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Ethnobotanical and phytochemical properties of selected Tanzanian plant species with therapeutic potential: A review

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Abstract
Plants have lifelong importance to a wide range of human life aspects throughout human history. The global plant population is vast, comprising a myriad of medicinal plants. Populations from developing countries potentially rely on plants as a primary source of heath care on traditional basis. With research advances, it is now clearer that most developed countries have successively utilized traditional knowledge of plants for the bioprospecting of biologically active compounds and development of therapeutic agents. Besides the availability of potential therapeutic plants, most of the developing countries are dependent on conventional drugs from big pharmaceutical industries in the developed world. This can be attributed to little research development in the developing world. The interest in natural product research is increasing and ethnopharmacological studies are progressively drawing attention in many parts including Africa. Tanzania, as one of the countries with growing natural product research, harbors an attracting phytogeography with an intriguing ethnobotanical profile. The territory encompasses a broad spectrum of plant species with multiple utilities that have been substantiated by traditional healers and the ongoing research surveys. In this paper we review some of the least studied but most attractive plant species; *Neorautanenia mitis*, *Ocimum basilicum*, *Tagetes minuta*, *Clutia abyssinica*, *Uvariodendron gorgonis* and *Xylotherca tettensis*, which have portrayed potential candidacy in drug sourcing as per recent ethnobotanical and pharmacological research reports. We also present the phytochemical information regarding each species in relation to its bioactivity and point out its comparative pharmacological potential based on the inherent phytochemical properties.

Keywords: ethnobotanical, phytochemistry, therapeutic potential, bioactivity, plant species

Introduction
Throughout human history, plants have been an important source of human needs such as energy, recreation, furniture, food additives, and medicine, among others. The arising and increasing challenges to humans have progressively increased creativity and advances in the exploitation of plants (Vongtau *et al.*, 2000) [66]. To date the interest in natural product research is increasing concomitantly with the emergence and reemergence of diseases, drug resistance, cosmetic industry development and their associated rewarding outcomes. It is well established that over 75% of the global population relies on plants as the source of health care (WHO, 1996) [70]. In the developing world, more than 80% of the population depends of traditional medicine from plants as the primary source of therapy (Ruffo *et al.*, 2002) [55]. Tanzania is among the low income countries rich in plants and whose largest proportion of inhabitants utilizes plants for the traditional health care. In addition besides the vastly growing discipline of bioprospecting all over the world, Tanzania harbors a wide range of plants most of whose therapeutic potential is yet to be unraveled. Among others, *Neorautanenia mitis*, *Ocimum basilicum*, *Tagetes minuta*, *Clutia abyssinica*, *Uvariodendron gorgonis* and *Xylotherca tettensis* present some of the locally available plant species that traditionally used for various purposes. There is considerable published research reporting the ethnobotanical and phytochemical characteristics of these plant species (Breytenbach, 1986; Rufo *et al.*, 2002; Magadula *et al.*, 2009) [5, 38]. However, the literature is limited to a few important ethnobotanical aspects and a narrow spectrum of phytochemical information is provided. Nevertheless, little pharmacological and no clinical trial information is available about the plant species. Thus in this paper we review the available research data on the ethnobotany and phytochemistry, and hence we critically discuss the relevant pharmacological and therapeutic potential of the plant species in question based on their attractive ethnobotany and phytochemistry. We recognize these plant species as the major sources of essential oils rich in secondary metabolites biologically active against wide range pathogenic agents including bacteria, fungi, viruses and parasites. Furthermore, we discuss the potential of each plant species in the development of drugs for treatment of metabolic diseases

including diabetes mellitus, cardiovascular diseases, liver disease and cancer.

Neorautanenia mitis

Neorautanenia mitis is a leguminous flowering plant that belongs to the family of Fabaceae. Members of the genus *Neorautanenia* occupy a range of Tropical habitats spanning from Cote D'Ivoire, Nigeria to Somalia, South to Namibia, northern S. Africa, Zimbabwe and Mozambique (Vongtau *et al.*, 2004) [65]. Members in the genus include *Neorautanenia brachypus* and *Neorautanenia ficifolia*, among many others (*Neorautanenia mitis* (*N. mitis*), also known as *Neorautanenia amboensis* is among the potential medicinal plants with an array of biological activities (Joseph *et al.*, 2004) [27].

Phytogeographical description

Neorautanenia mitis is a shrub of 2m- height, scrambling around trees. It inhabits well drained soils of sany locations. In Tanzania, *N. mitis* is widely distributed across Rukwa, Iringa and Tabora (Magadula *et al.*, 2009) [38]. Table 1 represents a summary of description of *N. mitis*.

Table 1: Description of *Neorautananenia mitis*.

