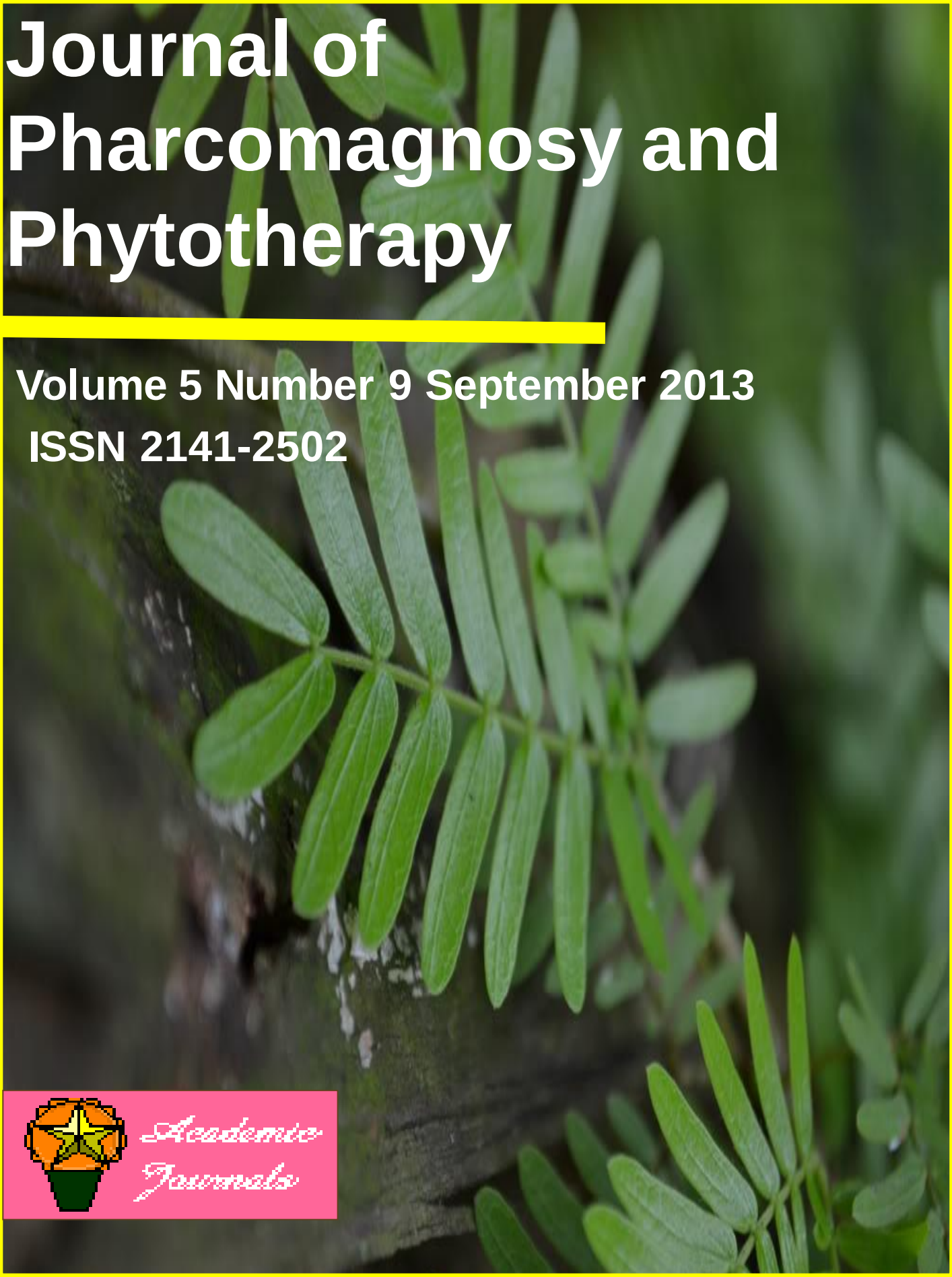

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Charnley AK (1992). Mechanisms of fungal pathogenesis in insects with particular reference to locusts. In: Lomer CJ, Prior C (eds), Pharmaceutical Controls of Locusts and Grasshoppers: Proceedings of an international workshop held at Cotonou, Benin. Oxford: CAB International. pp 181-190.

Jake OO (2002). Pharmaceutical Interactions between *Striga hermonthica* (Del.) Benth. and fluorescent rhizosphere bacteria Of *Zea mays*, L. and *Sorghum bicolor* L. Moench for Striga suicidal germination In *Vigna unguiculata*. PhD dissertation, Tehran University, Iran.

Furmaga EM (1993). Pharmacist management of a hyperlipidemia clinic. Am. J. Hosp. Pharm. 50: 91-95

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Research Articles

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Journal of Pharmacognosy and Phytotherapy

Full Length Research Paper

Evaluation of anti-acne activity of hydroalcoholic extract of *Punica granatum* Linn.

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Accepted 29 July, 2013

Nature always stands as a golden mark to exemplify the outstanding phenomena of symbiosis. Acne vulgaris is an extremely common disorder affecting many adolescents and adults throughout their lifetimes. The pathogenesis of acne is multifactorial and is thought to involve excess sebum, follicular hyperkeratinization, bacterial colonization, and inflammation. Pomegranate, *Punica granatum* Linn. (Punicaceae) is an ancient, mystical, unique fruit used in several systems of medicine for a variety of ailments. The synergistic action of the pomegranate constituents appears to be superior to that of single constituents. The current research was focused on evaluation of anti-acne activity of *Punica* extract followed by its biological screening. The fingerprinting and spectroscopic analysis of the extract was determined. The attempt was made to investigate the extract of *P. granatum* for the said activity with the goal of elucidating the active potential compounds.

