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Phyto-Chemical Screening and Ethno-Botanical Properties of Selected Plants of the Obafemi Awolowo University, Ile-Ife, Nigeria

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Abstract

Aim: Reported cases of arthritis and typhoid fever have been on the increase in Nigeria, West Africa. This has led us into the ethno-botanical and phyto-chemical studies of some plants used in the treatment of these diseases in Nigerian traditional practice.

Materials and Methods: Twenty plants were screened for the phytochemical compounds tannins, saponins, alkaloids, flavonoids and carotenoids using standard biochemical methods. The habits of the test plants were 90% trees, 50% herbs, 40% shrubs and 20% climbers. The plant parts used were 100% leaves.

Results: All the tested plants contained high levels of varied concentrations of saponins, alkaloids and flavonoids compared to their levels of tannins and carotenoids.

Conclusion: Further studies on these secondary metabolites should shed more light into the Nigerian trado-medical claim of these plant parts. This study will be of significance and value in therapeutics and drug development.

Keywords: Plants; Phyto-chemicals; Ethnomedicines; Typhoid fever; Arthritis

Introdution

Plants have been indispensable sources of both preventive and curative medical preparations in centuries [1,2]. According to the World Health Organization (WHO), estimates of up 80% of the world's population, mostly in the developing countries have adapted trado-medicinal curative practices in health needs [3]. With a value in therapeutics, plant part preparations are used in China, France and Germany as herbal remedies with less stringent side effects as assumed in the medical world [2]. Plants have been recorded as containing phtochemicals which act as antioxidants, interfere with hormonal actions, stimulate body enzymes, interfere with DNA replication, inhibit bacterial function (bacteriocidal or bacteriostatic) [4]. In the present investigation, certain plants in Nigeria, West Africa used in trado-medical treatment of typhoid fever and arthritis were screened for phyto-chemical properties with a view to justifying their application in Nigerian traditional curatives and the possibility of the development of drugs of herbal sources for human health.

Materials and Methods

Collection of plants

Plants used in traditional practice for the treatment of arthritis and typhoid fever: *Morinda lucida*, *Cymbopogon citratues*, *Citrus aurantifolia*, *Citrus paradisi*, *Blighia Sapida* were obtained along the Polytechnic Road, University of Ibadan, Ibadan, Nigeria. *Spondias mombin*, *Azadirachta indica*, *Khaya grandfoliola*, *Momordica charantia* and *Alstonia boonei* were gotten from the Department of Forest Resource Management, University of Ibadan, Nigeria. *Musa paradisiaca*, *Phyllantus amarus*, *Carica papaya*, *Psidium guajava*, *Solenostemon monostachyus*, *Terminalia catappa*, *Ocimum gratissimum*, *Boerhavia diffusa*, *Parquetina nigrescens* were collected within the premises of Mozambique Hall, Obafemi Awolowo University, Ile-Ife, Nigeria.

Plant identification

All plant samples were identified at the species level by Professor Bukola Adedeji at the Department of Botany, Obafemi Awolowo University, Ile-Ife, Nigeria.

Preparation of plant materials

The plant parts were washed thoroughly, cut into small parts and air-dried. They were then milled into coarse powder. The powdered samples were stored in glass containers at room temperature (28 °C).

Phyto chemical screening

The qualitative and quantitative screening of powdered plant samples were carried out at Kappa Biotechnology Laboratories (Research Support R & D Analytical Services), Trans Amusement Park, Old Airport Road, Bodija, Ibadan, Nigeria using standard methods [5-7].

Results

Table 1: Profile of plants used for the treatment of arthritis.