Basic attribute	Description
Botanical name	*Neorautanenia mitis*
Vernacular name	Lidupala (Hehe), limpumpu (Nyamwezi), Tuha (Sambaa)
Distribution	Across Africa
Altitude	2m
Description	

Ethnobotanical information

Historically, the genus *Neorautanenia* has been the source of poisonous agents which were used traditionally for fish poisoning in Central and South Africa (Breytenbach, 1986) [5]. Different morphological parts of *Neorautanenia* spp contain toxic compounds with insecticidal properties among other effects (Joseph *et al.*, 2004) [27]. *N. mitis* has been used by Tanzanian communities for the treatment of malaria, syphilis and bilhazia (Magadula *et al.*, 2009) [38]. Powdered leaves of *N. mitis* have been used in some African communities to treat scabies and remedy pain such as dysmenorrhea (Vongtau *et al.*, 2004; Vongtau *et al.*, 2005) [65, 66]. Other common uses include acaricidal, insect repellency, and treatment of syphilis and female frigidity (Lasis and Adesomaju, 2012). In Iringa, Tanzania, the indigenous (Hehe and Bena) people use the plant as a pesticide, controlling maize pests (Kihampa. 2011) [32].

Phytochemistry and bioactivity of *Neorautanenia mitis*

Neorautanenia mitis exhibits an attractive phytochemistry that has been reported from studies done in several parts of the world. This includes saponin glycosides, flavonoids, tannins and alkaloids (Vongtau *et al.*, 2000) [66]. In one study, Vongtau *et al.* (2000) [66] found that extracts from *N. mitis* had antinociceptive and antiinflammatory effects on rat uterus and rabbit jejunum. Phytochemical screening by Sakurai *et al.* (2006) [57] revealed the presence of novel pterocarpans, rautandiol A and rautandiol B along with known compounds including three rotenois, rotenone, and 12-hydroxyrotenone, isoelliptol, 12a-hydroxyerosone, in addition to a coumarin, pachyrrizine. Rautandiol A, rautandiol B, rotenone and 12-hydroxyrotenone are known to possess significant anticancer activity against breast cancer cell lines (Sakurai *et al.*, 2006; Magadula *et al.*, 2009) [57, 38]. These findings are attracting the use of *N. mitis* as a good candidate for bioprospecting of anticancer lead drugs and development of chemotherapeutic drugs. Furthermore, in Tanzania, tuber extracts of *N. mitis* have been shown to possess a range of including flavonoids (neorautanone), neoduline 4-methoxyneoduli and nepseudin with larvicidal activity against *Anopheles gambiae* and *Curex quinquefaciatus* larvae (Magadula *et al.*, 2009) [38]. The biological activity of these flavonoids indicates their potential candidacy for development of mosquitocidal drugs. The available ethnonobotanical and phytochemical data are enough to mount bioprospecting research on the pharmacological and pharmaceutical utility of *N. mitis* towards treatment of infectious diseases such as syphilis, *Chlamydia* and fungal infections such as candidiasis. Interestingly, the bioactivity pterocarpans is attractive to the development of antitumor drugs.

Tagetes minuta

The genus *Tagetes* (Asteraceae) comprises plants which in the human history have been commonly used sources of ingredients in beverages, condiments, ornamentals, as medicinal decoctions, and in ritual (Soule, 1993). The genus *Tagetes* consists of sunflower plants. The leaves of these plants are remarkable for their orange yellow-orange carrotenoids, used as food coloring agents in the food industry for instance vegetables, margarines, pasta and many others (Karimian *et al.*, 2014) [29]. The genus contains many spices including *Tagetes erecta* and *Tagetes minuta*. *Tagetes minuta* (*T. minuta*) is one of the plant species that have been known for being good sources of essential oils. Common names for *Tagetes minuta* include southern marigold, stinking roger, wild marigold and black mint (Neher, 1968) [50]. Table 2 presents a list of some of the vernacular names applied by different African tribes referring to *T. minuta* according to Prelude Medicinal Plants Database (2017).

Table 2: Vernacular names applied to *Tagetes minuta*

Vernacular name	Tribe/community	Region
Mushushathuri, mukakambanzhe	Luvenda	S. Africa
lbangi	Dorobo, Suiei	East Africa, Northen Kenya
Ikimogimogi	Kirundi	Central Africa
Anyach	Luo	East Africa, Kenya
mokazi murofa	Rutooro	East Africa, Uganda
Mbangi	Swahili	East Africa, Tanzania
Mûbangi	Kikuyu	East Africa, Kenya

Phytogeographical profile

Tagetes minuta is a native species of the temperate grasslands and Montane ecosystems of various South American countries, including Argentina, Chile, Bolivia, Peru as well as Paraguay (Karimian *et al.*, 2014) [29]. It is also found in many parts of Africa including Tanzania, Kenya, South Africa and many other countries (Chalchat *et al.*, 1995; Seyoum *et al.*,

2002; Motsei *et al.*, 2003) [58, 48]. *Tagetes minuta* (*T. minuta*) is an annual herb, 0.5-2 m erect with odorous foliage and short tapering taproots surrounded by fibrous lateral roots known to form mycorrhizal associations (Neher 1968, Hulina, 2008) [50, 20]. Their stems are broken or cut off near the base and may be branched in their upper part with singly oriented opposite pinnately compound leaves (Hulina, 2009).

