

Nigerian Medicinal Plants II

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ABSTRACT

Aframomum meleguata, *Dennettia tripetala*, *Monodora myristica*, *Piper guineense*, *Tetrapleura tetraptera* and *Xylopia aethiopica* are some of the Nigerian medicinal spices. These plants are rich sources of phytochemicals, vitamins, carbohydrates and minerals and contain phenolic compounds, flavonoids, alkaloids, saponins and tannins. Many flavonoids present in the plants exhibit antioxidant, antimicrobial and oxytocic properties. These plants are used in herbal medicine to regulate irregular menstruation or dysmenorrhea (menstrual pain) and help to normalize menstrual cycle. Other medicinal uses include inhibition of tumor growth, anti-inflammatory, antispasmodic and antiallergic action. The plants showed uterine contraction activity when administered to animals. These medicinal plants could therefore have side effects of inducing abortion when used during pregnancy.

Keywords: antioxidants, oxytocic plants, phytochemicals, phytomedicine, spices

CONTENTS

INTRODUCTION.....	97
<i>Aframomum meleguata</i> K. Schum (<i>Zingiberaceae</i>).....	97
<i>Dennettia tripetala</i> G. Baker (<i>Annonaceae</i>).....	98
<i>Monodora myristica</i> Dunal A Rich (<i>Annonaceae</i>).....	99
<i>Piper guineense</i> Schum and Thonn (<i>Piperaceae</i>).....	99
<i>Tetrapleura tetraptera</i> Schum & Thonn (<i>Mimosaceae</i>).....	99
<i>Xylopia aethiopica</i> (Dunal) A Rich (<i>Annonaceae</i>).....	99
PHYTOCHEMISTRY REVIEWED	100
NUTRITIVE VALUES	101
PHARMACOLOGICAL/BIOLOGICAL STUDIES	101
CONCLUSION.....	102
REFERENCES.....	102

INTRODUCTION

In Nigeria, many indigenous plants are used as spices, food or medicine. Spices are used to add flavor, relish or piquancy to foods. Modern food processors use spices to give appealing and appetizing flavors to food (Achinewhu *et al* 1995; Okwu 2001b, 2006). Indigenous spices and herbs are used to prepare pepper soup, which exhibits hot and spicy tastes. Some forest fruits and seeds are sometimes added to food meant for pregnant and nursing mothers as medicinal spices (Okwu 2005, 2006). The uses of botanicals are one of several treatments used in Eastern Nigeria to attempt to increase milk lactation of nursing women (Okwu and Ibeawuchi 2005). These plants possess potent physiological effects when they are administered to animals. Modern herbalists value these medicinal plants primarily for their anti-inflammatory, anti-spasmodic and estrogenic or oxytocic properties (Okwu 2005; Okwu and Omodamiro 2005; Agyare *et al.* 2006). The activity of these plants as sources of bioactive compounds make it possible for them to be used in many traditional medicinal preparations as well as spice in local foods (Okwu and Ibeawuchi 2005). The flavoring properties inherent in these plants prompted their inclusion as additives in food prepared for pregnant and nursing mothers particularly in Eastern parts of Nigeria (Okwu 1999, 2001a, 2001b; Okwu and Ibeawuchi 2005). These spices have been traditional dietary and medicinal herbs in Nigeria (Okwu

and Morah 2004; Okwu and Ibeawuchi 2005). Modern herbalists value these spices primarily not only for their capacity to promote wound healing (cell proliferation) but also have been stated to possess analgesic, astringent, anti hemorrhagic, oxytocic and restorative properties (Ojmelukwe *et al.* 2000; Okwu and Omodamiro 2005). The phytochemical composition of *A. meleguata*, *D. tripetala*, *M. myristica*, *T. tetraptera*, *P. guineense* and *X. aethiopica* provides a profile of plants well suited for evaluation for their medicinal and pharmacological activities.

***Aframomum meleguata* K. Schum (*Zingiberaceae*)**

Aframomum meleguata (Alligator pepper) (**Fig. 1A**) is a plant with both medicinal and nutritive values, found commonly in the rain forest region of Nigeria (Agoha 1974). The seeds are commonly used in flavoring food in Eastern Nigeria (Okwu 2005). It is used in liquor and alcoholic beverages, medicine for intermittent fever, dysentery and gastrointestinal trouble (Agoha 1974; Okwu 2005). The seeds are used as spice in food and wine (Enwere 1998). The taste is spicy, hot and a little bitter due to a volatile oil. It contains hydroaryllalkanone on acetone extract (Okwu 2005). The constituents include essential oils, paradol, resin, and tannins (Gill 1992). Alligator pepper is extensively used as a common ingredient of traditional medicine (Gill 1992). It is generally used as a stimulant and febrifuge (Gill 1992). The

