponins are known to have haemolytic properties and the ability to reduce body cholesterol by preventing its reabsorption. The high saponin content in the root may lead to gastroenteritis manifested by diarrhea. Oxalates have been known to cause irreversible oxalate nefrosis when ingested in large doses. Thus, there is need to isolate the specific component(s) responsible for the toxicity in the root extract in order to standardized the preparation for maximum therapeutic benefit. [20]

Maikai, V. A. studied Acute toxicity studies of the stem bark of *X. americana* was evaluated for its phytochemical constituents and acute toxicity effect on the Swiss albino mice (Maikai *et al.*, 2008). The results from the extracts administered intraperitoneally/orally at doses of 10, 100 and 1000 mg/kg body weight revealed no death with doses up 5000 mg/kg body weight. Post mortem, hematological and histopathological examination did not show any significant ($P<0.05$) weight changes. Phytochemical screening of the aqueous extract stem bark revealed the presence of cardiac glycosides, flavonoids, saponins and tannins. The results suggested that the aqueous extract is not acutely toxic to the mice.[21]

Romézio Alves et al revealed, hexane and ethanolic extracts of *X. americana* seeds were subjected to silylation reactions followed by analysis of the silylated derivatives by gas chromatography-mass spectrometry (GC/MS). In the hexane extract, 18 substances were identified, where the most abundant and most important components were the Octadec-9-enoic (38.14%), (9*Z*,12*Z*)-Octadec-9,12-dienoic (18.83%), Ethanedioic (8.21%) and (*Z*,*Z*,*Z*)-9,12,15-Octadecatrienoic (7.22%) acids. From the ethanol extract 18 substances were also identified

having D-Sucrose (29.36%), L-Sorbose (9.19%), syllo-Inositol (8.34%) and D-Glucose (7.45%) as the main components. In addition, the presence of a steroid in hexane extract and triterpenes in ethanol extract was recorded. The constituents were identified using chromatographic and spectrometric methods, especially gas chromatography-mass spectrometry. To our knowledge,this is the first study of this nature from the oil of the *X. americana* seeds.[22]

Paolo, R. studied Food composition and cosmetic use of Glyceride blends containing ximenynic acid (found in *X. americana*) are useful for the preparation of food compositions or food supplements, including margarine, chocolate, ice cream, mayonnaises, cheese, dry soups, drinks, cereal bars and sauces and snack bars. The blend provides a composition providing health benefits consisting of insulin resistance, or related disorders such as diabetes, delaying the onset of symptoms related to development of Alzheimer's disease, improving memory function, lowering blood lipid levels, anticancer effects or skin antiageing effects. *X. americana* flowers are a replacement for orange blossoms with similar fragrance and soothing cosmetic properties. [23]

SCIENTIFIC REPORT OF *LINDERA COMMUNIS*

Kobayashi et al. Proved Anticancer, anti-inflammatory, and antiviral properties of Eudesmane sesquiterpenes and Germacrane sesquiterpenes isolated from Lindera plants mainly include lindenane, eudesmane, germacrane, and guaiane. In all, 99 sesquiterpenoids have been isolated and structurally characterized from Lindera plants, of which some exhibit anticancer, anti-inflammatory, and antiviral properties. [24]

Gan et al Studied, Antihypertensive, anti-inflammatory, and analgesic effects of Alkaloids isolated from Lindera communis. Aporphines, one of the characteristic constituents produced by plants belonging to the Lauraceae family, include majority of alkaloids and exhibit significant pharmacological actions. [25]

Niwa et al. isolated **Butanolides** from Lindera plants, mainly L. glauca, L. akoensis, L. obtusiloba, L. benzoin, and L. communis. Most butanolides have anticancer properties, whereas some have antibacterial properties.[26]

Kim et al a flavone molecule from lindera were fused with one or two p-methene units. These compounds exert cytotoxic effects and inhibit the release of LDH from BSO-treated H9c2 cardiac myocytes [27]

