

## **Ethnobotanical Survey of Medicinal Plants used in Treatment of Cough in Akinyele Local Government Area, Oyo State, Nigeria**

### **ABSTRACT**

Majority of people in developing countries rely on Traditional Medical Practitioners (TMPs) or herbalist, hunters and community elders for the treatments of various diseases and illness. They possess a vast knowledge of medicinal plant uses. There is need to protect the flora and fauna and also the knowledge database often stored in the memories of elders, tribal's and traditional healers. Ethnobotanical study of medicinal plants used in the treatment of cough was carried out in Akinyele Local Government with the aim to document plants and indigenous knowledge of local people in the treatment of cough. **Seven** villages were selected purposively due to the relic of forest in those villages. The villages are Ijaye, Onidundu, Otunagbakin, Moniya, Idi- ose, Apapa, Aroroand Olanla. Respondents were stratified into 2 strata in each of the village, namely Traditional Medical Practitioners (TMPs) or herbalist and hunters. Within each stratum, a random selection of 10 respondents were carried out thereby making 20 respondents in each village and total number of 160 respondents as sample size. Semi structured questionnaire was used to obtain information from the respondents. The interview was conducted one-on-one using the local language (Yoruba). The data collected were analysed with descriptive statistics. The result showed a total number of 16 plants belonging to 16 families were recorded and enumerated along with their botanical name, family and local name. Information on methods of preparation of recipes, plant part used, form in which plant part is used, mode of administration, dosage and shelf life were also documented. There is need for domestication and conservation of these plants to prevent them from extinction. The bioactive compound in some of these plants can be synthesized together to produce conventional drug cough. Also, further studies should be carried out on these plant species so as to find out more of bioactive compounds in them.

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**Keywords:** Traditional Medical Practitioners (TMPs), Hunters, Medicinal plants, Cough

### **INTRODUCTION**

Millions of people in the third world countries like Nigeria use herbal and traditional remedies for their well being. Traditional medicines are recognized by World Health Organisation (WHO) as essential building block for primary health care, especially in developing and vast country like Nigeria, where qualified doctors and other medical staff have not reached

especially in remote rural areas. It has been realized today that there is need to preserve the enormous trove of wisdom and traditional knowledge and also the cultures associated with them. There is need to protect the flora and fauna and also the knowledge database often stored in the memories of elders, tribal's and traditional healers.

Traditional Medicine is used globally and is rapidly growing in economic importance. It is still recognized as the preferred primary health care system in many communities, with over 60% of the world's population and about 80% in developing countries depending directly on medicinal plants for their medical purposes (Shrestha and Dhillon, 2003). In developing countries, Traditional Medicine is often the only accessible and affordable treatment available. The WHO reports that Traditional Medicine is the primary health care system for important percentage of the population in developing countries. This is due to a number of reasons including affordability, accessibility and low cost (Asase et al., 2008).

**Comment [A2]:** Include more recent references

**Comment [A3]:** Include more recent references

Plants have been used in traditional medicine for several thousand years (Abu-Rabia, 2005). From the time immemorial, human civilizations have been exploring and using various plants and plant products to cure the lethal diseases. Different plants species and their uses as medicine are greatly well-known to indigenous communities in different parts of the world. Local people are specialist for mounting inventive practices and products from their surrounding environment particularly, the plant world (Abbasi et al., 2013 and Abbasi et al., 2015). Many drugs have plant origin, and several plants are currently undergoing investigation to ascertain their therapeutic efficacies (Balunas and Kinghorn, 2005 and Torres et al., 2012). The knowledge about the use of traditional herbal medicines gradually perishes, although some of the traditional tribal communities and some human beings which believed in the usage of herbal medicines are still practicing the art of herbal healing effectively (Mujtaba et al., 2014). Today according to the World Health Organization (WHO), as many as 80% of the African population depend on traditional medicine for their primary healthcare needs (WHO, 1991).

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Herbal medicine is widely practiced throughout the world from time immemorial. These medicines are safe and environment friendly. The indigenous traditional knowledge of medicinal plants of various ethnic communities, where it has been transmitted orally for centuries is fast disappearing from the face of the earth due to the advent of modern technology and transformation of traditional culture (Ganesan et al., 2004). During the last few

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decades there has been an increasing interest in the study of medicinal plants and their traditional use in different parts of the world. The traditional healers are dwindling in number and there is a grave danger of traditional knowledge disappearing soon since the younger generation is not interested to carry on this tradition. Therefore, it becomes the responsibility of the scientific community to unravel the information and to document it for availability to the whole world for the benefit of human beings.

It was not known where or when plants first began to be used in the treatment of disease, but the connection between plants and health has existed for thousands of years (Faleyimu and Oluwalana, 2008). Herbal or botanical medicine, or phytotherapy, was defined as “the use of plant materials to prevent and treat ill health or promote wellness” (Amehe *et al.*, 2010). The use of herbs as medicine is the oldest form of healthcare known to humanity and has been used in all cultures throughout history (Barnes *et al.*, 2007).

There is limited documentation of medicinal plants used in the treatment of cough in Nigeria and in the study area in particular, but several ethnobotanical studies focusing on medicinal plants have been documented all over the world (Singh and Singh, 2001; Cox, 2005; Kumar *et al.*, 2005; Wang *et al.*, 2005). In view of this, it is paramount to document some medicinal plants used in the treatment of cough in the study area. This study aimed at providing baseline information on medicinal plants used in the treatment of cough and also serving as baseline information for validation.

**Comment [A6]:** Are there ethnobotanical studies in Nigeria? Report

## METHODOLOGY

### Description of the study area

The study area of this research work is Akinyele Local Government Area of Ibadan Oyo State, Nigeria. It is one of the eleven local governments that make up Ibadan metropolis. Its headquarters is located at Moniya. It has latitude of 7°33'41.47" N and 3°54'21.92" E. The whole Local Government Council area is five hundred and seventy five square kilometres (575 km<sup>2</sup>) with a projected population of 297, 600 as at 2016 from the 2006 national population census. The average annual rainfall is about 1200mm and ecological zone type is forest savanna. Akinyele Local Government is highly heterogeneous and metropolitan in nature especially in areas like Ojoo, Orogun, Sasa, Moniya and Akinyele where Nigerians from different tribes and foreign nationals reside. This development is evident of the friendly and accommodating nature of the people of the local government. The major occupations of

the people residing in the area are farming, carpentry, trading, marketing, food processing as well as carving work. Crop such as cassava, maize, yam, pepper, cucumber, water melon, tomatoes and okra are mostly grown in the area.

### Data Collection and Sampling Techniques

The ethnobotanical survey of this study was collected from April to December, 2017 using semi-structured questionnaires amidst informal conversation (Huntington, 2000). The survey was carried out in eight different villages of Akinyele Local Government. The villages were selected purposively due to the relic of forest in those villages. The villages are Ijaye, Onidundu, Otunagbakin, Moniya, Idi-ose, Apapa, Aroro and Olanla. Respondents were stratified into 2 strata in each of the village, namely Traditional Medical Practitioners (TMPs) or herbalist and hunters. Within each stratum, a random selection of 10 respondents were carried out thereby making 20 respondents in each village and total number of 160 respondents as sample size. Interviews were conducted individually to 160 respondents which comprise of 80 traditional medical practitioners (TMPs) or herbalist and 80 hunters. During the survey, the information regarding medicinal plants used in the treatment of cough, local names of the plant, plant parts used and the form in which it is used, methods of preparation and mode of administration, doses and shelf life of the herbal recipes were collected from the respondents and documented. The information collected was later sieved and only the information confirmed by three or more respondents was reported.

**Comment [A7]:** 160? (20 x 8)...

**Comment [A8]:** The abstract mentions indigenous knowledge. Detail here what you considered indigenous knowledge and how to obtain it.

**Comment [A9]:** How the species of medicinal plants was identified?

**Comment [A10]:** Include other important information such as: ethical care adopted and consent of the interviewees.

### RESULTS AND DISCUSSION

The study revealed that 16 plants belonging to 16 families are used in the treatment of cough in the study area. Among them, 3 are climbers, 5 are herbs, 1 is shrub, and 7 are trees (Table 1). This showed that tree had the highest number of species used. This may be attributed to the fact that trees are always available all season due to their perennial life existence and mostly not affected by seasonal variations (Albuquerque, 2006).