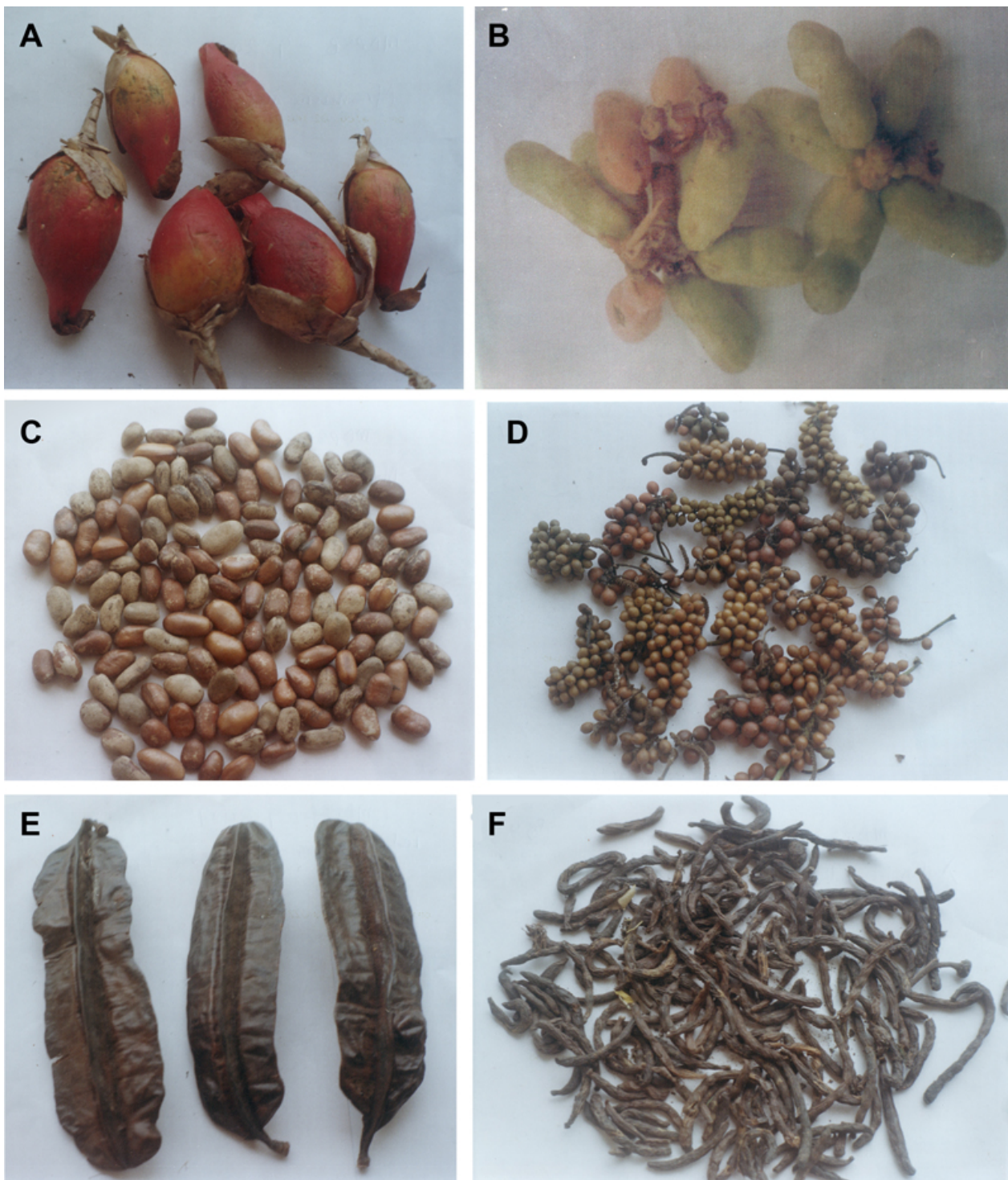


Fig. 1 Seeds of Nigerian medicinal plants mentioned in this review. (A) *Aframomum meleguata*. (B) *Dennettia tripetala*. (C) *Monodora myristica*. (D) *Piper guineense*. (E) *Tetrapleura tetraptera*. (F) *Xylopia aethiopica*.

decoction of the leaves is used for small pox and chicken pox. The fruits of *A. meleguata* and fruits of *Spondias mombim* when powdered are mixed together with cold pap and are recommended in herbal medicine as an anti-fertility agent (Gill 1992). Betti (2002) reported that *A. meleguata* is used against male sexual impotence in phytomedicine.