Wang et al. Studied the GC/MS analysis along with1Dand 2DNMRtechniques were used to identify various essential oils fromLindera plants. Eighteen compounds have been characterized from the essential oil of L. communis fruits, with bis(2-hydroxyethyl)lauramide (43.53 %) and n-carpic acid (35.28 %) being the predominant compounds. This essential oil exhibits obvious antifungal and antibacterial properties. Forty compounds have been characterized from the essential oil of L. neesiana fruit, with Z-citral (15.08 %), E-citral (11.89 %), eucalyptol (8.75 %), citronellal (6.72 %), apinene (6.63 %), and b-pinene (5.61 %)being the major compounds. This oil exhibits antimicrobial activity against Staphylococcus aureus and Candida albicans at doses that are non-cytotoxic to human keratinocytes, [28]

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Rajasekaran. S and R. Anandan studied Hepatoprotective Activity of Lindera communis Hemsl ethanolic leaf extract of *Lindera communis*for hepatoprotevtive activity using paracetamol (2g/kg) and D-galactosamine (400mg/kg) induced models. Acute toxicity study and preliminary Phytochemical screening were also studied to evaluate the toxicity. No toxicity profile was observed in rats after oral administration of the ethanolic leaf extract at the dose of 5g/kg body weight. The different dose of 200 mg/kg and 400 mg/kg administered with the extract of *Lindera communis*there was significant (P <0.001) reduction in biochemical parameters with respect to control. Phytochemical screening of the plant extract revealed the presence of tannins, alkaloids, flavonoids and saponins, and terpenoids.It can be concluded that the hepatoprotevtive activity elucidated by *Lindera communis*could be mainly due to the presences of high value of phenolic class of compounds as the major content in the plants.[29]

Shimomura et al. studied extracts of Lindera communis show obvious cardiovascular effects, mainly by inhibiting platelet aggregation, anti-inflammation, and anti-oxidative stress. Extracts of L. communis were investigated for their effects on systolic blood pressure, cardiac function, and plasma noradrenaline levels in spontaneously hypertensive rats (SHRs). Treatment with an extract of 10 g roots in 20 ml water for 30 weeks showed antihypertensive effect and increased cardiac function in SHRs. [30]

Anti-inflammatory activity

Li et al. and Wang et al. studied, Inflammation is a central feature of many pathological conditions and is mediated by various soluble factors and cellular signaling events. Previous studies have shown that extracts and constituents of Lindera plants show remarkable anti-inflammatory effects. Aqueous and alcohol extracts of L. aggregata roots at a dose 20 g/kg (raw material) antagonized ear swelling induced by an inflammatory agent. Oral administration of 50, 100, and 200 mg/kg of total alkaloids from Radix Linderae (TARL) to CIA rats for 20 days alleviated disease severity in a dose-dependent manner. TARL (100 and 200 mg/kg) also decreased serum level of IgG anti-CII and inhibited delayed-type hypersensitivity, as assessed by its effect on collagen II-induced ear swelling in mice.[31]

CONCLUSION

In general, the compounds found in *Ximenia americana and Lindera communis* were saponins, glicosydes, flavonoids, tannins, phenolics, alkaloids, quinones and terpenoids types. In addition, the plant is potentially rich in fatty acids and glycerides. We can see, from all the information summarized above, that work on plants of the genus. The present review compiles the published chemical and pharmacological information on the species *X. americana* and *Lindera communis* update important data reported the recent scientific literature. Ximenia and *Lindera* is justified, particularly *Ximenia Americana and Lindera communis* species, where systematic study is still not satisfactory, specially, relative to specific biological activity of their chemical constituents. So our further study plans to explore an assortment of pharmacological action of both plants.