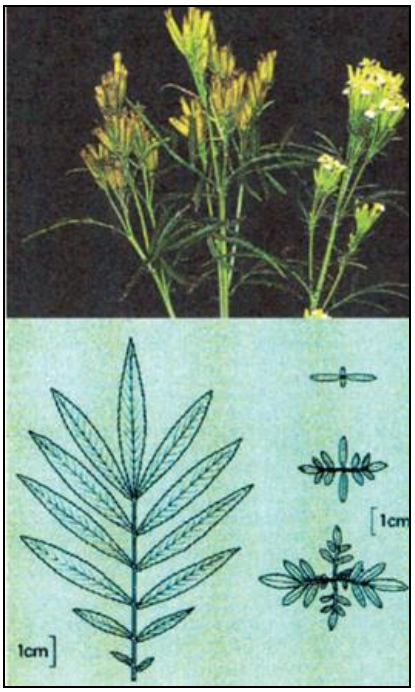

Fig 1: Morphological features of *T. minuta* (Source: Hulina, 2009)

Ethnobotanical profile

Tagetes minuta is traditionally used to keep away various insects such as mosquitoes, bedbugs, fleas, cockroaches, ants and termites (Seyoum *et al.*, 2002) [58]. In most parts of East Africa, the leaves are the most used morphological parts in the repellent function. In S. Africa, *T. minuta* has been used by indigenous people to treat fungal infections and AIDS (Motsei *et al.*, 2003; Moshi *et al.*, 2007) [48, 47]. It also known in Tanzania that aerial parts of *T. minuta* are traditionally used as insect repellent properties such as repelling mosquitoes (Ijani and Mmbaga, 2008; Athuman *et al.*, 2016) [22, 3].

Bioactivity and phytochemical properties

Crude methanolic extracts by Hamza *et al.* (2006) [19] demonstrated antifungal activity against a range of fungal species including *Candida*, *Cryptococcus* species. In addition, leaf extracts are used in the treatment of ring worm infections (Hamza *et al.*, 2006) [19]. In Pakistan, Shahzadi *et al.* (2010) [60] demonstrated that *T. minuta* seed organic extracts have multiple biological activities ranging from malaricidal, phytotoxic to insecticidal effects. These desirable effects have been linked to several classes of natural products including tarpenes particularly targetones and ocimenones, which are abundant in aromatic essential oils. Mostly, terpenoids known from *Tagetes minuta* are categorized into monoterpenes (e.g. limonene and *cis*-ocimene) and oxygenated monoterpenes (e.g. dihydrotagetone, *trans*- and *cis*-tagetone, *trans*- and *cis*-tagetenone). Besides being used widely in food production like beverage productions, the essential oils in *Tagetes minuta* have been commonly used as raw materials for perfume production in Argentina (Vozquez *et al.*, 2011). Among the secondary metabolites known include dihydrotagetone, α-phellandrene, limonene, o-cymene, as well as the isomers of β-ocimene, tagetone, and tagetenone (Wanjala and Wanzala, 2016). The abundance of terpenes in *T. minuta* is an important feature supporting the use of the plant in pharmaceutical and nutraceutical industry. Terpenoids are well-known for their striking antioxidant properties (Gonzalez-Burgos and Gomez-Serranillos, 2012) [17]. Thus *T. minuta* can be a good source of antioxidants for cosmetic and other industrial formulations. Low income countries like Tanzania are afflicted with high malnutrition rates. Food supplementation with extracts from *T. minuta* could be one of the nutraceutical approaches to remedy malnutrition. In addition, the essential oils from *T. minuta* can provide an important source for local food and drink supplementary ingredients with nutraceutical value. Moreover, the biologically active compounds can be further studied in Tanzania to find their potential in pharmaceutical formulations such as the development of terpenoid drugs for treatment of oxidative stress in chronic disease including liver disease, cancer, diabetes mellitus, cardiovascular and neurodegenerative disease.