***Dennettia tripetala* G. Baker (Annonaceae)**

Dennettia tripetala (Pepper fruit) (Fig. 1B) is a medium-sized tree commonly found in the tropical rain forest region of Nigeria and sometimes in savannah areas (Keay 1989). The young leaves and fruits have a distinctive spicy taste. Pepper fruit is a tropical tree common in the mangrove forests of the West Coast of Africa (Keay 1989). It flourishes at the beginning of the rainy season, especially during the

months of April and May (Keay 1989). The mature fruits constitute the major edible portions. However, some communities also utilize the leaves and the roots in addition to the fruits for medicinal purposes (Iwu 1989). *D. tripetala* is used as a masticator, which when chewed produces a special peppery effect (Achinewhu *et al.* 1995). The peppery spicy taste of mature fruits usually serves as a mild stimulant to the consumer. *D. tripetala* fruits are very popular in Southern Nigeria where they serve also for cultural entertainment of guests during festivals like coronation, new yam festivals, and weddings (Okigbo 1980).

Another important use of *D. tripetala* fruits is as a flavoring agent in food and wine (Enwere 1998). They are used as spices and seasoning, which are added to prepared food such as meat, sausages, stews, soup and vegetable (Enwere 1998). The bark of *D. tripetala* fruit is mixed with

food to create variations in the taste and flavor of different foods (Achinwehu *et al.* 1995; Enwere 1998). The peppery fruits of *D. tripetala* usually find application in food meant for pregnant women. In Nigeria, some communities utilize the leaves and the roots in addition to the fruits for medicinal purposes (Achinwehu *et al.* 1995; Okwu and Morah 2004). It was agreed (Okwu and Morah 2004) that *D. tripetala* seeds are very important in the diets of postpartum women. It is believed that this plant aids in the contraction of the uterus. Okwu *et al.* (2005) isolated an alkaloid uvaropsine from the fruits of *D. tripetala*. Uvaropsine is known to possess an affinity to adrenergic receptors and is one of the physiological active phytoconstituents of *D. tripetala*.

In the last two decades, considerable efforts have been directed and devoted in the use of extracts of *Dennettia tripetala* as a botanical insecticide (Osisiogu 1975; Okwute 1992). The essential oil of *D. tripetala* has been shown to be an effective protectant for stored grains such as cowpea and maize without affecting their viability (Osisiogu 1975; Osisiogu and Agbakwuru 1978). The possible uses of *D. tripetala* oil as a seed preservative and as a surface protectant of dry cowpea and maize grains from damage by *Callosobruchus maculatus* and *Sitophilus zeamais*, and *Mot-schulsky*, respectively have been reported (Agbakwuru *et al.* 1978; Osisiogu and Agbakwuru 1978).

Iwuala *et al.* (1981) have demonstrated the toxicity of extracts from *D. tripetala* to adults and nymphs of *Periplaneta americana* L. and *Zonocerus variegatus* L. Egwu-nyenga *et al.* (1998) evaluated the repellency of *Dermestes maculatus* F. Ewete *et al.* (1996) studied the biological activity of extract from *D. tripetala* against the European corn borer *Ostrinia nubilalis*. Their investigation showed that the ethnolic extract of *D. tripetala* significantly reduced larval growth of *O. nubilalis* at 1000 ppm in the diet.

***Monodora myristica* Dunal A Rich (Annonaceae)**

Monodora myristica (Jamaican nutmeg) is a tree that commonly grows in the rain forest (Keay 1989). It is a forest tree of up to 30 m high, with dense foliage and spreading crown. The fruit is green, about 15 cm in diameter, round and woody. The pulp is white and contains numerous seeds of about 2.5 cm long (Fig. 1C). Fruiting occurs from August to November (Agoha 1974). The ovoid fruits are commonly used as a spice in flavoring food in Eastern Nigeria (Okwu 2001a, 2001b; Okwu and Ibeawuchi 2005). The essential oil of *Monodora myristica* is used extensively as a carminative (Oliver 1986; Okwu 2001b). The essential oil is associated in the seed with solid fat. The oil contains α -pinene, camphene, geraniol and eugenol (Oliver 1986; Okwu 2001b). The oil is an aromatic stimulant and in high doses, it has convulsant and oxytoxic properties (Okwu and Ibeawuchi 2005). Essential oil from *M. myristica* is used as a flavoring agent for food (Oliver 1986; Okwu 2001b). The oil provides a valuable flavor in meal preparations, soups, sauces and canned foods (Okwu 2001a, 2001b; Okwu and Ibeawuchi 2005). *M. myristica* provides edible oils or vegetable fats (Agoha 1974; Oliver 1986). The presence of unsaturated fatty acids in *M. myristica* suggests its utilization as a source of dietary oil. The oil could therefore be used as a linolenic-rich salad oil or edible fat or margarine (Achinwehu *et al.* 1995). *M. myristica* possesses potent physiological effects when it is administered to animals. The presence of bioactive compounds makes it possible for the seeds of this plant to be used in many traditional medicinal preparations as well as spice in local foods (Okwu and Ibeawuchi 2005). It is the flavoring property and aroma that prompted its inclusion as an additive in food prepared for pregnant and nursing mothers, particularly in Eastern parts of Nigeria (Okwu 2001a; Okwu and Ibeawuchi 2005). *M. myristica* is used as a food supplement in traditional food-stuffs for lactating and pregnant women in Nigeria. The seeds of *M. myristica* yield a colourless, volatile oil with a pleasant taste and flavor and are used as condiments for soup (Agoha 1974).