The various plant parts such as leaves, fruits, seeds, bark and roots in the form of various preparations (Table 1 and 2) are used in the treatment of cough by the traditional medicine practitioners or herbalist and hunters in the study area. This agrees with the findings of Bright (2013) which stated that several diseases or ailments may be treated effectively with the roots, bark, leaves, fruits and flowers of plants. Plant such as *Ficus exasperata* and *Bryophyllum pinnatum* had more than one part been used in the treatment of cough. This

agrees with the findings that the active ingredients of medicinal and aromatic plants can be found in the roots, leaves, stems, flowers or barks (Okigbo *et al.*, 2009 and Kwon-Ndunget *al.*, 2018). Leaves of 4 plant species, roots of 4 plant species, seeds of 2 plant species, fruits of 2 plant species and bark of 3 plant species are used in the preparation of the herbal medicine (recipes) for the treatment of cough in the study area. This showed that leaves and roots of plants are commonly used in the treatment of cough. This was followed by bark, seed and fruits. This is in line with the finding of Kwon-Ndunget *al* (2018) which stated that leaves were found to be the most used plant part for the preparation of various recipes taken for medication. Adekunle (2008) reported that the leaves of plant are important ingredient in traditional treatment of various diseases as it featured more as a component in many herbal preparations. Leaves are the photosynthetic organ of the plant and it is well known to contain pharmacological bioactive compound than other plant parts (Rokaya *et al.*, 2014).

The reason for the widespread use of leaves may be due to the ease of obtaining them. The leaves remain lush and abundant for most part of the year since the State receives rainfall for about seven months of the year. Leaves have been observed as the most widely used plant part in many ethno botanical studies (Tabutiet *al.*, 2003; Kala, 2005; Muthu *et al.*, 2006; Gidayet *al.*, 2009; Hossanet *al.*, 2010). Harvesting leaves for medicinal use ensures plant survival unlike the roots that may threaten its continuity (Luleka *et al.*, 2008; Yin, 2009), unless a sustainable harvesting strategy has been developed (Cunningham, 2001). Feather of *Corvus albus* (*kanakana*) bird, honey from bees, water from coconut, oil palm, salt, shear butter oil, local eggs, ripe fruits of banana (*Musa nana*) are also used in the preparation of recipes (Table 2). The plant parts used can be fresh or dried; however, respondents affirmed that both forms of plant materials are efficient in herbal preparation. This agreed with the findings of Kwon-Ndunget *al* (2018). The most common method of preparation of the recipes was by grinding the herbal materials followed by squeezing to extract the juice, decoction, soaking and burning to ashes (Table 2). However, Decoction was reported as the most prevalent method of preparation of herbal materials for the treatment of diseases in Babungo, Cameroon and Rivers state, Nigeria (Simbo, 2010 and Kola *et al.*, 2012). The recipe was mostly administered orally. This may be related to the method of preparation of the recipes since all the methods used are usually administered orally. All the recipes in this study were prepared in crude form, thus lacking standardized dosage and quality control. This agrees with finding of Anonymous, (2008) and Nanyingiet *al.*, (2008).

Many of the plant species recorded in the present study have been reported in the available literature for the treatment of cough. However, some of these plant species are also used to treat other diseases and illness. For instance, Punjani and Kumar, (2002) reported that the stem bark powder of *Acacia nilotica* is given orally at bed time 10- 12 days regularly to cure asthma. The leaves of *Pergulariadaemia* mixed with the seeds of *Trachyspermumammi* are boiled with water; the extract is given orally for 7 days for quick relief against cough and asthma. The dried rhizome powder of *Zingiber officinale* is used as medicine for chest disease while the fresh juice of the rhizome is mixed with honey and given orally for 7 - 10 days to cure dry cough. Jabeenet al., (2009) also reported that the flower of *Acacia nilotica* is used to cure Asthma. The leaves of *Agerantumconyzoides* is used to cure cold and coughs (Qureshi et al., 2009). The fruits of *Psidium guajava* is used to cure Old cough, bronchitis and chronic whooping cough (Ishtiaqet al., 2015)

**Comment [A11]:** -For which cited plants do you already have research proving for cough? And which plants have not yet been researched for cough?

Around the globe, *Bryophyllum pinnatum* is consuming for the treatment and management of various pathologies such as conjunctivitis, edema, piles, cuts, eczema, constipation, epilepsy, cholera, asthma, chest colds, menstrual disorders, chicken pox and fever (Quaziet al., 2011). The plant parts are frequently applied for the cure of burns, rheumatoid arthritis, antiseptic, blisters, cough suppression, insect bites, psychiatric disorders and abdominal discomforts (Sadhana et al., 2017). Infusion of leaf of *Bryophyllum pinnatum* is used to treat cough, *Elaeisuineensis* is used to treat poison and cough, *Aframomum melegueta* is used to treat fever and to induce labour. It can also act as a decongestant to dry cough when taken with the fruits of *Garcinia cola*.

**Comment [A12]:** melegueta

*Garcinia cola* is used to treat high blood pressure (Ubafe and Ejale, 2019). *Bryophyllum pinnatum* to treat cough, ear infection and baby navel conform to the work of (Iduet al., 2010). The use of *Cocos nucifera* as a treatment for overdose drug (Ubafe and Ejale, 2019), this is in line with research of (Etukudo, 2003) which report that the water of coconut is an antidote.

Local people are using plants without any scientific base (Alamgeeret al., 2018). There is a gap between traditional use of plants and pharmacological evaluation as well as very limited number of phytochemical studies has been documented (Alamgeeret al., 2018). In view of this, an attempt was made to investigate the pharmacological and phytochemical activity of the enlisted plants from available literature to confirm their traditional use against cough.

*Abrus precatorius* is used to treat Asthma and cough. It has a pharmacological effect of Anti-allergic and Mast cell stabilizing effect in egg albumin induced de-granulation of mast cells (Kuo *et al.*, 1995 and Taur and Patil, 2007). Root contains glycyrrhizin and alkaloids like abrasine and precasine besides abrine and related bases (Daniel, 2006). The seeds yield alkaloids, steroids, lectine, flavonoids, and anthocyanins (Anand *et al.*, 2010). The root is considered emetic and alexiteric. The watery extract is useful in relieving obstinate coughs (Anand *et al.*, 2010).

*Zingiber officinale* has a pharmacological effect of anti-asthmatic anti-inflammatory and protection against LPS induced airway hyper reactivity (Thomas *et al.*, 2007 and Aimbire *et al.*, 2007). All major active ingredients of Ginger, such as zingerone, gingerdiol, zingibrene, gingerols and shogaols, are known to possess anti-oxidant activities (Chrubasik *et al.*, 2005).

Common phytochemicals in *Aframomum melegueta* includes Flavonoids, Phenolic compounds, Alkaloids, and Tannins (Okwu, 2004, 2005). The ethanolic leaf extract contains phytochemicals such as tannins, alkaloids, saponins, steroids, cardiacglycoside and terpenoids that have remarkable therapeutic actions in the treatment of gastrointestinal infections, nausea, respiratory problems, colds, fever, allergies, urinary tract infections and fungal infections. In short, ethanolic extract of *Aframomum melegueta* has a broad spectrum of antimicrobial activity (Edwin *et al.*, 2019).

The mature plant of *Ageratum conyzoides* is used for its haemostatic, anti-inflammatory, antispasmodic, antiasthmatic, properties for the treatment of wounds and in bacterial infections (Kokwaro, 1976; and Gonzalez *et al.*, 1991). The phytochemical in *Ageratum conyzoides* are Monoterpenes and sesquiterpenes, Benzofuran, Chromene, Chromone and coumarin, Flavonoids and alkaloids, Triterpenes and steroids. The pharmacological properties includes Analgesic activity, Antimicrobial activity and wound healing effects, Anti-inflammatory activity, Spasmolytic effects, Gamma radiation effects, Anti-cancer, anti-radical scavenging activity and gastric properties, Anti-malarial properties, Anticoccidial activity, Schistosomicidal activity, antioxidant property, Allelopathic property, Insecticidal property (Brojendro *et al.*, 2013)

Numerous chemical constituents and secondary metabolites of the *Bryophyllum pinnatum* have been documented in which the most significant are bufadienolides and flavonoids (Fürrer *et al.*, 2016). The presence of alkaloids, saponins, glycosides and tannins has been confirmed in the plant (Telefoet *et al.*, 2011). Phytochemical screening of the root showed the occurrence of different flavonoids and steroids (Majazet *et al.*, 2011). The presence of different flavonoids, polyphenols, triterpenoids and other chemical constituents in the plant are responsible for its various therapeutic activities such as anti-nociceptive, anti-inflammatory, anti-bacterial and anti-diabetic effects (Ferreira *et al.*, 2014). The biological and pharmacological effects of *Bryophyllum pinnatum* includes Anti-inflammatory, Analgesic, Anti-cancer, Anti-diabetic, Antihypertensive, Anti leishmanial, Antimicrobial and Antifungal, Urolithic, Gastroprotective/ Anti-ulcer, Hepatoprotective, Anti-oxidant, Wound healing activity, Neurosedative and muscle relaxant, Uterine relaxant activity and Nephroprotective effects (Latif *et al.*, 2019).