Key words: *Punica granatum*, broth dilution, cup plate method, high performance thin layer chromatography.

INTRODUCTION

Acne has plagued humankind since antiquity. Acne vulgaris is a highly variable disease attracting a crisp social rebuttal. Acne is the most common skin disease of adolescence and few teenagers escape the experience. The severity of acne varies considerably and in some individuals acne persists beyond the teens for reasons that are not yet clear. Acne usually begins at puberty when the output of sebum (grease) by tiny hair follicles on the face and upper trunk increases substantially. The sebum acts as a nutrient for a resident skin bacterium called *Propionibacterium acnes* (or more familiarly the acne bacillus), which grows abnormally in follicles whose pores are blocked (Kumar, 2005). The factors important in the development of acne are plugging of the hair follicle with abnormally cohesive desquamated cells, sebaceous gland hyperactivity, proliferation of bacteria (especially *P. acnes*) within sebum and inflammation. The changes in the hair follicle occur when the follicular canal becomes blocked with abnormally keratinized desquamating cells. This plug starts above the opening of the sebaceous gland into the follicular canal and causes gradual expansion of cells and sebum within the canal (Jain, 2007).

The pomegranate is an ancient, mystical, unique fruit used in several systems of medicine for a variety of ailments. The synergistic action of the pomegranate constituents appears to be superior to that of single constituents. The potential therapeutic properties of pomegranate are wide-ranging and include treatment and prevention of cancer, cardiovascular disease, diabetes, dental conditions, erectile dysfunction, and protection from ultraviolet (UV) radiation. This research indicates the most therapeutically beneficial pomegranate constituents are ellagic acid, ellagitannins (including punicalagins), punicic acid, flavonoids, anthocyanidins, anthocyanins, and estrogenic flavonols and flavones (Jurenka, 2008).

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It has a variety of uses such as blood purifier, in various skin diseases, immunomodulant, anti-inflammatory and anti-platelet-activating factor (PAF). The traditional claim on this plant for the fruit rind and bark reveals the anti-acne effect which can reduce the sebum production. That is why this research work is focused on carrying out anti-acne activity.

MATERIALS AND METHODS

Plant collection and extraction

The fresh fruit rinds of the plant *Punica granatum* Linn were collected from the local region of Pune. It was authenticated by Department of Botany, University of Pune (Voucher No. Bot /35/11). The powder of fruit rind prepared was extracted by maceration with hydroalcoholic mixture (60:40) for 72 h.

Histology

Histology was performed as to know the various microscopical aspects. The plant specimen of fruit rind were cut and fixed in formalin acetic acid (FAA) and then infiltration of specimen is carried out by paraffin wax (Sass, 1940). The specimens were sectioned with the help of microtome with thickness of 10 to 12 µm. The sections were stained with toluidine blue (O' Brien et al., 1964). Photographs of different magnifications were taken with Nikon Laboratory photo 2 microscopic units (Esau, 1964).

Preliminary phytochemical screening

The extract was then subjected to preliminary phytochemical screening to detect the presence of various phytoconstituents by various chemical tests (Mukherjee, 2002).

Anti-acne activity of the extract

The lyophilized cultures of bacteria *P. acne* (MTCC No. 1951) were procured from Indian Institute of Microbial Technology (IMTECH), Chandigarh. The dilutions of the extract were prepared and brain heart infusion broth was prepared. Tween 80 and 0.03 ml thioglycollic acid per 100 ml was added in the prepared broth as a reducing agent (Cunliffe, 1997). The 25 ml of the medium was poured in the ten test tubes followed by sterilization with autoclave at 15 lb pressure and 121°C for 30 min. Using sterile pipette exact amount of extract was added as indicated in the Table 1 and the final volumes were adjusted to 10 ml with medium followed by inoculation of cultures and incubation at 37°C for 48 h (Kumar, 2001). The growth in the tubes was monitored by turbidity method and minimum inhibitory concentration (MIC) of the extract was determined (Feldman, 2004; Fogdall, 1974). The extract was also subjected to anti-acne activity by cup plate diffusion method using clindamycin as internal standard and MIC was determined by zone of inhibition (Gemmell, 2007). Both analyses were performed thrice to confirm the efficacy of the result.

RESULTS

Pharmacognostic study

The quality control parameters were established and proximate analysis was found to be significant. Preliminary phytochemical screening revealed the presence of tannins and alkaloids.

Histology

The fruit or the pericarp is thick and fleshy and consist of less prominent epidermis or epicarp. Sclerides are distributed throughout in Mesocarp (Figures 1 and 2). Vascular strands have radial files of small xylem elements with phloem masses (Easu, 1964; Gambe, 1935).

Screening of extract for anti-acne activity

To screen the plant material for their anti-acne activity *in vitro* experiments were carried out by using the organism *P. acnes* (Rosso, 2004). The results as shown in Table 2 depict that the MIC values of hydroalcoholic extract of *P. granatum* was found to be 100 mg/ml (Leyden, 2001). The zone of inhibition was determined by cup plate diffusion method (Tables 1 and 2), where an increase in anti-acne activity was observed from zone of lysis emphasizing that the lysis may be due to the active components present in the extract of the plant (Kumar, 2001).