The aromatic seeds form a common ingredient in African medicines. A pomade made from the pulverize seeds fried in oil or roasted in fire and the powder produced are used to treat guinea worms and sores (Agoha 1974). They are used for constipation and as a stimulant with palm oil. The seed are chewed and rubbed on the forehead to stop headaches (Agoha 1974).

***Piper guineense* Schum and Thonn (Piperaceae)**

Piper guineense is a West African black pepper, which normally grows as a climber. It is slender climber with prominent nodes, common in the rain forest areas. The fruits occur in clusters, small, reddish or reddish brown (Fig. 1D) when ripe and black when dry (Agoha 1974). It is found commonly in Southern part of Nigeria (Okwute 1992). The black berries are used as spice. The pepper is used externally as a counter-irritant or in a stimulating ointment and internally as a stomachic and carminative. The pulverized grains are useful as an insecticide (Oliver 1986). The fruits of *P. guineense* have both aromatic constituents and pungent principles (Okwu 2001b). The aromatic constituent is contained in the essential oil while the pungent principles are found mainly in the alkaloids. The pungent alkaloids are responsible for the aroma the fruit often imparts upon foods (Okwu 2001b). The amide constituent, guineensine and piperine were isolated from the seed. Okwute (1992) observed that guineensine and piperine possessed insecticidal activity against *Callosobruchus maculatus* beetle (the insect storage pest of cowpea). *P. guineense* has potent physiological effects when they are administered to animals. It was reported (Addea Mensah *et al.* 1977; Oliver 1986; Okwute 1992; Okwu 2001b) that the active phytoconstituents comprising piperine, amide alkaloids (terpenes) and dihydropiperine has potent physiological effects when they are administered to animals. The piperine and alkaloids phytoconstituents have anti-microbial, anticonvulsant, antihypertensive, sedative, tranquilizing and insecticide properties (Oliver 1986; Okwute 1992; Okwu 2001b). *P. guineense* seeds are used not only to obtain relief from gripping conditions of the stomach after delivery but also to restore the uterus to normal condition (Ojimelukwe *et al.* 2000; Okwu 2001b). *P. guineense* is used extensively as an additive in food meant for nursing mothers. The fruits are used as spices to flavor soup, rice and stew. The oil distilled from them is used in perfumery and in soup making (Agoha 1974).

***Tetrapleura tetraptera* Schum & Thonn (Mimosaceae)**

Tetrapleura tetraptera is a tree of about 180 m high, found commonly in the rain forest (Keay 1989). The bark is smooth, grayish, reddish and strong smelling (Okwu 2001b). The fruits are brown and usually lightly curved with ridges (Fig. 1E) (Okwu 2006). *T. tetraptera* is used as a tonic and stimulant. Besides oil, *T. tetraptera* contains resins, fats, carbohydrates, coloring matter and fatty acids (Okwu 2001b). Screening of the fruits of *T. tetraptera* revealed the presence of oleanic acid, triglycoside and scoplatin, a coumarin (Okwu 2001b, 2006). It is perhaps the presence of coumarin that is responsible for the aroma the fruits often impart upon food and its ability to serve as a potential condiment in soups (Okwu 2001, 2006). In Nigeria, the fruits of *T. tetraptera* are used in phytomedicine for the treatment of infertility in women (Igoli *et al.* 2005). The fruit is milled into powder and added to soup as a sauce. The pulp is sometimes added into palm wine as a flavouring.

***Xylopia aethiopica* (Dunal) A Rich (Annonaceae)**

Xylopia aethiopica is a tree of about 20 m high, found in lowland rain forest and forest areas bordering the Savanna (Agoha 1974). The fruits occurs in bunches of narrow carpels. They are reddish at first, and becoming blackish with age (Fig. 1F). Each fruit contains from 7-9 seeds, which