Ocimum basilicum

Ocimum basilicum (Lamiaceae) commonly known as sweet basil is among the plants that in history are recognized for their aroma, making them potent flavoring agents in food (Jain and Jain, 1972; Marotti *et al.*, 1996; Labra *et al.*, 2004) [24, 40, 34]. *Ocimum* is among the largest genera in the family Lamiacea, comprising up to 150 species with varied distributions worldwide (Evans *et al.*, 1996). Among others, the genus *Ocimum* includes *Ocimum americanum*, *Ocimum gratissimum*, *Ocimum kilmandsclaricum*, *Ocimum cannum* and *Ocimum sanctum*, in addition to *Ocimum basilicum* (Jain and Jain, 1972) [24]. The most common Tanzanian vernacular name in is malumba (Swahli/Sukuma). Table 3 gives a short list of vernacular names pertaining to *Ocimum basilicum.*

Table 3: Vernacular names for *O. basilicum* on the basis on locality/tribe according to Prelude Medicinal Plants Database

Tribe/Region	Name
Kimbundu	njilika
Kimmbundu	nxilika
Poruguese	mangericao
Chagga	mshongoo
Katoro/Kagera	nzitoima, omuki
Kiswahili	Kinuka, kivumbasi

Phytogeographical information

Ocimum basilicum (*O. basilicum*) is native to tropical Asia, likely to have originated in India (Khan *et al.*, 2012) is currently estimated to be distributed worldwide (Marotti *et al.*, 1996; Tixier and De Bon, 2006; Mahajan *et al.*, 2012) [40]. It is an annual plant, usually propagated through seeds. It is widely distributed in tropical areas and can be easily found at an altitude of 1800 meters in Himalayan region (Sajjadi, 2006) [56].

Description

Ocimum basilicum is an aromatic, annual herb, usually ranging from 0.3-0.5 metres tall, although some cultivars may reach up to 1 m (Razavi *et al.*, 2009; Aghaei *et al.*, 2012) [54, 1]. The plant is almost hairless. Some cultivars, such as the Dark Opal', have leaves and stems deep purple in color. The leaves are ovate, often puckered, flowers white or pink, and fruits have four small nutlets, which are mucilaginous when wet (Labra *et al.*, 2004; Razavi *et al.*, 2009) [34, 54].

Fig 2: Morphology of *O. basilicum* (Source: Royal Botanical Gardens, Online)

Ethnobotanical information

Ocimum basilicum is primarily used in food flavoring and as a medicinal plant (Tilebeni, 2011; Prakash and Gupta, 2005; Dolatkhah *et al.*, 2014) [62, 52]. Leaves of *O. basilicum* are used as spices in traditional cuisine as for example components of salad (Lee *et al.*, 2005; Kaya *et al.*, 2008) [36, 30]. In some other parts, both leaves and flowers have been traditionally used as agents of decoction in which fresh or dried parts are dissolved and processed (Lee *et al.*, 2005; Dambolena *et al.*, 2010; Chiang *et al.*, 2012) [36, 9]. Essential oils have been extracted and utilized as food additives and approved by FDAs (Dambolena *et al.*, 2010) [9]. More importantly, roots, leaves and flowers have been used in the history as medicinal parts (Dambolena *et al.*, 2010; Tilebeni, 2011; Chiang *et al.*, 2012) [62, 9]. A variety of health problems have been treated using either some parts or the whole plant (Juad *et al.*, 2001). Such diseases include renal disease, diabetes mellitus, various fevers, headaches, stomach disease, colds and mouth wounds (Prakash and Gupta, 2005; Dolatkhah *et al.*, 2014) [52]. Other uses include sedative, carminative, treatment of delayed menstruation, heart disease and mosquito bites (Keita *et al.*, 2001; Jiofack *et al.*, 2010; Deabes *et al.*, 2015) [26, 10]. In addition, the plant is used traditionally to treat various infections including viral, bacterial and fungal infections (Kaya *et al.*, 2008; Deabes *et al.*, 2015) [30, 10].