DISCUSSION

The results of the zone of inhibition for *P. granatum* are shown in Tables 1 and 2 (Kumar, 2001). The hydroalcoholic extract shows good anti-acne activity as compared to standard drug clindamycin. Thus the targets in the microbial cell could be surface exposed adhesion, cell wall peptides and membrane bound enzymes (Gnanamani, 2003).

Here tannins are the major phytoconstituent present in this plant which is responsible for anti-acne as in plant *Portulaca oleracea* containing the tannins possesses the said activity, also ethanolic extract of *Vernonia scorpioides* possess anti-acne action by improving regeneration due to the presence of tannins. Thus the experimental findings suggest the plant was found to be effective as to inhibit the effects caused by the *P. acnes.*

Conclusion

This study thus demonstrates the anti-acne activity of hydroalcoholic extract which may be effective in the treatment of acne vulgaris.

ACKNOWLEDGEMENTS

The authors are thankful to the Indian Institute of

Table 1. Protocol for evaluation of MIC by broth dilution method.

S/N	Amount of extract/ml	Amount of medium	Total volume of solution (ml)	Concentration of extract in final sol (ml)
1	0.1	9.9	10	0.1
2	0.2	9.8	10	0.2
3	0.3	9.7	10	0.3
4	0.4	9.6	10	0.4
5	0.5	9.5	10	0.5
6	0.6	9.4	10	0.6
7	0.7	9.3	10	0.7
8	0.8	9.2	10	0.8
9	0.9	9.1	10	0.9
10	1.0	9.0	10	1.0

Table 2. Zone of inhibition by cup plate method.

S/N	Amount of extract/ml	Zone of inhibition in mm for *Punica* extract (including borer size)
1	0.1	12
2	0.2	13
3	0.3	14

Diameter of standard borer 6 mm.

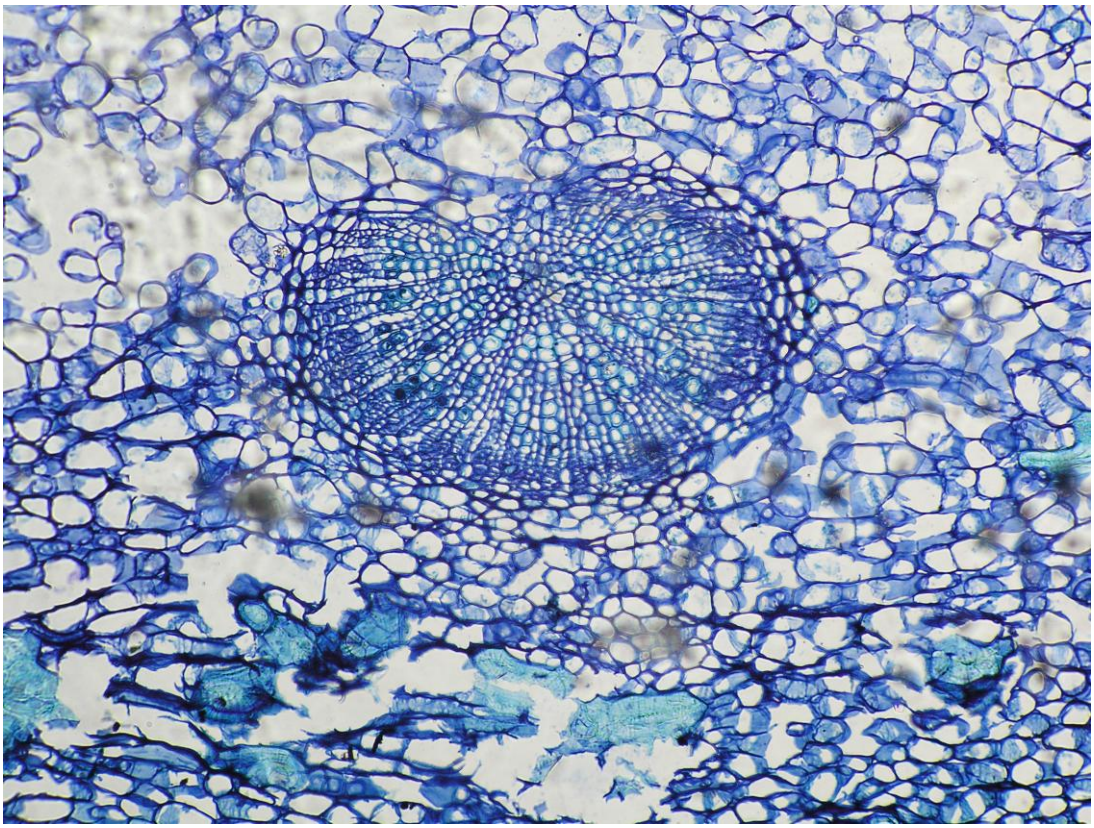

Figure 1. Histology showing sclerides throughout mesocarp region.