bear arils at their base. Fruiting occurs from October to March (Agoha 1974). *X. aethiopicum* is a traditional dietary and medicinal plant in Nigeria. It is mainly consumed as a spice, flavoring agent and stimulant (Okwu and Ibeawuchi 2005; Okwu and Omodamiro 2005). Modern herbalists value this spice primarily for its anti-inflammatory, anti-spasmodic, febrifuge and diaphoretic properties (Okwu and Omodamiro 2005). Fruits and seeds of *X. aethiopicum* are hot to the taste and are used as a stimulant and restorative after childbirth (Ojmelukwe *et al.* 2000; Okwu 2001b; Okwu and Omodamiro 2005). This spice is alleged to possess medicinal properties and is used to provide relief from gripping conditions of the stomach after delivery and to restore the uterus to a normal condition (Ojmelukwe *et al.* 2000). *X. aethiopicum* is used to prepare soups that are hot and spicy and is consumed during the cold season. Fruits and seeds of *X. aethiopicum* are sometimes added to food meant for pregnant and nursing mothers (Okwu and Ibeawuchi 2005). The main chemical constituents isolated from *X. aethiopicum* comprises mainly xylopic acid, diterpenic acid 15 β -acetoxy(-)kauran-16-ene-19-oic acid, three diterpenic alcohols, one of them identified as kauran-16- α -ol, 4-diterpenic acids, fats, oils and essential oils (Oliver 1986; Okwu and Ibeawuchi 2005). The essential oil enhances the aroma of foods, while the acid is responsible for the taste or hot taste, which characterizes *X. aethiopicum* (Okwu 2001b). Fluid extract or a decoction of the fruits or bark is drunk as treatment for bronchitis and dysentery. It is also a remedy for biliousness. The crushed seeds are rubbed on the forehead to stop headache and neuralgia (nervous pains); or poultice of the leaves and fruits are used (Agoha 1974).

The spicy fruits and seeds have many local medicinal applications both external and internal. They are used as cough medicine, carminative, and purgative. They are added in other medicines such as the Yoruba "Agbo pot" as stimulant (Agoha 1974). The decoction of the fruit is used as a woman's remedy to encourage fertility (Irvine 1961; Okwu 2001a, 2001b; Okwu and Ibeawuchi 2005). It is used as lotion for boils and eruptions. A seed extracts is used for round worms and as an emetic for biliousness (Irvine 1961; Agoha 1974)

The exhibition of anti-microbial property by *X. aethiopicum* may be due to the presence of xylopic acid and other diterpenes in the fruit extract (Amadioha and Obi 1998).

PHYTOCHEMISTRY REVIEWED

A. meleguata, *D. tripetala*, *M. myristica*, *P. guineense*, *T. tetraptera* and *X. aethiopicum*, like other higher plants have a complex phytochemical profile. The predominant phytochemical compounds include flavanoids, phenolic compounds, saponins, alkaloids and tannins (Table 1).

A. meleguata contains paradol and hydroarylalkane, *D. tripetala* contains uvariopsine while the amide constituent guineense and piperine were isolated from *P. guineense*, and xylopic acid, diterpenic acids and alcohols were isolated from *X. aethiopicum*. *T. tetraptera* contained a coumarin, scopolatin and oleanic acid (Table 2).

Some of the general properties of saponins include formation of foams in aqueous solution, hemolytic activity and cholesterol binding properties and bitterness (Sodipo *et al.* 2000). The natural tendency of saponins to ward off microorganisms such as *Candida albicans* and *Aspergillus niger* makes them good candidates for treating fungal and yeast infections (Okwu and Ndu 2006). These compounds serve as natural antibiotics, which help the body to fight infections and microbial invasion (Sodipo *et al.* 2000). Plant saponins help humans to fight fungal infections, combat microbes and viruses, boost the effectiveness of certain vaccines and knock out some kinds of tumor cells, particularly lung and blood cancers (Sodipo *et al.* 2000). They also lower blood cholesterol thereby reducing heart disease. The most outstanding and exciting prospects for saponins are how they inhibit or kill cancer cells. They may also be able to do it without destroying normal cells in the process, as is the mode of some cancer-fighting drugs. Cancer cells have more cholesterol-type compounds on their membranes than normal cells; saponins therefore bind cholesterol and thus interfere with cancer cell growth and division (Ryan and Shattuck 1994).

Apart from saponin, other phytoconstituents of *A. meleguata*, *D. tripetala*, *T. tetraptera*, *P. guineense* and *X. aethiopicum* include the alkaloids and tannins. Alkaloids are classified as one of the efficient, therapeutically significant plant substances with pronounced physiological functions. Pure isolated plant alkaloids and their synthetic derivatives are used as basic medicinal agents for their analgesic, anti-spasmodic, antimalarial, fungicidal and bactericidal properties (Okwu 2005). The tannin content could be responsible for the hot, bitter and pungent nature of *A. meleguata*, *D.*

Table 1 Phytochemical composition of six Nigerian medicinal plants expressed as mg/100 g dry weight.