Bioactivity and phytochemical properties

Various preclinical studies on Oc*imum basilicum* have been done and revealed a wide range of biological activities *in vitro* and *in vivo*. These include hypoglycemic, antidiabetic, hypolipidemic, antiulcer, antioxidant, anticancer (Marwat *et al.*, 2011) [41] and cardioprotective (Fathiazad *et al.*, 2012) [14]. These pharmacological attributes have attractive implication in the development of drugs against a broad spectrum of non communicable diseases such as diabetes mellitus and cancer. Most phytochemical research on *O. basilicum* has emphasized on the role of essential oils in its multiple utilities as part of the phytochemistry and characteristic aromatic phytochemistry (Keita *et al.*, 2001; Javanmardi *et al.*, 2002; Lee *et al.*, 2005; Oliveira *et al.*, 2009; Aghaei *et al.*, 2012) [1, 36, 25]. Screening studies have revealed prevalence of various forms of terpenoid, flavonoids and phenolic compounds (Aghaei *et al.*, 2012; Fathiazad *et al.*, 2012) [1, 14]. Rosmarinic acid is one of the richest compounds in *O. basilicum* leaves and has been highly associated to the cardioprotective activity of the plant ethanolic extracts in Wistar rats (Fathiazad *et al.*, 2012) [14]. Oliveira *et al.* (2009) reported plausible neuropharmacological effects of *O. basilicum* essential oils in which the extract demonstrated depressant and anticonsulsant properties in Wistar rat's central nervous system (CNS). These findings were linked to seven compounds among which 1, 8-cineole, linalool, and geraniol were the most abundant. This interesting bioactivity is a strong line of evidence that *O. basilicum* is a good candidate for neurotherapeutic drug leads.

Research also reveals that *O. basilicum* has therapeutic potential against infectious diseases. Various extracts from *O. basilicum* have shown efficacy against mosquito larvae, bacteria, fungi as well as some viruses (Chiang *et al.*, 2005; Zhang *et al.*, 2009; Dambolena *et al.*, 2010; Runyoro *et al.*, 2010) [7, 9]. In a study by Chiang *et al.* (2005) [7], phytochemical screening from aqueous and ethanolic leaf extracts revealed a number of compounds namely carvone, cineole, caryophyllene, farnesol, fenchone, geraniol, myrcene, thujone, apigenin, linalool and ursolic acid. The latter three demonstrated a broad spectrum of antiviral activity against various viral strains as shown in Table 4. Ursolic acid has been reported from many sources to be potent antiviral, antioxidant and antitumor compound (Chiang *et al.*, 2005) [7].

Table 4: Antiviral activities of selected *O. basilicum* compounds

Compound name	Compound class	Target virus	Half maximal effective concentration (EC_{50})	Selectivity index (SI)
Ursolic acid	Triterpenoid	HSV-1	6.6 mg/L	15.2
		ADV-8	4.2 mg/L	23.8
		CVB-1	0.4 mg/L	251.3
		EV71	0.5 mg/L	201
Epigenin	Flavonoid	HSV-2	9.7 mg/L	6.2
		ADV-3	11.1 mg/L	5.4
		Hepatitis B surface antigen	7.1 mg/L	2.3
		Hepatitis B e antigen	12.8 mg/L	1.3
Linalool	Monoterpenoid	ADV-11	16.9 mg/L	10.5

The ability of the ursolic acid to inhibit viral replication at selectivity indices above 200 accounts for its suitability as a drug lead for further studies.

To date, symbiotic association between plants and microorganisms such as bacteria and fungi is increasing attention on the role of endosymbiotic microorganisms in the biosynthesis of secondary metabolites of health importance. Interestingly, a recent study has demonstrated that *O. basilicum* contains taxol-producing endophytic fungi (Michalczyk *et al.*, 2014) [46]. This encounter turns the plant species into another source of taxol (paclitaxel), a potent anticancer drug known for its effectiveness against breast, uterine, cervical and lung cancers, among others. The wide range by which *O. basilicum* exhibits health benefits may account for its being a good source of pharmaceutically valuable drugs for both infectious and non infectious diseases. Additionally, the antifungal, sedative and uteronic and cytotoxic effects of the extracts are interesting findings that call for bioprospecting of antiinflammatory and anticancer compounds and attempting further steps to clinical trials.

Clutia abyssinica

The genus *Clutia* (family Euphobiaceae) native to sub-Saharan Africa and comprises up to 60 species (Mergia *et al.*, 2014) [45]. *Clutia abyssinica* is widely distributed across East and Central Africa and has been used by natives in various settings.

Phytogeographical information

Clutia abyssinica (*C. abyssinica*) is an erect woody herb ranging from 1-4 m tall native to sub-Saharan regions including Southern, Western and Eastern African regions. *Clutia abyssinica* inhabits dry forests, hillside wooded grassland, lakesides and riverine and evergreen thickets at an elevation altitude range between 300-700 m (Matu, 2008) [42]. Morphologically, *C. abyssinica* is a shrub of up to 4 m height, with elliptic lanceolate, light green, blue or orange leaves. The stem bears axillary clusters of unisexual yellowish to greenish flowers and hairless pale green roundish fruits (up to 5 mm diameter) with and whitish pustules (Hyde *et al.*, 2017) [21].