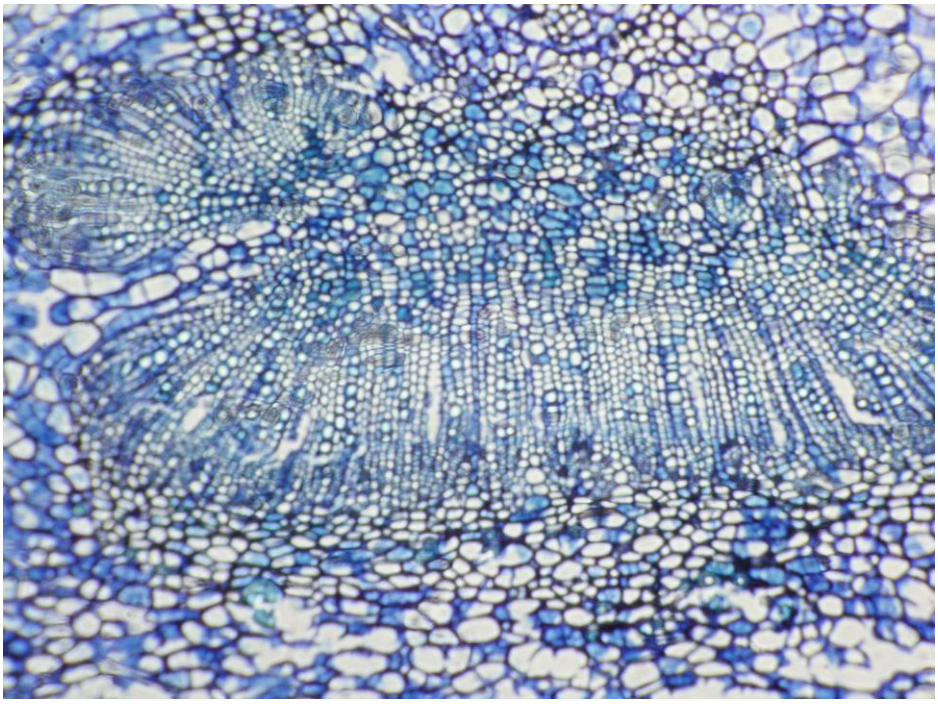

Figure 2. Histology showing vascular strands with xylem and phloem masses.

Microbial Technology (IMTECH) Chandigarh for providing the specified cultures of microorganism and also to Anchrom laboratory (Mumbai) for providing the appropriate technical assistance for fingerprinting analysis.

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Full Length Research Paper

Ethnobotanical survey of plants used in the management of fertility and preliminary phytochemical evaluation of *Abelmoschus esculentus* (L.) Moench

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The rise and fall in fertility level remain a serious concern in economic planning nations. In spite of concerted efforts of governmental and non-governmental organization to control birth through campaign and provision of safe sex devices, yet not much success has been recorded. There is dearth of information on plants traditionally used for fertility regulation in literature. In this study an ethnobotanical survey of plants used in the management of fertility was conducted across Ago-Iwoye and Oru areas of Ijebu-North Local Government, Ogun State, Nigeria. From the survey, 30 plant species which belong to 20 families were found to be used frequently by the indigenes of the areas. Most of the plants encountered (16.7%) belonged to the family Euphorbiaceae. Phytochemical evaluation of the leaves of *Abelmoschus esculentus*, the most prominent in the recipes indicated the presence of cardiac glycosides, flavonoids, phenolics, saponins and tannins in high concentrations while alkaloids, anthraquinones and cardenolides were absent. Moreover, the roots of *A. esculentus* showed high concentration of flavonoid compounds such as phenolics and saponins which were present in low concentrations while alkaloids, anthraquinones, cardenolides, cardiac glycosides and tannins were absent.

Key words: Ethnobotanical survey, fertility, phytochemical evaluation.

INTRODUCTION

Ethnobotany and ethnomedical studies are today recognized as the most viable method of identifying new medicinal plants or refocusing on those earlier reported for bioactive constituents. Ethnobotanical survey has been found to be one of the reliable approaches to drug discovery (Fabricant and Farnsworth, 2001). Thus, it is remarkable to note that most of the drugs derived or originally isolated from higher plants were discovered in ethnobotanical survey around the world (Thirumalai et al., 2009). Several active compounds have been discovered from plants on the basis of ethnobotanical information and used directly as drugs (Carney et al., 1999).

Fertility is the most important aspect of human life, which is not only an expression of miracle and mystery, but directly has an effect on the future of living organisms (Hoffman, 2012). The earth's population reached seven billion in October, 2011. This global milestone is both a great opportunity and a challenge. Although, people are living longer and healthier lives and couples worldwide are choosing to have fewer children, yet huge disparity persists. The current growth rate is adding about 78 million more people every year (United Nations, 2010). Poor reproductive health is the leading cause of death and disability among women of 15 to 49 years in develop-

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ing countries (World Bank, 2011). Infection associated with unsafe abortion is another leading cause of infertility in Africa (Rosenfield, 1994). Abortion is not permitted under the law in many African countries including Nigeria.

Consequently, women with unwanted pregnancies frequently resort to self-induced abortions or abortions done improperly under unhygienic conditions, leading to high rates of infections (Etuk, 2009). The current issues on fertility with the trend in global population have proffered little or no solution to reproductive health, because the economic cost of maintaining reproductive health is high (United Nations, 2012).