The leaf of *Erythrophleum africanum* is used in the treatment of various ailments which include emetics, as an anti-inflammatory agent, as an analgesic and also in sore and wound dressing. It is also used to treat chicken pox and gangrenous sores. The leaf decoction of this plant is well known by the traditional healers for several ailments including cardiovascular disease, various inflammation, diabetes, simple goiter, dysentery, diarrhea and as an astringent (Dalziel, 1999). This plant is reported to contain flavonoids and anthocyanidins and as such was used as a tooth pick for oral hygiene (Nwude and Chineme, 1981; Burkill, 1995). Some alkaloids (pyrolizine alkaloids, PAS) from the leaf of this plant have been implicated to be gastro-intestinal tract irritants, cholinesterase inhibitors and also affect the nervous system by causing drowsiness, salivation, labored breathing, trembling, loss of consciousness, coma and death due to paralysis (Roberts and Wink, 1998; Ahmad *et al.*, 1994). The leaves contain tannins, saponins, sterols, terpenoids, alkaloids, flavonoids and cardiac glycoside (Mohammed *et al.*, 2014).

*Ficus exasperata* is used in the treatment of hypertension, arthritis, pre-term labour and peptic ulcers (Acharya and Shrivastava, 2008; Coolborn and Bolatito, 2009). The leaves exhibit anti-ulcer, hypotensive, hypoglycemic, hypolipidemic, anti-inflammatory, anxiolytic, oxytocin inhibiting, anticonvulsant, antinociceptive, antipyretic, anti-microbial, anti-candidal, insecticidal and pesticidal activities (Akahet *et al.*, 1998; Ayindeet *et al.*, 2007; Odunbaku *et al.*, 2008; Woodeet *et al.*, 2009; Taiwo *et al.*, 2010; Adewoleet *et al.*, 2011; Woodeet *et al.*, 2011;



Baforet *et al.*, 2011 and Ogunleye, 2011). In African traditional medicine, different parts of this plant (fruit, leaf, sap, bark, and root) are considered medicinally important. In Africa, Yemen and India, various parts of the plant are used as analgesic, antiarthritic, diuretic, vermifuges, febrifuge, abortifacient, ecboic, wound healing, animal fodder and also in general debility, malnutrition, parasitic infection (cutaneous, subcutaneous), leprosy, ophthalmic and oral infections, nasopharyngeal afflictions, arthritis, rheumatism, gout, edema, kidney disorders, diarrhea, dysentery, hemorrhoids and venereal diseases. (Burkill, 1995; GRIN, 1994; Bafor and Igbinuwen, 2009). The leaves are used for treatment of hemostatic ophthalmia, coughs, hemorrhoids anxiety disorders, epilepsy, high blood pressure, rheumatism, arthritis, cancer, intestinal pains, colics, bleeding and wounds (Cousins and Michael, 2002). It contains flavonoids, tannins and saponins polyphenols and anthraquinones (Takonet *et al.*, 2013).

Extracts of various parts of *Garcinia kola* are used extensively in traditional African medicine (Xu *et al.*, 2013), especially for the preparation of remedies for the treatment of laryngitis, cough and liver diseases (Farombi and Owoeye, 2011). Other medicinal uses include its use as purgative, antiparasitic, antimicrobial, antiviral, anti-inflammatory, antidote to the effects of *Strophantusgratus* remedy for guinea-worm infection and for the treatment of gastroenteritis, rheumatism, asthma, menstrual cramps, throat infections, cure headache, relieve colic, chest colds, cough, and liver disorders (Iwuet *et al.*, 1990; Lewis and Elvin-Lewis, 1977). Esimone *et al.* (2007) documented the phytochemical constituents of *Garcinia kola* seeds which include saponins, tannins, flavonoids, proteins, glycosides, reducing sugar, starch, sterols and triterpenoids, with flavonoids predominating. Other Chemical investigations of the seeds have shown that they contain a complex mixture of phenolic compounds, including GB-type biflavonoids, xanthenes, benzophenones, cycloartenol and triterpenes (Seanego and Ndip, 2012; Antia *et al.*, 2010), Kolaviron (Adaramoye *et al.*, 2005; Lacmata *et al.*, 2012), biflavonoids, xanthenes, kolanone, amekoflavone, 2,4,3-methylenecyclartenol, coumarine and prenylate benzophenones (Narcisi and Sacor, 1996), oleoresin (Onayade *et al.*, 1998), the chromanols, garcioic and garcinal (Terashima and Takaya, 2002). The pharmacological activities of *Garcinia kola* as reported by Olivier *et al.*, (2016) includes antimalarial, anti-trypanosomal, anti-asthmatic, antihypertensive, antioxidant, antimicrobial, anti-diabetic, anti-inflammatory and analgesic activity. Others are anti-Candida infections, Cardioprotective, Gastroprotective, Hepatoprotective, Nephroprotective activity.

Various parts of *Paulliniapinnata* are used in traditional medicine for treating various diseases. In South West Nigeria, the leaf juice of *Paulliniapinnata* is used for the treatment of sore throat (Fred-Jaiyesimi and Anthony, 2011), an infusion is used for fever while the roots are used for the treatment of leprosy, jaundice, snake bites (Gill, 1992), nausea and vomiting (Chabra *et al.*, 1996). The whole plant is used in Ghana to treat dysentery. The roots, mashed with seeds of *Piper guineense*, are applied as a styptic to cut veins and to treat leprosy (Dokos, 1998). The roots are also chewed for coughs and pulmonary diseases, gonorrhoea, fractures or abscesses or used on open sores. It is also used as aphrodisiac (Abbiw, 1990). The phytochemical screening of the plant *Paulliniapinnata* revealed the presence of flavonoids, alkaloids, tannins, saponins, glycosides, steroids, phenol and terpenoids (Imade *et al.*, 2015).

The aerial parts and whole plant of *Pergulariadaemia* is used for snake bite, in diabetes mellitus (Dutta and Ghosh, 1947). Entire plant used as an anthelmintic, emmenagogue, emetic, antiseptic, emetic, expectorant (Elango *et al.*, 1986; Singh *et al.*, 1980 and Arseculeratneet *et al.*, 1985) and antivenin and used to facilitate parturition (Gill and Akinwumi, 1986), while used in Ayurvedic medicine for delayed childbirth, amenorrhea, asthma, snakebite, rheumatic swellings and used to treat post-partum hemorrhage (Raman and Nachiket, 2019). Latex of this plant used for boils and sores (Raman and Nachiket, 2019). Dried leaf used as an emetic, antirheumatic and used for bronchitis, amenorrhea, dysmenorrhea, asthma (Flora of Tamil Nadu, 1987; Raman and Nachiket, 2019), healing cuts and wounds, while used to treat whooping cough and to facilitate parturition. Fresh leaf used as fish poison, while leaf juice used for amenorrhea, dysmenorrhea, catarrhal infections, infantile diarrhea (Raman and Nachiket, 2019) and used to reduce the body pain. Whole plant used as in treatment of diabetes mellitus (The wealth of India, 2001). Dried root used as an abortifacient, emetic, bronchitis and used for cough, asthma and constipation (Jean Bruneton, 1997), while fresh root used as an abortifacient and used to treat gonorrhoea (Singh and Zaher, 1998; Selvanayagam *et al.*, 1994). Shoots used to treat whooping cough (Chatterjee and Chandra, 2003). Stem bark has been used to treat malaria and twig used as an antipyretic and appetizer (Chopra *et al.*, 1956). Phytochemical constituents of *Pergulariadaemia* consists of alkaloids, flavonoids, glycoside, steroids, carbohydrates steroid, tannins and reducing sugar (Sachin *et al.*, 2018). The pharmacological profiles includes antifertility activity of alkaloidal fraction, amelioratory effect of flavonoids, anti-inflammatory, analgesic and antipyretic activity, central nervous system depressant activity, hepatoprotective activity, antioxidant activity, anticancer activity, antidiabetic activity, antibacterial activity, antiurolithiatic

activity, phytomedicine characteristics (Raman and Nachiket, 2019; Bhaskar, 2009; Golam *et al.*, 2001; Anagapann, 20016; Mohammed and Mohammed, 2012 and Shridevis, 2018).

*Spondias mombins* has been traditionally noted for its medicinal and food values. The leaves exhibit antimicrobial, leishmanicide, antiviral, antifungal, antiedematogenic, hypoglycemic and antioxidant properties (Fred-Jaiyesimia *et al.*, 2009; Lorenzi and Matos, 2008; Nworu *et al.*, 2011; Silva *et al.*, 2011, 2012), for the treatment of several topical and systemic diseases like inflammation of the mouth and throat and in cases of prostatitis and herpes labialis (Lorenzi and Matos, 2008). Quantitative phytochemical screening revealed the presence of saponins, alkaloids, flavonoids, tannins and cyanogenic glycosides, and phenol, steroids, terpenoids (Njoku, and Akumefula, 2007).