Ethnobotanical information

Clutia abyssinica also known as *Clutia glabrescens* Knauf ex Pax, is in English, known as large or mooth-fruited lightning-bush plant (Hyde *et al.*, 2017) [21]. Table 5 shows a list of local names applied to *C. abyssinica.* The plant species is commonly used by various indigenous people to treat many diseases. Among the commonly reported diseases malaria, trypanosomiasis, skin diseases, fungal infections, diarrhea (*de* Boer *et al.*, 2005; Murungi, 2013; Mergia *et al*, 2014) [45, 11, 49].

Table 5: Local names applied to *Clutia abyssinica* among different tribes in East Africa.

Name	Tribe/Community	Reference
Engodo	Maasai	Vesa *et al.*, 2010
Kigwapa	Hehe	Walsh and Moyer, 2002
Lupumo	Hehe	Walsh and Moyer, 2002
Mhende	Sambaa	Vesa *et al.*, 2010
Msakasua	Sambaa	Vesa *et al.*, 2010
Mvuruku	Pare	Vesa *et al.*, 2010
Omubarama	Baganda	Stangeland *et al.*, 2011

In Tanzania, *C. abyssinica* is also applied by Pare and Sambaa tribes in treating headache, fungal skin infections, while the wood is ground to make a powder and smoked to relief menstrual pains. In addition, the Sambaa apply the leaf and root parts in healing malaria. Furthermore, in both Tanzania and Uganda, the crude materials (roots and leaves boiled in water) are applied for killing round worms, for kidney cleansing and against headache (de Boer *et al.*, 2005) [11]. Through our personal communication with indigenous people along Magamba Hills in Lushoto District, Tanga Region Tanzania we were informed that in addition to the aforementioned uses in Tanzania, *C. abyssinica* leaf juices are used in remedying alopecia. This is one of the most interesting traditional uses encountered in many ethnobotanical studies, and it draws attention to investigate bioactivity of the plant against alopecia. In Kenya and Rwanda leaf crude extracts are consumed with food to treat liver problems, whereas in Congo, the plant is used to treat fever, cough, gonorrhea, elephantiasis, and to relief anxiety and bring about euphoria in pregnant women (Matu, 2008) [42].

Bioactivity and phytochemistry of *Clutia abyssinica*

Clutia abyssinica has demonstrated antimicrobial activity, with efficacy against bacterial, fungal and trypanosomatid

pathogens (de Boer, *et al.*, 2005) [11]. Several studies *in vivo* and *in vitro* have been done on the plant in effort to explore its utility. As tested against *Trypanosoma congolense* in albino mice, methanolic extracts of leaves from *C. abyssinica* demonstrated a very high trypanosuppresive effect against the parasite at a dose of 400 mg/kg and elevated packed cell volume by 1.12% and body weight by 1.36%, with impression of lowering the parasitic load (Mergia *et al.*,2014) [45]. The latter conducted phytochemical screening and revealed the presence of various classes of natural products including alkaloids, flavonoids, anthraquinones, glycosides, steroids, saponins terpens as well as tannins. The presence of alkaloids may account for the antimalarial and antitrypanosomal activities of *Clutia abyssinica*. However, studies are required to elucidate the phytochemical link between *C. abyssinica* and its antiparasitic activities. In a recent study by Koesch *et al.* (2017), dichloromethanolic root extracts from *C. abyssinica* have portrayed analgesic effect in Swiss albino rats. These findings concurred with the traditional use of the plant species in many local communities as an analgesic agent. This desirable property may be attributed to the presence of steroids and alkaloids, among others. Studies to elucidate the molecular basis of antiinflammatory activities of various *C. abyssinica* extracts are highly required. In general, besides the richness of information regarding the ethnobotanical uses of *C. abyssinica*, scant scientific knowledge is available to support these putative qualities. Both, crude extracts and purified compounds are required to account for the pharmacological and therapeutic properties of *C. abyssinica*.

Xylotheca tettensis

Xylotheca is a genus in the family Flacourtiaceae, which comprises more than 90 genera and about 1000 species (Chase *et al.*, 2002) [6]. Recent classification has placed the genus *Xylotheca* in the family *Achariaceae* (GBIF 2016). The genus *Xylotheca* includes *Xylotheca kraussiana* and *Xylotheca tettensis*, among others. Other names for *Xylotheca tettensis* include *Oncoba tettensis* and *Chlanis tettensis*. While considerable botanical, ethnobotanical and ethnopharmacological information is available on the closely related species *Xylotheca kraussiana* (Mahlo *et al.*, 2013) [39], there is limited amount of information about *Xylotheca tettensis*, its use by natives as well as its prospects. Taking into account their close relationships, this short paper presents the available ethnobotanical information and other relevant data for the sake of drawing attention on the utility of the plant species in question.