However, the use of natural products as alternative therapy is common in countries with populations that do not have access to scientific medical assistance. Plants and their extracts are used popularly for fertility control, and for producing temporary sterility, possibly by interfering with embryonic implantation. Several plants have been confirmed as antifertility, abortive, uterine stimulant, estrogenic or cytotoxic agents in animals and humans (Farnsworth et al., 1975). Besides, research has shown that some medicinal and highly nutritive plants when taken in diet for their known properties have accidental effects on the sex hormones of the individual ingesting it (Williamson et al., 1996). The very recent is the work of Erhabor et al. (2013) who reported the use of thirty one medicinal plants commonly used by Ifa Nkari people of Akwa-Ibom State, Nigeria in the management of male infertility.

The aim of this study was to document ethnobotanical information on plants used in the management of fertility and to evaluate the phytochemicals present in the leaves and roots of *Abelmoschus nesculentus* (L.) Moench which was the most prominent plant in the recipes obtained.

MATERIALS AND METHODS

Ethnobotanical survey

This survey was carried out across Ago-Iwoye and Oru in Ijebu-North Local Government, Ogun State, Nigeria (6°56'N 3°48'E to 7°00'N 4°00'E). A semi structured questionnaire was used to gather information on plants commonly used in the management of fertility in these areas. Relevant information on the plants, parts used, mode of preparation, mode of administration and precautions were obtained from the herbal practitioners. The questionnaire was administered to twenty traditional healers with notable records of success and good patronage in the herbal practice in the study area.

Collection of plant

Fresh leaves and roots of *A. esculentus* were collected in August 2012 from commercial farms. The plant was identified and authenticated at the Elikaf Herbarium of the Department of Plant Science and Applied Zoology, Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria, and the voucher specimen was also kept and was allocated EHA 00323.

Extraction of plant

The leaves and roots of *A. esculentus* were air dried at room temperature (20°C), oven dried (Gallenkamp hot box oven, England) at 40°C, pulverized and stored in air tight container. About 300 and 400 g of the roots and leaves of *A. esculentus* was macerated in 3000 and 3500 ml of ethanol (absolute), respectively and stirred for 10 min for five consecutive days at room temperature. The plant materials, leaves and roots of *A. esculentus* were filtered using filter paper and the extract was concentrated using a water bath and a rotary evaporator (Buchirotavapor R110) at 75°C.

Phytochemical screening

Phytochemical screening was carried out on the leaves and roots of *A. esculentus* to test for alkaloids, anthraquinone glycosides, cardiac glycosides, flavonoids, saponins and tannins using standard protocols according to Sofowora (1993), Harborne (1992) and Trease and Evans(2002).

RESULTS

Table 1 lists the 30 plant species documented for the management of fertility in the study area. The species belong to 20 different families (Table 2). The family Euphorbiaceae had the highest number of plants (5 or 16.7%), followed by the Compositae (3 or 9.9%), Cucurbitaceae (3 or 9.9%), Melastomataceae (2 or 6.7%) and Caesalpiniaceae (2 or 6.7%). The rest of the families had 1 or 3.3% occurrence (Table 3).

DISCUSSION

Indigenous people have a vast knowledge on medicinal plants and there is a need to document this knowledge for continuity and discovery of new drugs. Fertility is the most important aspect of human life, which is not only an expression of miracle and mystery but directly have an effect on the future of living organisms (Hoffman, 2012); hence, the concept of fertility regulation is not a new one. The use of plants as abortifacients, emmenagogues, and as local contraceptives had been known and to some extent documented by the ancient physicians (Rodrigues, 2007). Different plants of medicinal value are found to interfere with the different stages of reproduction.

The present study recorded 30 plants used by the natives of Ago-Iwoye and Oru areas of Ijebu North Local Government in Ogun State, Nigeria. As far as we could ascertain, nineteen (19) of the plants have not been previously reported for abortifacient effect in women just as eleven (11) have been reported and investigated for anti fertility effect in men and women.

Significant findings in this study suggest the abortifacient properties of the roots and leaves of *A. esculentus* contrary to the deleterious effect of the aqueous fruit extract of *A. esculentus* on some male reproductive parameters in Sprague Dawley rats

Table 1. Plants used in the management of fertility in Ago Iwoye and Oru areas of Ogun State, Nigeria.