Shea butter obtained from the kernel of *Vitellaria paradoxa* is used in the treatment of several ailments which include inflammation, rashes, dermatitis, ulcers as well as rheumatism (Hong, 1996). Decoctions prepared from *V. paradoxa* leaves are used to treat stomach ache, headache, oral infection and can as well be used as an eye lotion (Ndukwe *et al.*, 2007). Different parts of this plant, eg., leaves, roots, seeds and stem bark are useful in treating enteric infections such as diarrhoea, helminthes, skin diseases and wound infections (Soladoye *et al.*, 1989). Studies have shown that triterpene alcohols extracted from shea butter possess anti-inflammatory activity (Verma *et al.*, 2012). Stem bark extracts of *V. Paradoxa* had been found to exhibit significant antifungal activity (Ahmed *et al.*, 2009). The root, leaves and bark of *V. Paradoxa* contains the following phytochemical constituents, tannin, saponin, flavonoids, alkaloids, steroid, terpene, phlobaphene, cardiac glycoside, phlobaphenol and anthraquinone (Falana *et al.*, 2016).

Table 1: Plants used in the treatment of cough in the study area

S/n	Botanical names	Family name	Form	Common names	Local name	Plant part and form used	Habitat, Abundance (Rare/ Native/ Introduced)	Cultivation, common)
1	<i>Abrus precatorius</i> Linn.	Leg-Papilionoideae	Climber	Jumble beads, Crab eye	Oju-ologbo	Dried seed	Secondary forest, wild, common, indigenous, native	
2	<i>Aframomum melegueta</i> K. Schum	Zingiberaceae	Herb	Alligator peper	Atare	Dry seed (Bunch)	Forest/ farmland, common, native.	
3	<i>Agerantum conyzoides</i> (L.) L	Asteraceae	Herb	Goat weed	ArunsanImi-esu	Fresh leaves	Savanna, farmland. common, native	Wild,
4	<i>Bryophyllum pinnatum</i> (Lam.) Oken	Crassulaceae	Herb	Resurrection plant	Abamoda Odundun	Fresh root and leaves	Savanna, plantation crop, farm settlement., wild, rare, introduced	
5	<i>Cocos nucifera</i> L.	Euphorbiaceae	Tree	Coconut	Agbon	Coconut water	Farmland, cultivated, common introduced	
6	<i>Elaeis guineensis</i> Jacq.	Palmae	Tree	Palm tree	Ope	Oil	Both secondary forest and derived savanna. Cultivated, common, introduced	
7	<i>Erythrophleum africanum</i> (Benth.) Harms	Leg- Ceas	Tree	African blackwood	Epo Obo	Fresh bark	Forest, Rare, Native, wild	
8	<i>Ficus exasperata</i> Vahl	Moraceae	Tree	Sand paper	Epin, Ipin	Fresh or dry roots epin Fresh tender leaves of epin	Forest, common wild, native	

**Comment [A13]:** detail the area, as well as in the title

**Comment [A14]:** Fabaceae

**Comment [A15]:** Arecaceae

**Comment [A16]:** Arecaceae

**Comment [A17]:** Fabaceae

9	<i>Garcinia kola</i> Heckel	Guttiferae	Tree	Bitter kola	Orogbo	Dry fruits	Forest, Common, Native, no cultivated	Comment [A18]: Garcinia
10	<i>Musa nana</i> Lour.	Musaceae	Herb	Banana	Ogedo mini	Matured ripe fruit	Savanna, cultivated, common, introduced, introduced	
11	<i>Paulliniapinnata</i> Linn	Sapindaceae	Climber	Sweet gum	Kakans ela	Fresh root	Forest, wild, rare, indigenous	
12	<i>Pergulariadaemia</i> (Forssk.) Chiov.	Apocynaceae	Climber	Pergularia, Trellis-vine	Koleor ogba	Fresh or dry leaves	Farmland, savanna, rare wild, native	
13	<i>Psidium guajava</i> Linn.	Myrtaceae	Shrub	Guava	Grofa	Fresh bark	Both secondary forest, savanna and farmland, cultivated, common, introduced	Formatted: Font: 12 pt
14	<i>Spondias mombins</i> Linn	Anacardiaceae	Tree	Hog plum	Iyeye	Fresh bark	Both forest and savanna farmland, around towns and villages, wild, Common, native	Comment [A19]: mombin
15	<i>Vitellariaparadoxa</i> C.F. Gaertn.	Sapotaceae	Tree	Shear butter oil	Ori	Oil	Savanna, cultivated, common, native	
16	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Herb	Ginger	Ata ile	Fresh root of ginger	Farmland, savanna, cultivated, common, introduced	

Habitat (Forest= 9, Savanna= 9, Farmland= 7), Abundance (Rare= 3, Common= 13), Cultivated= 8, Wild= 8, Native= 9, Introduced= 7

Source: Field survey data, 2017

According to the respondents 13 plant species used in the treatment of cough are common in the study area and can easily be sourced from the surroundings and from herb sellers, 3 of the plants are rare and cannot easily be sourced. Hamilton (2004) stated that globally 4,160 to 10,000 medicinal plants are endangered by habitat losses or overexploitation in areas where rural families traditionally collected them. This raises concern about the need for both short and long term intervention strategies to save the species from extinction. 8 species are found in the wild, this showed that the wild habitats are important for local communities in terms of basic needs. Beltrán-Rodríguez *et al.* (2014) also pointed to the importance of wild habitats for people's livelihood in a rural community of Mexico and found a greater diversity of plant uses in wild habitats than in managed environments. 8 species of plants used in the treatment of cough are cultivated in the study area. Beltrán-Rodríguez *et al.* (2014) also reported that relatively few medicinal and aromatic plants species are cultivated. The great majority of medicinal plants are still provided by collection from the wild (Lange and Schippmann, 1997; Srivastava and Vietmeyer, 1996). In term of habitat, 9 species each can be found in both forest and savanna while 7 species are found on farmland; however the habitat of some species overlaps. 9 species are native and 7 species are introduced. However, a total number of 16 plant species belonging to 16 families are recorded and enumerated along with their scientific name, family, common and local names, parts used and form in which they are used, method of preparation, mode of administration, dosage and shelf life (Table 1 and 2).

Table 2: Enumeration of the Recipes for the treatment of cough

S/n	Method of preparation of recipes	Mode of administration dosage and shelf life
1	Collect plenty feather of <i>Corvus albus</i> ( <i>kanakana</i> ) bird, one bunch of dry Aligator pepper and ten or more dry fruits of bitter kola. Burn all to ashes and put inside honey.	Lick the honey once a day by 6pm. When it finishes
2	Grind the fresh bark of <i>Erythrophleum</i> that was peeled with stone into powder, and mix it with water from 3 coconuts, shear butter oil and honey in a container and put it inside sun for the shear butter oil to melt. Mix it properly	Take one teaspoon by 6 am in the morning. Half teaspoon for a child. Take it every three days. When it finishes
3	Grind the leaves of <i>Pergulariadaemia</i> and mix with palm oil (red oil)	Lick it regularly When it finishes
4	Cut the root of <i>Ficus exasperata</i> into pieces and put it in plastic bottle with water. Squeeze fresh tender leaves of <i>Ficus exasperata</i> in water	Drink half stainless cup twice daily. When it finishes
5	Eat fresh or dry root of ginger and swallow the water. Also chew the fresh tender leaves of ginger and swallow the water.	Do it regularly

6	Squeeze the steam leaves of <i>Agerantumconyzoides</i> , add palm oil and salt and lick it regularly. For high temperature, do not add salt, use it to rub	Lick it regularly Four days
7	Boil the root of <i>Bryophyllum pinnatu</i> thoroughly in water or put the leaves on hot object for five minutes, squeeze and drink the extract.	Drink regularly Five days
8	Chew the fresh root of <i>Zingiber officinale</i> and swallow the liquid	Do it regularly
9	Chew the fresh root of <i>Paulliniapinnata</i> and swallow the liquid against cough.	Do it regularly
10	Mix palm oil with pure honey	Lick regularly. When it finishes
11	Cook the bark of <i>Spondiamombin</i> and bark of <i>Psidium guagava</i> together with water.	Drink half stainless cup three times daily. When it finishes
12	One or two fruits of <i>Musa nana</i> with one or two local egg (“eyinororo”), palm oil, honey and shear butter (ori). These are squeezed and mix together.	The liquid is licked regularly Two weeks
13	The dropped leaves of <i>Ficus exasperata</i> are collected, grinded, mixed with honey	Lick regularly When it finishes
	Or cook the dropped leaves of <i>Ficus exasperata</i> with “ogedeomini pupa” ( <i>Musa nana</i> ).	Drink 3 times daily Five (5) days
14	Grind the dry seeds of <i>Garcinia kola</i> into powder and add little salt to it, mix the powder with honey	Lick it regularly When it finishes
15	Shade dry the leaves of <i>Abrusprecatorius</i> , grind it into powder and mix it with honey or palm oil and shear butter in equal quantity	Lick it regularly When it finishes
	Also you can cook the leaves and drink 3 times daily.	