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REFERENCES

1. Kefelegn GA, Desta B (8 March 2021). Mansour A (ed.). "Ximenia americana: Economic Importance, Medicinal Value, and Current Status in Ethiopia". TheScientificWorldJournal. 2021: 8880021. doi:10.1155/2021/8880021.
2. Feyssa, Debela Hunde; Njoka, Jesse T.; Asfaw, Zemede; Nyangito, M. M. (2012). "Uses and Management of Ximenia Americana, Olacaceae in semi-arid East Shewa, Ethiopia" (PDF). Pakistan Journal of Botany. 44: 1177–1184.
3. Mevy, Jean-Philippe; Bessiere, Jean-Marie; Greff, Stéphane; Zombre, Gérard; Viano, Josette (1 July 2006). "Composition of the volatile oil from the leaves of Ximenia americana L." Biochemical Systematics and Ecology. 34 (7): 549–553.
4. USDA, NRCS (n.d.). "Ximenia americana". The PLANTS Database (plants.usda.gov). Greensboro, North Carolina: National Plant Data Team. Retrieved 7 August 2015.
5. Mahato SB, Nandy AK, Roy G. Triterpenoids. Phytochemistry 1992; 7(10): 180-187.
6. Fatope MO, Adoum OA, Takeda Y. C18 Acetylenic Fatty Acids of *Ximenia americana* with potential pesticidal activity. J Agr Food Chem 2000; 48: 1872-1874.
7. Visuthikosol V, Chowchuen B, Sukwanarat Y, Sriurairatana S, Boonpucknavig V. Effect of *Aloe vera* gel to healing of burn wound a clinical and historic study. J Med Assoc Thai 1995; 78: 403–9.
8. Atta-ur-Rahman (2005). *Studies in Natural Products, Bioactive Natural Products (Part L), Vol. 32*, Atta-ur-Rahamn, Karachi, Pakistan.
9. Shugang Li, Xi-wen Li, Jie Li, Puhua Huang, Fa-Nan Wei, Hongbin Cui & Henk van der Werff. Lauraceae. Flora Of China. Missouri Botanical Garden Press; St. Louis.1994, Vol 7 p-102
10. Badami, R. C. & Patil, K. B. (1981). Structure and Ocurrence of Unusual Fatty Acids in Minor Seed Oils. *Progress in l Lipid Research*, Vol. 19, pp. 119-153, ISSN 01637827.
11. Braga, R. (3ª Ed). (1976). *Plantas do Nordeste, especialmente do Ceará*, Escola Superior de Agricultura, Mossoró, Brasil.
12. Brasileiro, M. T.; Egito, M. A. & Lima, J. R.; Randau, K. P.; Pereira G. C.; Neto, P. J. R. (2008). *Ximenia americana* L: botânica, química e farmacologia no interesse da tecnologia farmacêutica. *Revista Brasileira Farmacognosia*, 89, 2, pp. 164-167.
13. Bruneton, J. (3a Ed) (1999). *Pharmacognosie, phytochimie, plantes médicinales*, Tec & Doc Ed., Angers, France.
14. Chhabra S. C.; Viso, F. C., (1990). A Survey of the Medicinal Plants Eastern Tanzania for Alkaloids, Flavonoids, Saponins and Tannins. *Fitoterapia*, Vol. 61, No. 4, pp. 307- 316.
15. Spjut, R. W. & Perdue Jr., R. E. (1976). Plant folklore: a tool for predicting sources of antitumor activity ?. *Cancer Treatiment Reports*, Vol. 60, pp. 979-985.
16. Geyid, A.; Abebe, D.; Debella, A.; Makonnen, Z.; Aberra, F.; Teka, F.; Kebede, T.; Urga, K.; Yersaw, K.; Biza, T.; Mariam, B. H. & Guta, M. (2005). Screening of medicinal plants of Ethiopia for their anti-microbial properties and chemical profiles. *Journal of Ethnopharmacology*, Vol. 97, pp. 421-427