Medicinal plants	Part screened	Alkaloids	Flavonoids	Tannins	Phenols	Saponins	Reference
<i>Aframomum meleguata</i>	Seed	0.28 \pm 0.20	5.76 \pm 0.10	0.38 \pm 0.11	0.09 \pm 0.10	1.24 \pm 0.30	Okwu 2005
<i>Dennettia tripetala</i>	Seed	0.24 \pm 0.11	2.26 \pm 0.22	0.06 \pm 0.04	0.03 \pm 0.11	1.44 \pm 0.22	Okwu 2003
<i>Monodora myristica</i>	Seed	0.42 \pm 0.01	0.11 \pm 0.30	0.02 \pm 0.30	0.02 \pm 0.10	0.86 \pm 0.30	Okwu and Ibeawuchi 2005
<i>Pepper guineense</i>	seed	1.20 \pm 0.22	5.70 \pm 0.11	0.05 \pm 0.20	0.04 \pm 0.22	0.45 \pm 0.10	Okwu 2001b
<i>Tetrapleura tetraptera</i>	Fruit	0.21 \pm 0.10	5.80 \pm 0.11	0.32 \pm 0.11	0.06 \pm 0.20	1.28 \pm 0.11	Okwu 2006
<i>Xylopicum aethiopicum</i>	Fruit	0.25 \pm 0.20	0.08 \pm 0.03	0.08 \pm 0.10	0.18 \pm 0.40	0.25 \pm 0.01	Okwu and Ibeawuchi 2005

Data are means \pm standard deviation of triplicate determinations on a dry weight basis.

Table 2 Phytoconstituents, antimicrobial, insecticidal and pharmacological activity of six Nigerian medicinal plants.

Plants	Part used	Active phytoconstituents	Action/acts on	References
<i>Aframomum meleguata</i>	Seed	Paradol, tannins, resins, hydroxyarylalkane	Concentration of 100mg/ml Inhibit <i>Staphylococcus aureus</i> , <i>Samonella typhii</i> , <i>Bacillus subtilis</i>	Gill 1992
<i>Dennettia tripetala</i>	Fruit	Uvariopsine	Concentration of 100mg/ml inhibit <i>Pseudomonas aeruginosa</i> , <i>Bacillus subtilis</i> , <i>Samonella typhi</i>	Okwu 2003; Okwu <i>et al.</i> 2005
<i>D. tripetala</i>	Seed	Essential oil	1000ppm in diet reduced European Corn borer, <i>Ostrinia nubilalis</i>	Ewete <i>et al.</i> 1996
<i>Monodora myristica</i>	Seed	α -pinene, geraniol, eugenol, camphene	Oxytocic activity, concentration of 100 mg/ml inhibit <i>Pseudomonas aeruginosa</i> , <i>Klebsiella pneumoniae</i>	Oliver 1986
<i>Piper guineense</i>	seed	Piperine amide alkaloids (terpenes), dihydropiperine	Concentration of 100 ug/ml inhibit <i>Candida albicans</i>	Addea-Mensah <i>et al.</i> 1977a, 1977b; Oliver 1986; Okwute 1992
<i>Tetrapleura tetraptera</i>	Fruit	Saponosides (oleanolic acid) triglycoside (scopolatin)	Insecticidal	Adesina <i>et al.</i> 1980; Sofawara 1980; Oliver 1996
<i>Xylopicum aethiopicum</i>	Fruit	Kauren-diterpenes, diterpenic alcohols	Anti-inflammatory	Oliver 1986
<i>X. aethiopicum</i>	Fruit	Xylopic acid diterpenic acid, diterpenic alcohol	Concentration of 100 mg/ml inhibits <i>Escherichia coli</i> , <i>Bacillus subtilis</i> , <i>Staphylococcus aureus</i> , <i>Candida albicans</i>	Okigbo <i>et al.</i> 2005

tripetala, *P. guineense* and *X. aethiopica*. Tannins have an astringent property, hasten the healing of wounds and inflamed mucous membrane (Okwu and Okwu 2004; Okwu 2005). The presence of tannins in these plants strongly supports their use in treating wounds, varicose ulcers, hemorrhoids, frostbite and burns in herbal medicine (Okwu 2005). The biological functions of flavonoids include protection against allergies, inflammations, free radical, platelet aggregation, microbes, ulcers, hepatoxins, viruses and tumors. The availability of flavonoids help to prevent platelet stickiness and hence platelet aggregation (Sodipo *et al.* 2000). Moreover, *A. meleguata*, *D. tripetala*, *P. guineense*, *T. tetraptera*, *M. myrsitica* and *X. aethiopica* protect the vascular system and strengthen the tiny capillaries that carry oxygen and essential nutrients to all cells. The presence of phenols indicates that the plant could act as anti-inflammatory, immune enhancers and hormone modulators (Okwu and Omodamiro 2005). Phenols have been the subject of extensive research as disease preventives and are able to block specific enzymes that cause inflammation (Duke 1998). They also modify the prostaglandin pathways and thereby protect platelets from clumping (Okwu and Omodamiro 2005).