Source: Field survey data, 2017

## CONCLUSION

The study has helped to identify important plants and plant parts used in the treatment of cough in the study area. The documentation of these plants and their uses will go a long way in preserving the traditional knowledge of cough treatment from one generation to the next. Some of the plants utilized by the respondents for cough treatment are rare and from the wild, therefore there is need for domestication and conservation of these plants to prevent them from extinction. The bioactive compound in some of these plants can be synthesized together to produce conventional drug cough. Also, further studies can be carried out on these plant species so as to find out more of bioactive compounds in them.

## REFERENCES

- Abbasi, A. M., Shah, M. H., Khan, M. A. (2015). Wild edible vegetables of Lesser Himalayas: Ethnobotanical and Nutraceutical Aspects. Volume 1. Springer, New York.
- Abbasi A. M, Khan S. M, Ahmad M, Khan M. A, Quave CL.(2013). Botanical ethnoveterinary therapies in three districts of the Lesser Himalayas of Pakistan. *J EthnobiolEthnomed*. 9: 84pp.
- Abbiw, D. (1990). Useful plants of Ghana. Intermediate Technology Publication Ltd and the Royal Botanic Gardens, KEW, London, UK, , pp. 182-205
- Abu-Rabia, A. (2005). Urinary diseases and ethnobotany among pastoral nomads in the Middle East. *J.EthnobiolEthnomed*. 1: 4pp.
- Adaramoye, O.A., Farombi, E. O., Adeyemi, E. O. and Emerole, G. O. (2005). Inhibition of human low density lipoprotein oxidation by flavonoids of *Garcinia kola* seeds. *Pakistan J. Med. Sci*. 21(3):331-339.
- Adekunle, M.F. (2008), Indigenous uses of plants leaves to treat malaria fever at Omo Forest Reserve (OFR), Ogun State, *Nigeria. Ethiopia J. Environ. Stud. Man., 1 (1): 31-35*
- Adewole, S. O., Adenowo, T., Naicker, T., Ojewole, J. A. (2011). Hypoglycaemic and hypotensive effects of *Ficus exasperata* Vahl. (Moraceae) leaf aqueous extract in rats. *Afr J Tradit Complement Altern Med*; 8:275-83.
- Acharya, D. and Shrivastava, A. (2008). Indigenous Herbal Medicines (Tribal formations and traditional herbal practices). Aavishkar publishers distributor, Jaipur – India. Pp 16 – 20.
- Ahmad, W., Ahmad, Z., Najumul, S., Kazim, H., Malik, A. (1994). Pyrrolizidine alkaloid content of the genus *Senecio*. *J. Chem. Society Pak*. 16:64-81.
- Ahmed, R. N., Sani, A., Igunnugbemi, O. O. (2009). Antifungal profiles of extracts of *Vitellaria paradoxa* (Shea Butter) bark. *Ethnobotanical Leaflets*; 13: 679-88.
- Aimbire, F., Penna, S. C., Rodrigues, M., Rodrigues, K. C., Lopes-Martins, R. A., Sertié, J. A. (2007). Effect of hydroalcoholic extract of *Zingiber officinalis* rhizomes on LPS-induced rat airway hyperreactivity and lung inflammation. *Prostaglandins Leukot Essent Fatty Acids*; 77:129–38.
- Akah, P. A., Orisakwe, O. E., Gamaniel, K. S., Shittu, A. (1998). Evaluation of Nigerian traditional medicines: II. effects of some Nigerian folk remedies on peptic ulcer. *J Ethnopharmacol*; 62:123-7.

**Comment [A20]:** Organize references according to the authors guidelines. Reduce the number of references, maintaining the essential ones to support research



- Alamgeer, Waqas Younis, Hira Asif, Amber Sharif, Humayun Riaz, Ishfaq Ali Bukhari and Asaad Mohamed Assiri (2018), Traditional medicinal plants used for respiratory disorders in Pakistan: a review of the ethno- medicinal and pharmacological evidence. *Chinese Medicine* 13:48 1-29pp. <https://doi.org/10.1186/s13020-018-0204-y>
- Albuquerque, U. P. (2006). Re-examining hypothesis concerning the use and Knowledge of medicinal plants: a study in the Caatinga vegetation of NE Brazil. *Journal of Ethnobiology and ethno medicine* (2006). 2:30pp.
- Ameh, S.J., Obodozie, O. O., Inyang, U. S., Abubakar, M. S and Garba, M. (2010). Current phytotherapy - a perspective on the science and regulation of herbal medicine. *Journal of Medicinal Plant Research*, 4(2):072-081.
- Anagapann, R. (2016). Amelioratory effect of flavonoids rich *Pergulariadaemia* extract against CFA induced arthritic rats., <https://doi.org/10.1016/j.biopha.2016.03.019> Get rights and content
- Anand, R. A., Kishor, V. O., Rajkumar, V. S., Chandrashekhar, D. U., Tanaji, D. N. (2010). *Abrus precatorius* Linnaeus: A Phytopharmacological Review. *Journal of Pharmacy Research*, 3(11), 2585-2587. ISSN: 0974-6943 Available online through [www.jpronline.info](http://www.jpronline.info)
- Anonymous (2008). International Plant Names Index Database. Available at: <http://www.ipni.org/ipni/plantnamesearchpage.do>. Accessed on 16 October 2011
- Antia, B. S., Pansanit, A., Ekpa, O. D., Ekpe, U. J., Mahidol, C. and Kittakoop, P. (2010). Alpha-glucosidase inhibitory, aromatase inhibitory and antiplasmodial activities of a biflavonoid GB1 from *Garcinia kola* stem bark. *Planta Medica* 76(3):276-277.
- Arseculeratne, S. N., Gunatilaka, A. A. L., Panabokke, R. G. (1985). Studies on medicinal plants of Srilanka. Part 14: Toxicity of some traditional medicinal herbs. *J Ethnopharmacol*; 13 (3): 323-3.
- Asase, A., Kokubun, T., Grayer, R. J., Kite, G., Simmonds, M. S. J., Oteng-Yeboah, A. A., (2008). Chemical constituents and antimicrobial activity of medicinal plants from Ghana: *Cassia sieberiana*, *Haematostaphis barteri*, *Mitragynaine* *ermis* and *Pseudocedrela kotschy*. *Phytotherapy Research* 22(8):1013-1016
- Ayinde, B. A., Omogbai, E. K., Amaechina, F. C. (2007). Pharmacognosy and hypotensive evaluation of *Ficus exasperata* Vahl (moraceae) Leaf. *Acta Pol Pharm*; 64:543-6.
- Bafor, E. E., Omogbai, E. K., Ozolua, R. I., (2011). Oxytocin inhibiting effect of the aqueous

- leaf extract of *Ficus exasperata*(Moraceae) on the isolated rat uterus. *Acta Pol Pharm*; 68:541-7.
- Bafor, E. E and Igbinuwen, O. (2009). Acute toxicity studies of the leaf extract of *Ficus exasperata* on haematological parameters, body weight and body temperature. *J Ethnopharmacol*; 123:302-7.
- Balunas. M. J., and Kinghorn, A. D., (2005). Drug discovery from medicinal plants. *Life Sci*. 78: 431-441.
- Barnes, J., Anderson, L. A., and Phillipson, J. D. (2007). *Herbal medicine*. 3rd Edition, Pharmaceutical Press, London. pp 1-23.
- Beltrán-Rodríguez, L., Ortiz-Sánchez, A., Mariano, N. A., Maldonado-Almanza, B. and Reyes García V. (2014). Factors affecting ethnobotanical knowledge in a mestizo community of the Sierra de Huautla Biosphere Reserve Mexico. *Journal of Ethnobiology and Ethnomedicine* 10: 14pp.
- Bhaskar, V. H. (2009). Veliparuthi *P. Daemia* Forsk. As *Phytomedicine: Review*, *IJPTR*, 1(4)305-313.
- Bright, A. (2013). Utilization of Traditional Herbal Medicine and its Role in Health Care Delivery in Ghana: The Case of Wassa Amenfi West District. Unpublished Thesis submitted to the Department of Geography and Rural Development, Kwame Nkrumah University of Science and Technology. In partial fulfilment of the requirements for the degree Of Master of Philosophy Geography and Rural Development Faculty of Social Sciences, College of Art and Social Sciences. pp. 1-122.
- Brojendro S. Singh, Radhapiyari W. Devi, Marina A, Indira W. Devi, Swapana N. and Chingakham B. Singh (20013). Ethnobotany, phytochemistry and pharmacology of *Ageratum conyzoides* Linn (Asteraceae). *Journal of Medicinal Plants Research* Vol. 7, pp. 1-15. DOI:10.5897/JMPR012.897. ISSN 1996-0875. Available online at <http://www.academicjournals.org/JMPR>
- Burkill, H. M. (1995). The useful plants of West Tropical Africa. Royal botanic garden Kew (UK), 3pp.
- Chabra, S. C., Makuna, R. L. A. and Mshiu, E. N. (1991). Plants used in traditional medicine in Eastern Tanzania *J. Ethnopharmacol*, , 33: 147-57.
- Chatterjee, A. and Chandra, S. (2003). The Treatise of Indian Medicinal Plant