Phytogeographical information

Xylotheca tettensis (*X. tettensis*) is distributed along East Tropical Africa across Tanzania, Kenya Mozambique and Zimbabwe. For several decades, in Tanzania, the plant has been known to occupy small areas of Bagamoyo and Pugu Hills in Dar es Salaam (Lovett and Clarke, 1998). Recently, Ruffo *et al.* (2002) [55] described four varieties found in various parts of Tanzania as follows:

a) var. *fissistyla*: which is only found in Bagamoyo
b) var. *kirkii*: found in Tanga, Pwani, Morogoro and Lindi Regions and on Zanzibar
c) var. *macrophylla:* found in Pwani and Lindi Regions;
d) var. *tettensis*: found in Arusha, Morogoro, Pwani and Lindi Regions

Our field survey in Dar es Salaam revealed the plant in Changanyikeni (6°46′24″S; 39°11′15″E) near University of Dar es Salaam Main Campus. *X. tettensis* is a wild deciduous shrub ranging from 1-5m tall inhabiting lowland woodland, bushland, secondary bushland, at elevations to 600 meters above sea level (Ruffo *et al.*, 2002) [55]. A summary of biological description is given in Table 6 and images showing *in situ* morphological features are shown in Fig 3 taken during our survey.

Table 6: Description of *Xylotheca tettensis*

Basic attribute	Description
Botanical name	*Xylotheca tettensis*
Vernacular name	Mchekacheka (Swahili), Mripuripu (Swahili),
Locality	Changanyikeni, University of Dar es Salaam
Altitude	600m
Habitat	Disturbed bushy areas
Description	Branches and branchlets densely long-hairy. Mature leaf-blades (5–)7–9(–11) cm. long, 4–6(–7.5) cm. broad, ± densely pubescent; lateral nerves 6–8 pairs. Fruit usually smooth.
Collector	F. Mbago

A B

Fig 3: Images of *X. tettensis* morphological features; A: A whole plant; B: Aerial parts showing leaves and fruit morphology

Ethnobotanical data

Xylotheca tettensis has long history in the East African tradition over to be used in herbal medicine and sorcery since back in 1970s (Weiss, 1979). Various morphological parts serve different purposes such as source of medicine, wood and ornament (Ruffo *et al.*, 2002) [55]. When ripen, fruit pulps possess sweet flavor and thus are edible (Ruffo *et al.*, 2002) [55]. While fruits are edible, roots of the *X. tettensis* have been used as source of aphrodisiac agents among Coastal Tanzanian societies (Greenway *et al.*, 1988). The roots are chewed and the juice is swallowed, discarding the rest (Ruffo *et al.*, 2002) [55]. Table 7 clearly summarizes the ethnobotanical relevance of each morphological part of the plant species.

Table 7: Summarized ethnobotanical applications of different morphological parts of *X. tettensis*

Ethnobotanical application	Morphological part and processing
Medicine : Aphrodisiac	Roots boiled or chewed
Food	Fruits, ripen, pulps
Other uses: Fuel	Stem wood

As aforementioned, information regarding the bioactivity and phytochemistry of *X. tettensis* is scant in spite of the available ethnobotanical information. More research is required to document its use among the local people. Nevertheless, with the contemporary need for drug discovery, the available information about *X. tettensis* and its intimate species is sufficient to trigger bioprospecting undertakings leading to the biological activities of crude extracts as well as elucidation of the underlying phytochemical properties. The aphrodisiac use of the is an interesting use which arouses interest in the pursuit of prostaglandin and phosphodiesterase inhibitors, among many other compounds with health benefits beyond aphorodisia.

Uvariodendron gorgonis

Uvariodendron is a genus in the family Annonaceae, which comprises about 17 genera (Ogeto *et al.*, 2014) [51]. *Uvariodendron* constitutes the largest genus in the family Annonaceae, which includes *Uvariodendron kirki*, *Uvariodendron senso stricto*, *Uvariodendron occidentale*, *Uvariodendron giganteum* and *Uvariodendron gorgonis* (*U. gorgonis*), among others (Gereau *et al.*, 2016; Gottsbergera *et al.*, 2010) [16]. *U. gorgonis*, also known as Mkenene in Sambaa (Lovett *et al.*, 2006) [37] is a native of Kenya and Tanzania and is among the endangered species (Ogeto *et al.*, 2014) [51]. There is limited information from studies on *U. gorgonis*. The available ethnobotanucal and bioprospecting information is more elaborate on the relative species than on *U. gorgonis.* This report presents the ethnobotanical and other relevant information to enrich the literature and enhance the basis for phytochemical pharmacological studies on the plant species in question.