Botanical Name	Common Name	Family Name	Part Used	Habit
Alstonia boonei De Wild	Stool wood	Apocynaceae	Leaf	Tree
Phyllanthus amarus Schum. & Thonn.	Stone plant	Euphorbiaceae	Leaf	Herb
Solenostemon monostchyus (Palisot de Beauvois) Briquet	Monkey's Potato	Lamiaceae	Leaf	Herb
Boerhavia diffusa Linn.	Pig weed	Nictaginaceae	Leaf	Herb
Parquetina nigrescens (Afzel.) Bullock		Asclepiadaceae	Leaf	Climber
Carica papaya Linn.	Pawpaw	Caricaceae	Leaf	Shrub
Spondias mombin Linn.	Hog plum	Anacardiaceae	Leaf	Shrub
Morinda lucida (Benth.)	Brimstone tree	Rubiaceae	Leaf	Tree
Khaya grandifoliola (Welw) CDC	Mahogany	Maliaceae	Leaf	Tree
Blighia sapida (koenig)	Akee	Sapindaceae	Leaf	Tree

Table 2: Profile of plants used for the treatment of typhoid fever.

Botanical Name	Common Name	Family Name	Part Used	Habit
Psidium guajava Linn.	Guava	Myrtaceae	Leaf	Tree
Terminalia catappa Linn.	Almond	Combretaceae	Leaf	Tree
Citrus aurantifolia Swing.	Key lime	Rutaceae	Leaf	Tree
Cymbopogon citratus (DC.) Stapf	Lemon grass	Poaceae	Leaf	Herb
Azadirachta indica A. Juss	Neem tree	Meliaceae	Leaf	Tree
Musa paradisiaca Linn.	Banana	Musaceae	Leaf	Shrub
Citrus paradisi Linn.	Grape fruit	Rutaceae	Leaf	Tree
Momordica charantia Linn.	Bitter lemon	Cucurbitaceae	Leaf	Climbers
Ocimum gratissimum Linn.	African basil	Lamiaceae	Leaf	Herb
Carica papaya Linn.	Pawpaw	Caricaceae	Leaf	Shrub

The profile of plants in this investigation revealed that the samples were from the families Euphorbiaceae, Laminaceae, Nictaginaceae, Asclepiadaceae, Caricaceae, Anacardiaceae, Rubiaceae, Maliaceae, Apocynaceae, Sapindaceae, Myrtaceae, Combretaceae, Rutaceae, Poaceae, Musaceae, Cucurbitaceae. The test plants were 90% trees, 50% shrubs, 40% herbs, 20% climbers having leaves as the only used plant part in the study (Table 1 & 2). Among the plants used for the treatment of arthritis and typhoid fever, *Carica papaya* appeared for both treatments. From the results of Table 3, there seems to be an order, very high amount of alkaloids and flavonoids, moderate amount of saponins but little amount of tannins and carotenoids in the tested plant extracts. The qualitative analysis was derived from the quantitative analysis and rated according to the highest and lowest figures present in the column Table 4. As observed in Table 5, the amount of saponins, alkaloids and flavonoids in the tested plant extracts were high contrary to their very low amounts of tannins and carotenoids. These tested plants used in the treatment of typhoid fever seem to contain relatively high amounts of saponins, alkaloids and flavonoids. Table 6 represents the qualitative phyto-chemical analyses of some plant extracts used in the treatment of typhoid fever in the African-Nigerian locality. Saponin is absent in *Citrus sinensis* as the only absence recorded in all the samples tested.

Table 3: Bioactive compounds in plants and their average amount used in the treatment of arthritis.

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Spondias mombin	45.5	650	2350	1550	137
Alstonia boonei	94	1200	3340	2190	67
Blighia sapida	58	950	965	860	34
Phyllantus amarus	96	620	1870	1140	185
Solenostemon monostachyus	76	865	3450	1150	95
Khaya grandifoliola	64	560	680	1590	45

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Boerhavia diffusa	72	760	1740	2140	171
Parquetina nigrescens	53	90	890	1165	86
Morinda lucida	166	350	3520	860	55
Carica papaya	138	1075	2460	650	245

Table 4: Qualitative phyto-chemical analysis of plants used in the treatment of arthritis.