- Vol.4, National institute of science and communication and information resources, New Delhi, p.135-136.
- Chopra, R. N., Nayar, S. L., and Chopra, I. G. (1956) In: Glossary of Indian Medicinal Plant. CSIR, New Delhi, p.188
- Chrubasik, S., Pittler, M. H. and Roufogalis, B. D. (2005). *Zingiberisrhizoma*: a comprehensive review on the ginger effect and efficacy profiles. *Phytomedicine*, 12:684-701.
- Coolborn, A. F. and Bolatito, B. (2009). Antibacterial and phytochemical evaluations of three medicinal plants. *Journal of Natural Products*, 3: 27 – 34.
- Cox, P. A. (2005). The seven pillars of ethnomedical wisdom. *Ethnobotany*, 17:24-34.
- Cousins, O. N., and Michael, A. H. (2002). Medicinal Properties in the Diet of Gorillas: An Ethno-Pharmacological Evaluation. *Afr Study Monogr*; 23:65-89.
- Cunningham, A. B. (2001). Applied Ethnobotany: People, Wild Plant Use and Conservation. London, UK: Earthscan.
- Dalziel, J. M. (1999). Useful plants of tropical West Africa. Crown Agents London. pp. 432-434.
- Daniel, M. (2006). Medicinal Plants: Chemistry and properties, Ed 1st, Oxford and IBH publishing house co. pvt.ltd, New Delhi, 118-119pp.
- Dokosi, O. B. (1998). Herbs of Ghana. Ghana Universities Press. 1998, pp. 615-623
- Dutta, A. and Ghosh, S. (1947). Chemical examination of *Daemiaextensa*. I. *J Amer Pharm Ass Sci Ed*; 36: 250-252.
- Edwin Yu Sheng Toh, Chooi Ling Lim, Anna Pick Kiong Ling, Soi Moi Chye and RhunYian Koh (2019). Overview of the Pharmacological Activities of *Aframomummelegueta*. *J. Trop. Agric. Sc.* 42 (1): 1 - 13: <http://www.pertanika.upm.edu.my/>
- Elango V, Ambujavalli L, AmalaBaskerE, Sulochana N. (1986). Pharmacological and microbiological studies on *Pergularia extensa*. *Fitoterapia*; 56 (5):300-302.
- Etukudo, I. (2003). Ethnobotany: Conventional and Traditional uses of plants. The Verdict Press, Uyo. 1: 191 - 193.
- Esimone, C. O., Adikwu, M. U., Nworu, C. S., Okoye, F. B. C. and Odimegwu, D. C. (2007). Adaptogenic potentials of *Camellia sinensis* leaves, *Garcinia kola* and *Kola nitida* seeds. *Science Research Essays*, 2:232-237.
- Faleyimu, O. I., and Oluwalana, S. A. (2008). Medicinal Value of Forest Plant Seeds in Ogun State, Nigeria. *World Journal of Biological Research*, 1(2): 1-6.
- Farombi, E. O. and Owoeye, O. (2011). Antioxidative and chemopreventive properties of

- Vernonia amygdalina and Garcinia biflavonoid. *International Journal of Environment Research and Public Health*, 8(6): 2533-2555.
- Verma, N., Chakrabarti, R., Das, R. H., Gautam, H. K. (2012). Anti-inflammatory effects of Shea butter through inhibition of iNOS, COX-2, and cytokines via the Nf- $\kappa$ B pathway in LPS-activated J774 macrophage cells. *Journal of Complementary and Integrative Medicine*;9:1-11pp.
- Falana, M. B., Bankole, M. O., Ojo, D. A., Omemu, A. M. (2016). Comparative Phytochemical Investigation of the Various Parts of Vitellaria Paradoxa. *Journal of Natural Sciences Research*, Vol.6, No.11, 74-80. ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)[www.iiste.org](http://www.iiste.org)
- Ferreira, R. T., Coutinho, M. A. S., Malvar, D. d. C., Costa, E. A., Florentino, I. F., Costa, S. S and Vanderlinde, F. A. (2014). Mechanisms underlying the antinociceptive, antiedematogenic, and anti-inflammatory activity of the main flavonoid from Kalanchoe pinnata. *J. Evid. Based. Complement. Alternat. Med.* 2014: 1-9.
- Flora of Tamil Nadu, (1987) VOL. II, 1987
- Fred-Jaiyesimia, A., Kio, A., Richard, W., (2009). Amylase inhibitory effect of 3 $\beta$ -olean-12-en-3-yl (9Z)-hexadec-9-enoate isolated from Spondias mombin leaf. *Food Chem.* 116, 285–288.
- Fred-Jaiyesimi, A. A and Anthony, O. (2011). Larvicidal Activities of the Extract and fractions of *Paulliniapinnata* Linn leaf, *PhcogCommn.*, 1(2): 37-40
- Fürer, K., Simões-Wüst, A. P. von Mandach, U. Hamburger, M. and Potterat, O. (2016). *Bryophyllum pinnatum* and related species used in anthroposophic medicine: constituents, pharmacological activities, and clinical efficacy. *Planta. Med.* 82(11/12): 930-941.
- Ganesan, S., Suresh, N., Kesaven, L. (2004). Ethnomedicinal Survey of Lower Palani Hills of Tamilnadu. *I J Trad Knowledge*, 3(3): 299-304.
- Giday, M., Asfaw, Z., Woldu, Z., Teklehaymanot, T., (2009). Medicinal plant knowledge of the Bench ethnic group of Ethiopia: An ethnobotanical investigation. *J Ethnobiol Ethnomed*, 5, 34. Available at: <http://www.ethnobiomed.com/content/5/1/34> Accessed on 18 July 2011
- Gill, L. S. (1992). Ethnomedical uses of plants in Nigeria.: 82-83; 98
- Gill, L. S. and Akinwumi C. (1986). Nigerian folk medicine: Practices and beliefs of the Ondo people. *J Ethnopharmacol*; 18(3): 259-266.
- Golam Sadik MD, Gafur MA, Shah Alam B, Motiur Rahman M, Helal Biswas U. (2001).

- Antifertility Activity of the alkaloidal fraction of *P. daemia*. *The Sciences*; 1(4): 217-219.
- Gonzalez, A. G., Aguiar, Z. E., Grillo, T. A., Luis, J. G., Rivera, A, Calle, J. (1991). Methoxy flavone from *Ageratum conyzoides*. *Phytochem.* 30:1269.
- GRIN. (1994). *Germplasm Resources Information Network*. [Online Database]. USDA, ARS, National Genetic Resources Program. National Germplasm Resources Laboratory, Beltsville, Maryland;. Available from: <http://www.ars-grin.gov/npgs/>. [Last accessed on 2013 Jan 31].
- Hamilton, A. C., (2004). Medicinal plants, conservation and livelihoods. *Biodiversity Conservation* 13: 1477 - 1517.
- Hong, T. D. (1996). Linington S, Ellis RH. Seed storage behaviour, a compendium. Handbook for Genebanks: No. 4. International Plant Genetic Resources Institute, Rome, Italy; 1-115pp.
- Hossan, M. S., Hanif, A., Agarwala, B., Sarwar, M. S., Karim, M., Rahman, M. T., Jahan, R., Rahmatullah, M. (2010). Traditional use of medicinal plants in Bangladesh to treat urinary tract infections and sexually transmitted diseases. *Ethnobot Res Appl*, 8, 61–74.
- Huntington, H. P. (2000). Using traditional ecological knowledge in science: Methods and applications. *Ecol Appl*, 10, 1270–1274.
- Idu, M., Erhabor, J. O., and Efijuemue, H. M. (2010). Documentation on medicinal plants sold in markets in Abeokuta, Nigeria. *Tropical J. Pharma. Res.* 9 (2):110 – 118.
- Imade, F. N., Nosakhare, N.G. and Mensah, J.K. (2015). Phytochemical and Antibacterial Properties of the Leaf, Stem and Root of *Paullinia pinnata* Linn. *Nigerian Annals of Natural Sciences*, volume 15 (1) pp 079 –084. ISSN: 1115-2702 [www.nansjournal.org](http://www.nansjournal.org)
- Ishtiaq, M., Mahmood, A., Maqbool, M. (2015). Indigenous knowledge of medicinal plants from Sudhanoti district (AJK), Pakistan. *J Ethnopharmacol*; 168:201–7.
- Iwu, M. M., Igboko, O. A., Okunji, C. O. and Tempesta, M. S. (1990). Anti-diabetic and aldose reductase activities of biflavones of *Garcinia Kola*. *Journal of Pharmacy and Pharmacology* 42: 2903-2922.
- Jabeen, A., Khan, M. A., Ahmad, M., Zafar, M., Ahmad, F. (2009). Indigenous uses of economically important flora of Margallah hills national park, Islamabad, Pakistan. *Afr J Biotechnol.* 8(5):763–84.
- Jean. Bruneton, (1997). 'Pharmacognosy & Phytochemistry of Medicinal Plants', Published by CBS Publisher, 2nd edition, 456-498.