17. Soro, T. Y.; Traore, F. & Sakande, J. (2009). Activité analgésique de l' extrait aqueux de *Ximenia americana* (Linné) (Olacaceae). *Comptes Rendus Biologies*, Vol. 332, pp. 371- 377.
18. Siddaiah, M.; Jayavcera, K. N.; Mallikarjuna, R. P.; Ravindra, R. K.; Yasodha, K. Y. & Narender, R. G. (2009). Phytochemical screening and analgesic activity of methanolic extract of *Ximenia americana. Journal of Pharmacy and Chemistry*, Vol. 3, No. 1, pp. 23-25,
19. Maikai, V. A.; Maikai, B. V. & Kobo, P. I. (2009). Antimicrobial Properties of Stem Bark Extracts of *Ximenia americana*. *Journal of Agricultural Science*., Vol.1, No. 2, 2009, pp. 30-34.
20. James, D. B.; Owolabi, A. O.; Ibiyeye, H.; Magaji, J. & Ikugiyi, Y. A. (2008). Assessment of the hepatic effects , heamatological effect and some phytochemical constituents of Phytochemicals – A Global Perspective of Their Role in Nutrition and Health *Ximenia Americana* (Leaves, stem and root) extracts. *African Journal of Biotechnology*, Vol. 7, No. 23, , 2008, pp. 4274-4278,
21. Maikai, V. A.; Kobo, P. I. & Adaudi, A. O. (2008). Acute toxicity studies of aqueous stem bark extract of *Ximenia Americana. African Journal of Biotechnology*, Vol. 7, No. 10,2008, pp. 1600-1603.
22. Romézio Alves Carvalho da Silva*, Telma Leda Gomes de Lemos, Daniele Alves Ferreira, Francisco José Queiroz Monte. *Ximenia americana*: Chemical and Spectral Studies of Extracts of Seeds. Analysis of Trimethylsilyl Derivatives by Gas Chromatography and Mass Spectrometry. *American Journal of Analytical Chemistry*, 2016, 7, 192-202.
23. Paolo, R. Cosmetic use of the oil and flowers of *Ximenia americana*. *Rivista Italiana Essenze*, Vol. 61, No. 5, 1979 pp. 190-193.
24. Kobayashi W, Miyase T, Sano M, Umehara K, Warashina T, Noguchi H (2002) Prolyl endopeptidase inhibitors from the roots of Lindera strychnifolia F. VILL. Biol Pharm Bull 25(8):1049–1052.
25. Gan LS, Yao W, Mo JX, Zhou CX (2009a) Alkaloids from Lindera aggregata. Nat Prod Comm 4(1):43–46.
26. Niwa M, Iguchi M, Yamamura S (1975b) Three new obtusilactones from Lindera obtusiloba Blume. Chem Lett 7:655–658.
27. Kim JA, Jung YS, Kim MY, Yang SY, Lee S, Kim YH (2011) Protective effect of components isolated from Lindera erythrocarpa against oxidative stress-induced apoptosis of H9c2 cardiomyocytes. Phytother Res 25(11):1612–1617.
28. Wang FS, Yang DP, Ren SX, Peng JF (1999) Chemical constituents of volatile oil from fruits of Lindera communis and its antifungal and antibacteria activities. Nat Prod Res Devel 11(6):1–5.
29. Rajasekaran. S and R. Anandan Phytochemical and Pharmacological Evaluation of Lindera communis Hemsl for their Hepatoprotective Activity. *Ijppr.Human, 2016; Vol. 7 (1): 251-262.*
30. Shimomura M, Ushikoshi H, Hattori A, Murata I, Ohno Y, Aoyama T, Kawasaki M, Nishigaki K, Takemura G, Fujiwara T, Fujiwara H, Minatoguchi S (2010) Treatment with Lindera strychnifolia reduces blood pressure by decreasing sympathetic nerve activity in spontaneously hypertensive rats. Am J Chin Med 38(3):561–568.
31. Li QL, Jian GX, Dou CG, Wang ZT, Huang F (1997) Studies on the analgesic and antiinflammatory action of Radix Linderae extract. J Chin Med Mater 20(12):629–631.