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Spondias mombin	+	++	+++	++++	+++
Alstonia boonei	++	+++	++++	++++	++
Blighia sapida	++	++	++	++	+
Phyllantus amarus	++	++	+++	+++	++++
Solenostemon monostachyus	++	++	++++	+++	++
Khaya grandifoliolia	++	++	++	++++	+
Boerhavia diffusa	++	++	+++	++++	++++
Parquetina nigrescens	++	+	++	+++	++
Morinda lucida	++++	+	++++	++	++
Carica papaya	+++	+++	+++	++	++++

KEY: ++++Very High +++High ++Moderate +Low

Table 5: Phyto-chemical contents in plants used for the treatment of typhoid fever.

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Musa paradisiaca	22	1865	780	2355	150
Azadirachta indica	165	1340	3600	1870	28
Momordica charantia	142	2750	2950	1520	235
Citrus sinensis	83	1350	760	980	74
Citrus aurantifolia	90	750	1475	680	162
Citrus paradisi	125	980	450	880	78
Terminalia catappa	68	1945	2360	450	36
Ocimum gratissimum	186	1350	2110	2115	196.5
Cymbopogon citrates	175	345	1650	2255	232
Psidium guajava	25	450	2150	1350	116

Table 6: Qualitative analysis of plant extracts used in the treatment of typhoid fever.

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Musa parasidiaca	+	++++	++	++++	+++
Azadirachta indica	++++	+++	++++	++++	+
Momordica charantia	+++	++++	++++	++++	++++
Citrus sinensis	++	-	++	++	++
Citrus aurantifolia	++	++	++	++	+++
Citrus paradisi	+++	++	+	++	++
Terminalia catappa	++	++++	+++	+	+
Ocimum gratissimum	++++	+++	+++	++++	++++
Cymbopogon citrates	++++	+	+++	++++	++++
Psidium guajava	+	+	+++	+++	+++

KEY: ++++Very High +++High ++Moderate +Low

Discussion

Plant screened contained phytochemical compounds in varied concentration. Most of the tested samples contained high amounts of saponin, alkaloids and flavonoids but moderate amounts of tannins and carotenoids. Researches have shown that over 90% of most isolated chemical constituents of plants are alkaloids [8].

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Alstonia boonei have been used topically to reduce swellings and in treating rheumatic fever, muscular pain and hypertension [9]. In other findings, the anti-inflammatory properties of the alcohol extract of *Alstonia boonei* have been applied in herbal treatment of muscular pain and rheumatic fever [10]. *Carica papaya* occurrence in the two-treatment list for arthritis and typhoid diseases is suggestive of its versatility. Ming *et al.* [11] stated that pawpaw is an exceptionally promising system for the exploration of tropical-tree genomes and fruit-tree genomics. He reported further in the draft genome sequence of 'SunUp' papaya, as the first commercial virus-resistant transgenic fruit tree to be sequenced. In this investigation, carotenoids seem low in *Azadiractha in dica.* This finding tally with those described by Evans and Trease [12] and by Unnikannan *et al.* [13] who studied the effects of chromium on certain tree species. These secondary metabolites observed in *A. indica* could be responsible for its antimicrobial activities on *S. aureus*, *E. coli* and S. typhi characterizing the specific active constituent responsible for its therapeutic value. Alkaloids are known for their anti-inflammatory effects. Flavonoids which are naturally occurring phenolic compounds with anti-oxidative properties have earlier been described in *Carica papaya* and *Parquetina nigrescens* [14].

Phytochemicals exert antimicrobial activities through different mechanisms. For instance, tannins act by iron deprivation, hydrogen binding or specific interactions with vital proteins such as enzymes found in microbial cells [15,16]. Tannins have also been reported to induce anti-plasmodial activities [17,18]. Akinjogunla *et al.* [19] reported the efficacy of extracts of *Ocimum gratissimum* on *Escherichia coli. Terminalia catappa* had been earlier been observed to contain high amount of saponins in comparison with all other secondary metabolites. Saponins are major natural anti-oxidants with anti-carcinogenic properties. They have reducing power capabilities and are recognized as inhibitors of peroxidation [20]. Conclusively, the phytochemical compounds found in these plant samples may play significant roles in the treatment of arthritis and typhoid fever evidenced from existing literature and findings on these compounds. Their extraction and purification should be of value to drug development and therapeutics.

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