S/N	Taxon	Family	Common/ local names	Part used	Recipe/Dosage	Reported anti-fertility activity
1	*Abelmoschus esculentus* (L.) Moench	Malvaceae	Gumbo, Ila, lady's finger	Leaves, roots	Leaves or roots are pulverized and mixed with 5 ml of water; administered orally once	This is also reported by Olatunji-Bello et al. (2009).
2	*Acanthospermum hispidum* DC.	Compositae	Dagunro	Leaves	Leaves are finely powdered and mixed with 10 ml of water; two full tablespoons are taken once	This is also reported by Lemonica and Alvarenga (1994).
3	*Baphia nitida* Lodd.	Papilionaceae	Irosun	Roots	Decoction is prepared by boiling the roots with potash (1 g); one full tablespoon is administered once	This is also reported by Babalola (2009).
4	*Bauhinia rubescens* Pers.	Caesalpiniaceae	Jinga	Roots	5 ml of water is mixed with fine powder of the roots; half tablespoon is administered once	No reference found to confirm this survey finding.
5	*Bridelia micrantha* (Hochst) Baill.	Phyllantaceae	Asa, Isa	Leaves	The leaves are boiled with lime; onefull tablespoon is administered once	No reference found to confirm this survey finding.
6	*Carica papaya* L.	Caricaceae	Pawpaw, papaya, Ibepe	Roots of the male pawpaw	5 ml water is mixed with fine powder of the roots; one full tablespoon is administered orally once	This is also reported by Priyaet al. (2012) and Gupta and Sharma (2006)
7	*Chromolaena odorata* (L.) King and Robinson	Compositae	Akintola, siam weed	Roots	Dried and pulverized roots is mixed with 5 ml of water; one full tablespoon is administered once or a pinch of the powder infusion can be administered once	No reference found to confirm this survey finding.
8	*Citrus aurantifolia* Christm and Panzer	Rutaceae	Lime, osanwewe	Roots, leaves, fruit juice	A fresh extract of the leaves is prepared with potash (1 g) or dried and pulverized roots are mixed with 5 ml of water and potash or the juice of the fruit is extracted and mixed with potash; one full tablespoon of the leaves, roots or fruit juice is administered orally once	No reference found to confirm this survey finding.
9	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Egusibaara	Fruit	Infusion is prepared by soaking the fruit in alcohol mixed with potash (1 g); one full tablespoon is administered orally once	This is also reported by Chaturredi and Dixit (1997)
10	*Croton penduliflorus* Hutch.	Euphorbiaceae	Aworoso	Seeds	Decoction of the seeds; half full tablespoon is administered orally once	This is also reported by Aladesanmi et al. (2007)
11	*Croton zambesicus* Mull. Arg.	Euphorbiaceae	Ajekobale	Leaves	A fresh extract of the leaves is prepared by crushing or pounding; one full tablespoon of the extracted juice is administered orally once.	No reference found to confirm this survey finding.
12	*Cucumis myriocarpus* Naudin.	Cucurbitaceae	Egusiaije, paddy melon, prickly paddy melon	Seeds	Seeds are pulverized, dried and molded into small circles; administered anally by placing the molded circles in the uterine cavity.	No reference found to confirm this survey finding.
13	*Dissotis rotundifolia* (Sm.) Triana	Melastomataceae	Awede	Leaves	A fresh extract of the leaves is prepared by crushing or pounding; one full tablespoon of the extracted juice is administered thrice a day for 1 day.	No reference found to confirm this survey finding.

Table 1. Contd.

14	*Eleusine indica* (L.)	Poaceae	Gbegi, stubborn grass	Roots	Half tablespoon full of dried and pulverized roots is dissolved in 10 ml of water; one full tablespoon is administered orally once or a pinch of the powdered infusion is swallowed with water.	No reference found to confirm this survey finding.
15	*Garcinia kola* Heckel	Guttiferae	Orogbo	Seeds	Seeds are finely powdered; three-quarters of a tablespoon is administered orally once or dissolved in 10 ml of water; one full tablespoon is administered orally once.	This is also reported by Akpantah et al. (2005).
16	*Glyphae brevis* Spreng	Tiliaceae	Atori	Rootbark, leaves	Infusion is prepared from the pulverized root bark or leaves; two full tablespoons are administered orally once.	No reference found to confirm this survey finding.
17	*Gomphrena globosa* L.	Amaranthaceae	Obo	Stem bark	Stem bark is finely powdered and dissolved in 10ml of water; two full tablespoons are administered orally once.	No reference found to confirm this survey finding.
18	*Icacinia trichantha* Oliv**.**	Icacinaceae	Gbegbe	Roots	Roots are pulverized and dissolved in 10ml of water; two full tablespoons are administered orally once.	No reference found to confirm this survey finding.
19	*Ipomoea batatas* (L.) Lam.	Convolvulaceae	Odunkun, sweet potato	Leaves	A fresh extract of the leaves is prepared by pounding or crushing; two full tablespoons are administered orally once.	No reference found to confirm this survey finding.
20	*Jatropha curcas* L.	Euphorbiaceae	Iyalode	Seeds	Seeds are finely powdered, sieved and boiled until it thickens; four tablespoons are administered orally once.	No reference found to confirm this survey finding.
21	*Jatropha gosssipifolia* L.	Euphorbiaceae	Sese pupa, Botuje pupa	Leaves	A fresh extract of the leaves is prepared by pounding or crushing; 5 ml is administered orally once.	No reference found to confirm this survey finding.
22	*Macaranga barteri* Mull. Arg.	Euphorbiaceae	Agbaasa	Leaves	A fresh extract of the leaves is prepared by pounding or crushing; 5 ml is administered orally once.	No reference found to confirm this survey finding.
23	*Newbouldia laevis* (P.) Beav.	Bignoniaceae	Akoko	Roots	Roots are pulverized and dissolved in 10 ml of water; a full tablespoon is administered once or a pinch of the powder is swallowed with water	No reference found to confirm this survey finding.
24	*Nicotiana tabacum* L.	Solanaceae	Taba	Leaves	A fresh extract of the leaves is prepared by pounding or crushing; two full tablespoons of the extract are administered orally once or a pinch of the powder is swallowed with water	This is also reported by Emmanuel and Claidette (2007).
25	*Parquetina nigrescens* (Afzel.) Bullock	Periplocaceae	Ogbo	Roots	Roots are pulverized with potash(1 g), dried and boiled or decoction is made by boiling the roots with potash; one full tablespoon is administered orally once	No reference found to confirm this survey finding.
26	*Rothmania longiflora Salisb.*	Rubiaceae	Biye, Biyenme	Roots	Roots are pulverized, dried and dissolved in 10 ml of water; one full tablespoon is administered orally once	No reference found to confirm this survey finding.
27	*Senna alata (L.) Roxb.*	Caesalpiniaceae	Asuwon	Leaves, flowers	Leaves or flowers are finely powdered and mixed with honey; three full tablespoons are administered orally once	This is also reported by Babalola (2009).
28	*Sida acuta (Burm.) F.*	Malvaceae	Esoketu, isekutu	Roots, leaves	Roots or leaves are finely powdered and dissolved in 10 ml of water; two full tablespoons are administered orally once	No reference found to confirm this survey finding.