Phytogeographical description

Uvariodendron gorgonis grows in lowland rain forest (usually on limestone outcrops), on igneous intrusion with moist semi-deciduous forest (Doody and Hamerlynck, 2003). In Tanzania, Doody and Hamerlynck (2003) identified *U. gorgonis* in the Rufiji forest. The Eastern Arc Mountains & Coastal Forests CEPF Plant Assessment Project (2009) reported the abundance and distribution of the plant species to be limited and therefore categorized as among the endangered species. The plant species spans across the East Usambara, Nguru and Uluguru Mountains, and in Pugu Forest where only two plants were found upon extensive survey and identification by Mr Mbago, a botanist at University of Dar es Salaam. *U. gorgonis* grows selectively in high moisture soils and therefore is sensitive to dry conditions (Gereau *et al.*, 2016) [16]. Some important morphological features are given in Table 8 according to the description by Lovett *et al.* (2006) [37].

Table 8: Summarized morphological description of *Uvariodendron gorgonis*

Morphological parts	Characteristic features
Height	~12m
Bark	Dark brown/black/grey. Flaking/smooth.
Branchlets	Grey/brown, at first covered with silky silvery or ferruginous adpressed hairs but later glabrous
Leaves	Simple. Alternate. Lemon scented. Petiole: 0.5 - 1.2 cm. Lamina: Medium/large. 8 - 41 × 3 - 12 cm. Elliptic/oblong. Cuneate. Rounded. Obtuse/acuminate. Entire. Glabrous/hairy beneath.
Fruits	Greenish, cylindrical, cauliflorous monocarps, 50 - 60. 4 - 8 × 1 cm.

Ethnobotanical profile

Ethnobotanical information of *U. gorgonis* is scant. However, different parts of several closely related species are traditionally used to treat fevers, stomach-ache, gun-stock, and the wood as the source of fuel in many parts of Africa (Bele *et al.*, 2011) [4]. In central Tanzania, *U. gorgonis* is used in ethno-medicine and/or protection against insects in other parts of Africa (Innocent *et al.*, 2015) [23]. In Kenya, the plant is used by traditional maternal attendants to induce uterine contraction during labor (Ogeto *et al.*, 2012). Studies are now underway to

elucidate the bioactivity of crude extracts and characterize the phytochemistry of *U. gorgonis* (Parmena *et al.*, 2012; Ogeto *et al.*, 2014; Innocent and Hassanali*;* 2015) [23, 51, 53].

Bioactivity and phytochemical properties of *Uvariodendron gorgonis*

As pointed out earlier, *U. gorgonis* is scantly reported in terms of biological activities and phytochemical properties. Considerable information is available on the bioactivity and phytochemical aspects of other closely related species. A study by Menkem *et al.* (2012) [44], ethanolic extracts from *Uvariodendron calophyllum* and *Uvariodendron molundense* were found to possess antioxidant and antifungal activity against *Candida and Aspergillus spp.*, and phytochemical assays found the presence of glycosides, tannins and phenols. Recently, Emmel and micro-dilution methods on stem bark and leaf extracts of *Uvariodendron molundense*, have revealed efficacy against sickle cell anemia and bacterial pathogens in Congo (Ashande *et al.*, 2017) [2]. These effects were associated to the presence of phenolics, flavonoids, tannins as well as anthocyanins. However, with the limited information existing on *U. gorgonis*, phytochemical studies from several *Uvariodendron* species including *U. gorgonis* have reported abundance of essential oils mainly comprising linalool methyl eugenol, *trans*-methyl isoeugenol, elemicin, and 2-butylnaphthalene from leaves and backs, which have been linked to antimicrobial actitivities (Parmena *et al.*, 2012) [53]. Kihampa *et al.* (2009) [31] demonstrated larvicidal activity of *U. pycnophyllum* and *U. usambaranse* on *Anopheles gambianse* and attributed this effect to benzyl dihydrochalcones and flavanones metabolites.

Uvariodendron gorgonis is as among the less studied plant species. Despite the fascinating ethnobotanical application such as its uteronic application, little is known and thus, more research is indispensable to establish its pharmacological properties. The traditional utility of the *U. gorgonis* and the close species presents a compelling justification for bioprospecting for antimicrobial, anti-inflammatory and anticancer compounds from *U. gorgonis*.

Conclusion

The plant species discussed in this paper are commonly found in various parts of Tanzania and East Africa. Their ethnobotanical uses, phytochemical profile and biological activities have sufficed their health importance. However, most of the reviewed plant species in this paper lack extensive scientific support regarding their biological activities. In addition, the available literature expresses a gap on the link phytochemical properties and pharmacological activities. Studies are needed to expand the knowledge on the biological activity in vivo and characterize relevant biologically active compounds. Some compounds from *Ocimum basilicum* may be considered for further stages towards formulations for clinical trials. Furthermore, studies are highly needed to elucidate the molecular mechanisms of actions of the already characterized compounds.

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