- Kala, C. P. 2005. Ethnomedicinal botany of the Apatani in the Eastern Himalayan region of India. *Journal of Ethnobiology and Ethnomedicine*, 1 (11): 1-12.
- Kokwaro, J. O. (1976). Medicinal plants of east Africa, Nairobi. East African Literature Bureau. 58.
- Kola' K. Ajibesin, Danladi N. Bala and Uwemedimo F. Umoh (2012) Ethno medicinal survey of plants used by the indigenes of Rivers State of Nigeria, *Pharmaceutical Biology*, 50:9, 1123-1143, DOI: 10.3109/13880209.2012.661740.  
<https://doi.org/10.33109/3880209.2012.661740>
- Kumar, A., Tewari, D. D., Sharma, R., and Pandey, V. O. (2005). Practices of folk phytotherapy in Devipatan division, Uttar Pradesh. *India Journal Natcon*, 17(1), 153-161.
- Kuo, S. C., Chen, S. C., Chen, L. H., Wu, J. B., Wang, J. P., Teng, C. M. (1995). Potent antiplatelet, anti-inflammatory and antiallergic isoflavanquinones from the roots of *Abrus precatorius*. *Planta Med*; 61:307-12.
- Kwon-Ndung E. H., Goler E. E., Akomolafe G. F., Terna T. P., Waya J. I. and Markus M. (2018). Ethnomedicinal Assets of Plants Collected from Nasarawa State, North Central Nigeria. *European Journal of Biology and Medical Science Research* Vol.6, No.4, pp.47-57. Print ISSN: ISSN 2053-406X, Online ISSN: ISSN 2053-4078. Published by European Centre for Research Training and Development UK ([www.eajournals.org](http://www.eajournals.org))
- Lacmata, S. T., Kuete, V., Dzoyem, J. P., Tankeo, S. B., Teke, G. N., Kuiate, J. R. and Pages, J. M. (2012). Antibacterial activities of selected cameroonian plants and their synergistic effects with antibiotics against bacteria expressing MDR phenotypes. *Evidence Based Complementary and Alternative Medicine*. doi: 10.1155/2012/623723
- Lange, D., & Schippmann, U. (1997). Trade survey of medicinal plants in Germany. Bundesamt für Naturschutz, Bonn, 119pp.
- Latif, A., Ashiq, K., Qayyum, M., Ashiq, S., Ali, E. and Anwer, I. (2019). Phytochemical and Pharmacological Profile of the Medicinal Herb: *Bryophyllum Pinnatum*. *Journal of Animal & Plant Sciences*, 29(6): 1528-1534. ISSN: 1018-7081
- Lewis, W. H. and Elvin-Lewis, P. F. (1977). Medical Botany: Plants Affecting Man's Health. John Wiley – Int. Pub, 231-236.
- Lorenzi, H., and Matos, F. J. A. (2008). Plantas medicinais no Brasil nativas e exóticas. Nova Odessa, São Paulo.
- Lulekal, E., Kelbessa, E., Bekele, T., Yineger, H. (2008). An ethnobotanical study of

- medicinal plants in Mana Angetu District, southeastern Ethiopia. *J Ethnobiol Ethnomed*, 4, 10pp. Available online at: <http://www.ethnobiomed.com/content/4/1/10>. Accessed on 22 July 2011.
- Majaz, Q., Nazim, S., Shaikh, S., Gomase, P. and Choudhari, A. (2011). Phytochemical analysis of chloroform extract of roots of *Kalanchoe pinnatata* by HPLC and GCMS. *Int. J. Pharm. Sci. Res.* 2:1693-1699.
- Mohammed, M., Musa, A. M., Garba, M. A., Adeiza, A. A and Hanwa, U. A. (2014). Phytochemical and antimicrobial study on the leaf extracts of *Erythrophleum africanum* (Caesalpiniaceae). *African Journal of Biotechnology*, Vol. 13(4), pp. 598-603, DOI: 10.5897/AJB2013.13059. ISSN 1684-5315. <http://www.academicjournals.org/AJB>
- Mohammed Rageeb and Mohammed Usman, (2012). Anti-inflammatory activity of whole plant of *Pergularia daemia* Linn. *IJPSR*, 3(1) 262-67.
- Mujtaba, S. G., Abbasi, A. M., Khan, N., Guo, X., Ajab, K. M. (2014). Traditional uses of medicinal plants against malarial disease by the tribal communities of Lesser Himalayas Pakistan. *J Ethnopharmacol.* 155: 450-462.
- Muthu, C., Ayyanar, M., Raja, N., Ignacimuthu, S. (2006). Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India. *J Ethnobiol Ethnomed*, 2:43pp. Available online at: <http://www.ethnobiomed.com/content/2/1/43>. Accessed on 22 October, 2011.
- Nanyingi, M. O, Mbaria, J. M., Lanyasunya, A. L., Wagate, C. G., Koros, K. B., Kaburia, H. F., Munenge, R. W., Ogara, W. O. (2008). Ethnopharmacological survey of Samburu District, Kenya. *J. Ethnobiol Ethnomed*, 4, 14pp. Available online at: <http://www.ethnobiomed.com/content/4/1/14>. Accessed on 20 July 2011.
- Narcisi, E. M. and Sacor, N. E. (1996). In vitro effect of Tinidazole and furazolidone on metronidazole resistant *Trichomonas vaginalis*. *Antimicrobial Agents and Chemotherapy*, 40:1121-1126.
- Ndukwe, I. G., Amupitan, J. O., Isah, Y., Adegoke, K. S. (2007). Phytochemical and antimicrobial screening of the crude extracts from the root, stem bark and leaves of *Vitellaria paradoxa*. *African Journal of Biotechnology*; 6(16): 1905-9.
- Njoku, P. C. and Akumefula, M. I. (2007). Phytochemical and Nutrient Evaluation of *Spondias Mombin* Leaves. *Pakistan Journal of Nutrition* 6 (6): 613-615. ISSN 1680-5194

- Nworu, C. S., Akah, P. A., Okoye, F. B., Toukam, D. K., Udeh, J., Esimone, C. O., (2011). The leaf extract of *Spondias mombin* L. displays an anti-inflammatory effect and suppresses inducible formation of tumor necrosis factor-  $\alpha$  and nitric oxide (NO). *J. Immunotoxicol.* 8, 10–16.
- Nwude, N., Chineme, C. N. (1981) Toxic effects of the leaves of *E. africanum*(Harms) in Sheep. *Bull. Anim. Hlth. Prod. Afr.* 29:349-354.
- NPC, (2006). National Population Commission of Nigeria (web), National Bureau of Statistics (web)
- Odunbaku, O. A., Ilusanya, O. A. And Akasoro, K. S. (2008). Antibacterial activity of ethanolic leaf extract of *Ficus exasperata* on *Escherichia coli* and *Staphylococcus albus*. *Sci Res Essay*; 3:562-4.
- Ogunleye, R. F. (2011). Effectiveness of the leaf powder of *Ficus exasperata* Vahl. (Moraceae) in suppressing the population of two major storage insect pests. *Continental J Biol Sci*; 4:6-11.
- Okigbo, R. N., Anuagasi, C. L. and Amadi, J. E. (2009). Advances in selected medicinal and aromatic plants Indigenous to Africa. *Journal of medicinal plants Research*. Vol.3(2): 86-95.
- Okwu, D. E. (2004). Phytochemicals and vitamin content of indigenous spices of South Eastern Nigeria. *Journal of Sustainable Agriculture and the Environment*, 6(2), 30-34.
- Okwu, D. E. (2005). Phytochemicals, vitamins and mineral contents of two Nigerian medicinal plants. *International Journal of Molecular Medicine and Advance Sciences*, 1(4), 375-381
- Olivier Tene Tcheghebe, Martin Signe, and Armel Jack (2016). Review on traditional uses, phytochemical and pharmacological profiles of *Garcinia kola* Heckel. *Merit Research Journal of Medicine and Medical Sciences*, Vol. 4(11) pp. 480-489, (ISSN: 2354-323X). Available online <http://www.meritresearchjournals.org/mms/index.htm>
- Onayade, O. A., Looman, A. M. G., Scheffer, J. J. C. and Gbile, Z. O. (1998). Lavender lactone and other volatile constituents of the oleoresin from seeds of *Garcinia kola* Hechel. *Flavour fragrance Journal*, 13(6):409-12.
- Punjani, B. L and Kumar, V. (2002). Traditional medicinal plant remedies to treat cough and asthmatic disorders in the Aravalli ranges in North Gujarat, India. *Journal of Natural Remedies*, Vol. 2/2, 173 – 178
- Quazi Majaz, A., Tatiya, A., Khurshid, M., Nazim, S. and Siraj, S. (2011). The miracle plant