NUTRITIVE VALUES

Generally, these spices contain basic food nutrients, proteins, fats, carbohydrates, fiber and vitamins (Tables 3 and 4). Plant proteins may be consumed as a whole plants or leaves, raw, dried or cooked (Enwere 1998). The high inclusion of lipids in these plants is an indication of their potential as a source of vegetable oil (Okwu 2006).

A. meleguata, *D. tripetala*, *P. guineense*, *T. tetraptera*, *M. myrsitica* and *X. aethiopica* provide dietary fiber, which among other things promotes bowel regularity and enhances frequent waste elimination including bile acids, sterols and fats (Scala 1974; Akobundu 1999; Okwu 2004). Fiber has a physiological effect on the gastrointestinal function of promoting the reduction of tracolonic pressure, which is beneficial in diverticular disease (Pinater and Brukin 1971; Scala 1974; Akobundu 1999; Okwu 2006). This disease is characterized by small "blow out type" protruding lesions on the large intestine which progress to inflammation that may eventually burst, thus producing infection and cancer of the colon (Scala 1974; Akobundu 1999; Okwu and Morah 2004). Fiber has a biochemical effect on the absorption and re-absorption of bile acids and consequently the absorption of dietary fat cholesterol. This in turn lowers the cholesterol pool and prevents the formation of plaque whose components are cholesterol, some fats and protein (Scala 1974; Akobundu 1999; Okwu 2006). Rural communities that consume large quantity of roughage have lower incidence of diverticular disease unlike their city counterparts (Painter and Burkin 1971; Akobundu 1999;

Okwu 2006). The reduction of cholesterol through consumption of food with high roughage value is therefore a healthy habit. It is therefore important that high-fiber plant foods such as *A. meleguata*, *D. tripetala*, *M. myrsitica*, *P. guineense*, *T. tetraptera* and *X. aethiopica* should continue to form part of our diet in this part of the world.

PHARMACOLOGICAL/BIOLOGICAL STUDIES

A. meleguata, *D. tripetala*, *M. myrsitica*, *P. guineense*, *T. tetraptera* and *X. aethiopica* have been extensively used in herbal medicine not only for their oxytocic, analgesic, anti-inflammatory and antimicrobial properties but also provide relief in the treatment of human gastro-intestinal, hypermobility and peptic ulceration (Gill 1996). These plants have been reported (Oliver 1986; Ojmelukwu *et al.* 2000) to have antimicrobial, anticonvulsant, antihypertensive, sedative, tranquilizing and insecticidal properties. Small quantities act as a gastric stimulant and carminative, increase the flow of saliva and gastric juice, have diuretic and diaphoretic properties and act as a nervous stimulant (Oliver 1986). Extract of the fruit of *X. aethiopica* had been found to have some antibiotic effect on *Sarcina lutea* and *Mycobacterium phlei* (Okigbo *et al.* 2005) and on *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Candida albicans* (Oliver 1986). This action seems due mainly to xylopic acid which at a concentration of 100 mg/ml causes the inhibition of *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus* and *Candida albicans* (Okigbo *et al.* 2005). The effect of xylopic acid is compared to that of chloramphenicol (Oliver 1986). Alcoholic as well as aqueous extracts of the fruits of *T. tetraptera* have been found to exhibit marked tranquilizing properties on male albino mice and to cause lowering of their body temperature (Oliver 1986). Oral doses of an alcoholic extract of the fruit sedated mice within 30-40 min after injection of a convulsant drug (Lepazol[®]) and over 60% of the animals were protected (Adesina and Sofawara 1979; Oliver 1986). Anti-arrhythmic effects of scopoletin were demonstrated *in vivo* and *in vitro* (Ojewole 1983). Oliver (1986) reported that scopoletin and tetramethyl pyrazin protected and suppressed ouabain-induced arrhythmias in guinea pigs.

The hexane extract of *X. aethiopica* showed uterine contraction activity. It has similar action to that of oxytocin (Okwu and Omodamiro 2005). Oxytocin is a hormone, which makes the uterus experience strong contractions, thus producing labour (Okwu and Omodamiro 2005). *M. myrsitica*, *D. tripetala*, *P. guineense*, *A. meleguata*, *X. aethiopica* and *T. tetraptera* are used in herbal medicine to accelerate labor in South Eastern Nigeria. However, these plants if used during the first months of pregnancy could have abortifacient properties (Okwu and Omodamiro 2005). Moreover, when *A. meleguata*, *D. tripetala*, *P. guineense*, *T. tetraptera*, *M. myrsitica* and *X. aethiopica* are administered in

Table 3 Proximate composition and energy content of six Nigerian medicinal plants.