Table 1. Contd.

29	*Treculia africana* Decne.	Moraceae	Afon	Roots	Pulverize roots are dissolved in 10 ml of water; two full tablespoons are administered orally once	No reference found to confirm this survey finding.
30	*Vernonia amygdalina* Del.	Compositae	Ewuro, bitter leaf	Roots	Roots are finely powdered and dissolved in 10 ml of water	This is also reported by Kumar (2012), Lawal et al. (2008) and Emmanuel and Claidette (2007).

Table 2. Occurrence of plant species in each family.

S/N	Family	Occcurrence	%
1	Amaranthaceae	1	3.3
2	Bignoniaceae	1	3.3
3	Caesalpiniaceae	2	6.6
4	Caricaceae	1	3.3
5	Compositae	3	9.9
6	Convolvulacee	1	3.3
7	Cucurbitaceae	3	9.9
8	Euphorbiaceae	5	16.7
9	Guttiferae	1	3.3
10	Icacinaceae	1	3.3
11	Malvaceae	2	6.7
12	Melastomataceae	1	3.3
13	Moraceae	1	3.3
14	Papilionaceae	1	3.3
15	Periplocaceae	1	3.3
16	Phyllantaceae	1	3.3
17	Poaceae	1	3.3
18	Rubiaceae	1	3.3
19	Solanaceae	1	3.3
20	Tiliaceae	1	3.3
Total		30	-

(Olatunji-Bello et al., 2009). Moreover, this study reported the use of the roots of *Eleusine indica* to induce abortion contrary to its use in the prevention of abortion (Srithi et al., 2009).

Fruits and seeds of *Carica papaya* (pawpaw) have been investigated for anti spermatogenic activity in men (Das, 1980) and anti oestrogenic as well as anti implantation activity in women (Priya et al., 2012); method of preparation may differ. While in the present study, a decoction of the roots to induce abortion was reported. Babalola (2009) affirmed the use of concoction of the roots of male pawpaw.

The use of different plant parts in recipes is of common occurrence in ethnobotanical studies. Sometimes leaves may be used as in *Acanthospermum hispidum* DC (Lemonica and Alvarenga, 2004), *Nicotiana tabacum* L. (Emmanuel and Claidette, 2007), and *Senna alata* (L.) Roxb (Babalola, 2009), other times, roots may be more important as in *Vernonia amygdalina* Del. (Kumar, 2012; Lawal, 2008) and *Baphia nitida* Lodd (Babalola, 2009). In others, recipe fruits are common as in *Citrullus colocynthis* (L.) Schrad (Chaturredi and Dixit, 1997). In this study, the leaves and roots are the most used parts, which agree with previous ethnobotanical studies that have been carried out on plants used in the management of fertility (Kumar et al., 2012). Observable biological activities of plant extracts are due to one or more phytochemical components such as gossypol isolated from cotton plant, *Gossypium* species (Qian and Wang, 1984). Hence, the phytochemical evaluation of the leaves of *A. esculentus* confirmed the absence of alkaloids, anthraquinones and cardenolides and the presence of cardiac glycosides, flavonoids, phenolics, saponins and tannins in high concentrations. However, phytochemical evaluation of the roots of the same plants showed the presence of flavonoids in high concentrations, while phenolics and saponins were present in lower concentrations. Alkaloids, anthraquinones, cardenolides, cardiac glycosides, and tannins were absent.

Table 3. Phytochemical screening of *Abelmoschus esculentus*.

Phytochemicals	*Abelmoschus esculentus*	
	Leaves	Roots
Alkaloids	-	-
Anthraquinones	-	-
Cardenolides	-	-
Cardiac glycosides	++	-
Flavonoids	++	++
Phenolics	++	+
Saponins	++	+
Tannin	++	-

There are some indications of the possibility of use of the leaves of *A. esculentus* in the therapy of heart conditions and as anti-oxidants, anti-septics, anti-cancer, and laxatives as revealed by the class of natural products present in the plant. The roots of the plant is rich in flavonoids, this suggests the suitability of the plant as useful anti-

oxidants since this class of natural products are noted for their free radical scavenging properties. The mechanism behind its use for fertility enhancement could therefore be due to reduction of stress on the reproductive cells. These however require further research. In summary, plants documented in this survey are recommended for further biological investigation to establish the claim of their fertility regulating properties. If the plants are administered in very minute quantities, they enhance pregnancy otherwise they result in abortion and other complications in the human body.