- (*Kalanchoepinnata*): a phytochemical and pharmacological review. *Int. J. Res. Ayurveda. Pharm.* 2(5):1478-1482.
- Qureshi, R., Waheed, A., Arshad, M. U. (2009). Umbreen T. Medico-ethnobotanical inventory of tehsil Chakwal, Pakistan. *Pak J Bot.* 41:529–38.
- Raman R Chandak and Nachiket S Dighe (2019). A Review on Phytochemical & Pharmacological Profile of *PergulariaDaemialinn.* *Journal of Drug Delivery & Therapeutics.*; 9(4-s):809-814. Available online at <http://jddtonline.info>
- Roberts, M. F., Winks, M. (1998). *Alkaloids: Biochemistry, Ecology and Medical Applications*: Edited Roberts and Wink, Plenum Press, New York. pp. 397-424.
- Rokaya, M. B., Munzbergora, Z., and Timsina, B. (2010). Ethnobotanical study of medicinal plants from the Humla district of Western Nepal. *J. Ethnopharmacol.* 130:485-504.
- Sachin ShivlingBhusari, Shivani Gokul Bhokare, Kanchan DilipraoNikam, Avinash Narayanrao Chaudhary, Pravin Shridhar Wakte (2018). Pharmacognostic and Phytochemical investigation of stems of *Pergulariadaemia* *Asian Journal of Pharmacy and Pharmacology*; 4(4): 500-504
- Sadhana, D., Parveen, S., Bukhari, N.I., Shehzadi, N., Qamar, S., Ijaz, A., Niazi, S., Naheed, S.U., Latif, A. and Hussain, K. (2017). *Bryophyllumpinnatum*: botanical description, vernacular names, parts used, traditional uses, phytochemical and pharmacological activities. *Pakistan J. Pharm.* 30(1): 3-9.
- Seanego, C. T. and Ndip, R. N. (2012). Identification and antibacterial evaluation of bioactive compounds from *Garcinia kola* (Heckel) seeds. *Molecules* 17(6):6569-6584.
- Selvanayahgam, Z. E., Gnanevendhan, S. G., Balakrishna, K., Rao, R. B. (1994). Anti-snake venom botanicals from ethnomedicine. *J Herbs Spices Med Plants*; 2 (4): 45-100.
- Shrestha, P. M., and Dhillon, S. S. (2003). Medicinal plant diversity and use in the highlands of Dolakha district, Nepal. *Journal of Ethnopharmacology* 86(1):81-96
- Shridevis, G. (2018). An evaluation of *in vitro* and *in vivo* free radical scavenging and antioxidant potential of ethanolic extract of *Pergulariadaemia*, *Biocatalysis and Agricultural Biotechnology*, Volume 15, Pages 131-137.
- Silva, A. R. A., Morais, S. M., Marques, M. M. M., Lima, D. M., Santos, S. C. C., Almeida, R. R., Vieira, I. G. P., Guedes, M. I. F. (2011). Antiviral activities of extracts and phenolic components of two *Spondias* species against dengue virus. *J. Venom. Anim. Toxins Incl. Trop. Dis.* 17, 406–413.
- Silva, F. V. G., Silva, S. M., Silva, G. C., Mendonça, R. M. N., Alves, R. E., Dantas, A. L., (2012). Bioactive compounds and antioxidant activity in fruits of clone and ungrafted

- genotypes of yellow mombin tree. *Food Sci. Technol.* 32, 685–691.
- Simbo, D. J. (2010). An ethnobotanical survey of medicinal plants in Babungo, Northwest Region, Cameroon. *J. Ethnobiol Ethnomed*, 6, 8pp. Available online at: <http://www.ethnobiomed.com/content/6/1/8>. Accessed on 18 July 2011
- Singh, V. P., Sharma, S. K., Khare, V. S. (1980). Medicinal plants from Ujjain district Madhya Pradesh - part II. *Indian Drugs Pharm Ind*; 5: 7-12.
- Singh, V. K., and Zaher, A. A. (1998). In: Herbal Drugs of Himalaya Aspect of Plant Science, Vol-15, Today and Tomorrow Printer and Publisher, New Delhi, , p.148-149.
- Singh, N. K., and Singh, D. P. (2001). Ethnobotanical survey of Balrampur. *Flora-fauna*, 7(2), 59-66.
- Soladoye, M. O., Orihere, S. S., Ibimode, B. M. (1989). Ethnobotanical study of two indigenous multipurpose plants in the Guinea Savanna of Kwara State – *Vitellaria paradoxa* and *Parkia biglobosa* Biennial Conference of Ecological Society of Nigeria, 14 August, Forestry Research Institute, Ibadan; 13pp.
- Srivastava, J. L., and Vietmeyer, N. (1996). Medicinal plants. An expanding role in development. *The World Bank, Washington DC* (World Bank Technical Paper 320) 21pp.
- Tabuti, J. R., Lye, K. A., and Dhillon, S. S. (2003). Traditional herbal drugs of Bulamogi, Uganda: Plants, use and administration. *J Ethnopharmacol*, 88, 19–44.
- Taiwo, A., Adebisin, O. A. and Funmilayo, A. (2010). Glycaemic activity of *Ficus exasperata* in fructose-induced glucose intolerance in rats. *Res*; 2:80-3.
- Takon, I., Antai, S. P. and Okon, P. (2013) In-vitro evaluation of antibacterial activity of ethanolic and aqueous extracts of *Ficus exasperata* VAHL (Moraceae) leaves. *Journal of Microbiology and Biotechnology Research.*, 2013, 3 (4):7-12. ISSN: 2231 –3168 (<http://scholarsresearchlibrary.com/archive.html>)
- Taur, D. J. and Patil, R. Y. (2007). Some medicinal plants with antiasthmatic potential: a current status. *Asian Pac. J. Trop. Biomed*; 413–8.
- Telefo, P. B., Lienou, LL., Yemele, M.D., Lemfack, M.C., Mouokeu, C., Goka, C.S. and Moundipa, F. P. (2011). Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon. *J. Ethnopharmacol.* 136(1):178-187.
- Terashima, K., and Takaya, Niwa M. (2002). Powerful antioxidative agents based on garcinoic acid from *Garcinia kola*. *Bioorganic Medicinal Chemistry* 10(5):1619-1625.
- The wealth of India, (2001). Volume (N-Pe). In: A dictionary of Indian raw materials and industrial products, Vol- 7: New Delhi, CSIR, p. 311.

- Thomas, M., Sheran, J., Smith, N., Fonseca, S., Lee, A. J., AKL1 (2007). A botanical mixture for the treatment of asthma: a randomised, double-blind, placebo-controlled, cross-over study. *BMC Pulm Med*; 7:4pp.
- Torres, M. P., Rachagani, S., Purohit, V., Pandey, P., Joshi, S., Moore, E. D. (2012). A novel promising natural-derived drug that inhibits tumorigenicity and metastasis of pancreatic cancer cells in vitro and in vivo through altering cell metabolism. *Cancer Letters*. 323: 29–40.
- Ubafe Martha Okeand Ejale, U. Angela (2019). Ethnomedicinal survey of medicinal plants in Olomoro Clan, Isoko South Local Government Area, Delta State, Nigeria. *Biological Sciences and Pharmaceutical Research* Vol.7 (4), pp.71-81. Available online at <https://www.journalissues.org/IBSPR/https://doi.org/10.15739/ibspr.19.009>
- Wang, Yu-hua, Pei, S. J., and Xu, J. C. (2005). Sustainable management of medicinal plant resources in China: Literature review and implications. *Resources Science*, 24(4):81-88.
- Woode, E., Poku, R. A., Ainooson, G. K., Boakye-Gyasi, E., Abotsi, W.K., Mensah, T. L. (2009). An Evaluation of the anti-inflammatory, antipyretic and antinociceptive effects of *Ficus exasperata*(Vahl) leaf extract. *J Pharmacol Toxicol*; 4:138-51.
- Woode, E., Poku, R. A., Abotsi, W.K. (2011). Anxiolytic-like effects of a leaf extract of *Ficus exasperata*Vahl (Moraceae) in Mice. *West Afr J Pharm*; 22:75-81.
- WHO. (1991). *Guidelines for the Assessment of Herbal Remedies*. Traditional Medicine Programme of the World Health Organisation, Geneva. pp
- Xu, H. X., Mughal, S., Taiwo, O., Lee, S. F. (2013). Isolation and characterization of an antibacterial biflavonoid from an African chewing stick *Garcinia kola*Heckel (Clusiaceae). *Journal of Ethnopharmacology* 147(2):497-502.
- Yin, L. (2009). The survey and analysis of Tibet knowledge on utilization and value consciousness: A case of Yongzhi village, Deqin County, Yunnan, Province. In: Xu DY. ed. *Inheriting and benefit-sharing of traditional medicinal knowledge in ethnic areas of China*. Beijing, China: Chinese Environmental Science Press, 135–144.