Medicinal plant	Part screened	Protein N x 6.25%	Fats/oil (%)	Ash (%)	Carbohydrates (%)	Fiber (%)	Food energy (g/calories)	Reference
<i>Aframomum meleguata</i>	Seed	7.00 ± 0.10	1.68 ± 0.11	4.00 ± 0.22	80.72 ± 0.20	6.60 ± 0.30	357.60	Okwu 2006
<i>Dennettia tripetala</i>	Fruit	15.31 ± 0.03	3.47 ± 0.20	4.25 ± 0.10	62.00 ± 0.50	9.84 ± 0.20	480.24	Okwu and Morah 2004
<i>Monodora myrsitica</i>	Seed	15.31 ± 0.03	14.06 ± 0.01	8.20 ± 0.05	52.83 ± 0.40	9.06 ± 0.20	403.96	Okwu and Ibeawuchi 2005
<i>Piper guineense</i>	Seed	38.00 ± 0.06	7.30 ± 0.01	9.10 ± 0.07	40.29 ± 0.76	4.31 ± 0.01	378.86	Okwu 2001b
<i>Tetrapleura tetraptera</i>	Fruit	7.44 ± 0.11	20.36 ± 0.10	5.00 ± 0.20	49.06 ± 0.10	18.14 ± 0.22	379.48	Okwu 2006
<i>Xylopiya aethiopica</i>	Fruit	12.04 ± 0.06	9.40 ± 0.06	4.95 ± 0.10	67.18 ± 0.20	6.44 ± 0.03	401.45	Okwu and Ibeawuchi 2005

Table 4 Vitamin composition of six Nigerian medicinal plants on mg/100 g dry weight basis.

Medicinal plant	Part screened	Ascorbic acid	Riboflavin	Thiamine	Niacin	Reference
<i>Aframomum meleguata</i>	Seed	12.32 ± 0.10	0.26 ± 0.20	0.24 ± 0.22	0.05 ± 0.11	Okwu 2005
<i>Dennettia tripetala</i>	Seed	58.48 ± 0.20	0.56 ± 0.01	0.12 ± 0.10	10.08 ± 0.20	Okwu and Morah 2004
<i>Monodora myrsitica</i>	Seed	66.05 ± 0.10	0.15 ± 0.10	0.30 ± 0.30	0.75 ± 0.30	Okwu and Ibeawuchi 2005
<i>Piper guineense</i>	Seed	66.02 ± 0.10	0.92 ± 0.10	0.28 ± 0.20	0.82 ± 0.11	Okwu 2001b
<i>Tetrapleura tetraptera</i>	Fruit	48.30 ± 0.11	0.24 ± 0.10	0.41 ± 0.11	0.33 ± 0.10	Okwu 2006
<i>Xylopiya aethiopica</i>	Fruit	77.06 ± 0.03	0.08 ± 0.10	0.43 ± 0.20	0.50 ± 0.20	Okwu and Ibeawuchi 2005

Data are means ± standard deviation of triplicate determinations on a dry weight basis.

high doses, in powdered form or as concoction as used in herbal medicine, it prepares the uterus and ensures that fatigue disappears, producing strong, regular, uterine contraction to facilitate labor during the last month of pregnancy (Okwu and Omodamiro 2005). From these findings, it is recommended that pregnant women should avoid the regular consumption of these plants in the first trimester as their regular consumption may likely result in uterine contraction and consequently miscarriage. However, the use of *X. aethiopica*, *P. guineense*, *T. tetraptera*, *A. meleguata* and *M. myristica* in preparing food for pregnant women ready for birth as well as nursing mothers should be encouraged. It is believed that it strengthens and heals the wall of the uterus (Okwu and Ibeawuchi 2005; Okwu and Omodamiro 2005). *X. aethiopica*, *T. tetraptera*, *D. tripetala*, *A. meleguata*, *P. guineense* and *M. myristica* contribute to the hormonal balance of the female body, thus improving the mental state and providing a sense of well-being. The plants possess oxytocic and anti-inflammatory activities. These findings justify the traditional use of the plants to induce uterine contraction in traditional medical practice.

CONCLUSION

These six medicinal plants at the moment grow in the wild. It is important to conserve Nigeria's rich germplasm, which at the moment grow in the wild. Concerted efforts on seed research are required in order to provide seeds of high quality to growers. Existing traditional sacred grooves, herbal gardens and forest areas rich in medicinal plants need to be studied to identify species that are at the verge of extinction so that adequate measures may be taken to conserve and multiply these plants. The policy for sustainable development of medicinal plant resources should be encouraged. Multiplication techniques of the seeds should be developed through research. Superior high quality seeds should be supplied to growers. Information on the nutritive value and phytochemical profiles of these medicinal plants should be disseminated to pharmaceutical firms, which have been depending on the wild sources of medicinal plants for drug formulation. These plants offer wild-scope for utilization as raw materials for food and pharmaceutical industries.

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