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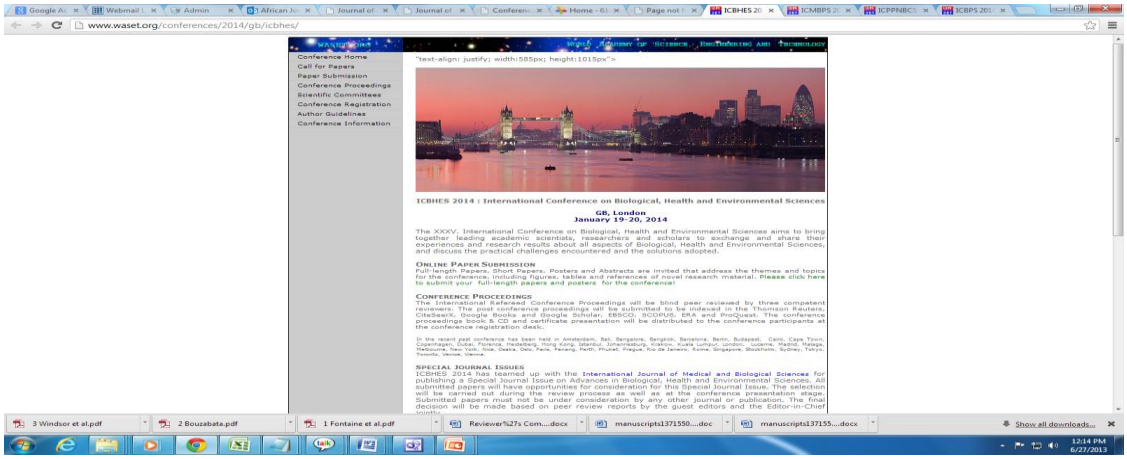

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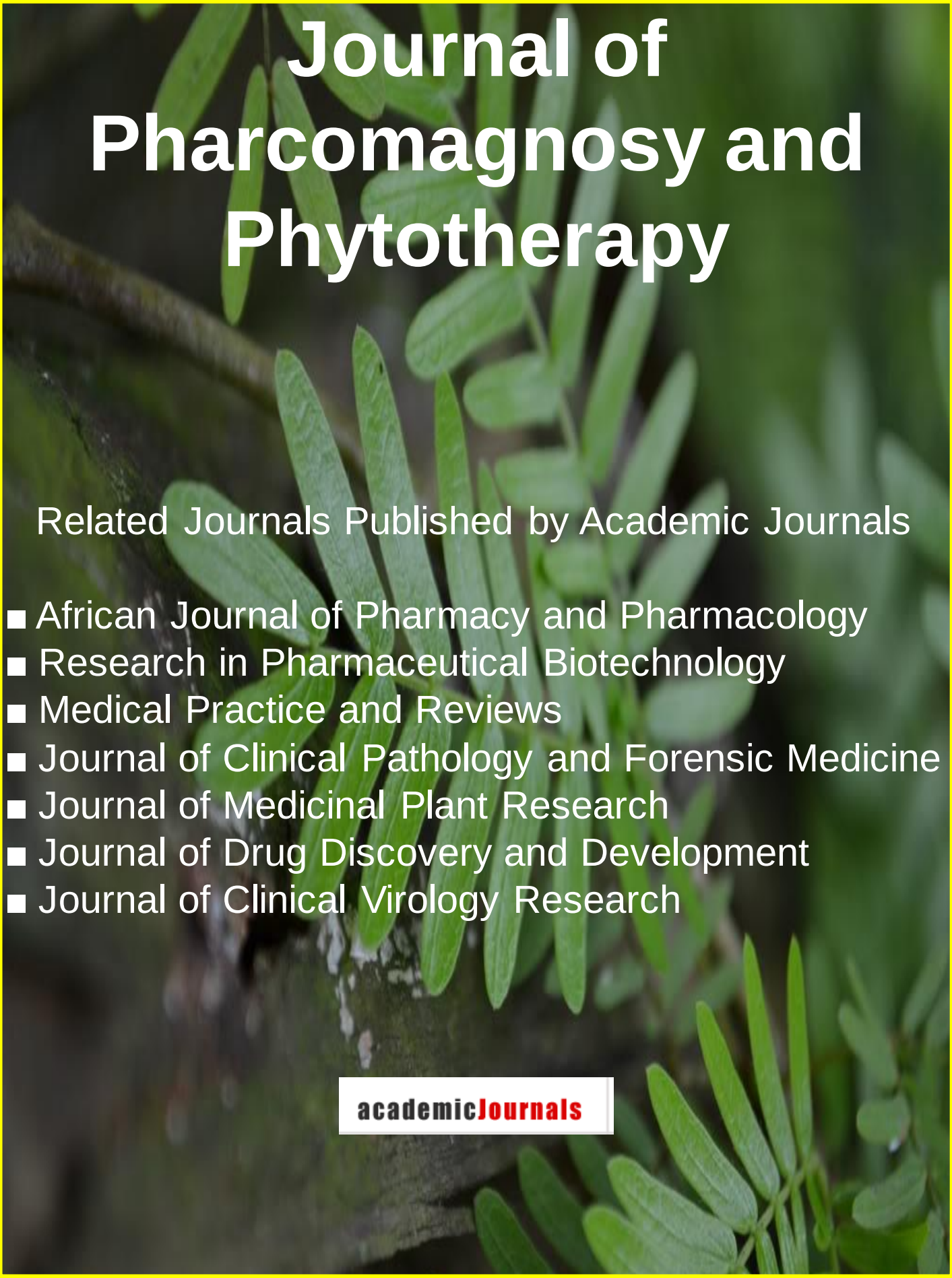

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