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Bioactive Profiling of the Essential Oil from the Leaves of Abrus Precatorious in Rajasthan India

Alagbe Olujimi John[1*], Shittu Daniel Muritala[2], Ojediran Taiwo K[3], Anaso Emmanuel U[4], Daniel Nnadozie Anorue[5]
[1]Adjunct Lecturer, Gandhi College of Agriculture, Rajasthan, India
[2,3]Ladoke Akintola University of Technology, Oyo State, Nigeria
[4,5]University of Abuja, Nigeria
Corresponding Author: Alagbe Olujimi John; demsonfarms00@gmail.com

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A B S T R A C T

Medicinal plants have a long tradition as therapeutic agents and have also been part of human and animal diet. They contain numerous bioactive components that are generally considered to be a safe replacement for antibiotics. They also create a pollution free environment and has no withdrawal period. The results of the gas chromatography mass spectrometry of Abrus precatorious oil revealed the presence of 19 bioactive compounds. These compounds include, γ-terpinene, β-caryophyellene, methylparaben, 3-pyridinol, dibutyl phthalate, α-terpineol, D-allose, limonene, α-pinene, p-cymene, n-hexadecanoic acid, 1-hexadecyne, octadecanoic acid ethyl ester, 2-methoxy-4-vinaylphenol, di-hydroxypropyl ester, 9,17-octadecadienal, oleic acid and 2-heptadecanone. D-allose (31.06 %), n-hexadecanoic acid (14.50 %), p-cymene (10.06 %), γ-terpinene (7.93 %), 3- pyridinol (5.90 %), β-caryophyellene (5.14 %), α-pinene (4.95 %), limonene (4.80 %) and α-terpineol (4.08 %) were the most abundant compounds. However, all phyto-components have numerous therapeutic applications (anti-inflammatory, cytotoxic, antioxidant, anti-helminthic, anti-diuretic, anti-cancer, antiviral, antimicrobial, antifungal, hepato-protective, gastro-protective, immuno-modulator, antidiarrheal, amongst others) and can be used in the treatment of diseases or infections

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INTRODUCTION

Abrus precatorious commonly known as rosary pea is an evergreen, slender, perennial plant belonging to the family fabaceae (Xiao et al., 2011). The genus arbus consist of more than 16 species widely distributed in Australia, Africa and some parts of Asia including India (Gul et al., 2013). The leaves of Abrus precatorious are long and pinnate while the seeds contain toxin (abrin) which is capable of causing convulsion, nausea and liver failure when found in higher concentrations in the systems of animals (Kim et al., 2022). The phytochemical screening of Abrus precatorious of leaves revealed the presence of various secondary metabolites including the phenols, flavonoids, alkaloids, terpenes, tannins, glycosides and saponins which possess antimicrobial, anti-diarrhea, anti-inflammatory, anti-cancer, antiviral, immuno-modulatory, gastro-protective, antifungal, antidepressant, cardio-protective, hypolipidemic, antimalarial, anagelsics amongst others (Jang et al., 2010). The plant leaf extracts are used in ethno-medical practices in the treatment of sores, wounds, skin infection, tetanus, pyrexia, gastro-intestinal infections (Greay and Hammer, 2015; Russo et al., 2013).

Essential oils from Abrus precatorious has strong antimicrobial activities and have been reported to inhibit the activities of Styphyllococcus aureus, Streptococcus spp, Escherichia coli, Klebsiellia spp and Salmonella spp (Huang et al., 2012). According to (Abdulkabir et al., 2016), oils from the leaves of Abrus precatorious contains selinene (15.30 %), cadinene (19.10 %), α-cubnene (12.80 %), α-copanene (7.70 %), linalool (6.30 %), β-elemene (5.40 %), α-caryophyllene (4.00 %), α-pinene (1.60 %), β-pinene (0.025 %) and cymene (0.022 %). Similarly, Shivam (2022) reported that Abrus precatorious leaf extract contains, D-allose (10.98 %), n-Hexadecanoic acid (8.25 %), 2-methoxy-4-vinaylphenol (6.81 %), Isosorbide (6.26 %), Abrusoside D (5 14 %), benzofuran (3.82 %), Abrusoside E (2.81 %), dibutyl phthalate (1.92 %) and Abrusoside B (1.63 %). These results suggest that Abrus precatorious oil has abundant pharmacological or medicinal properties.

Evaluating the bioactive components in Abrus precatorious oil will help to prevent toxicity, promote livestock sustainability, antimicrobial resistance and food security. Therefore, this study is aimed at accessing the bioactive compounds in the essential oil from the leaves of Abrus precatorious in Rajasthan India.

LITERATURE REVIEW

Collection of Abrus Precatorious Leaves

Fresh Abrus precatorious leaves were collected from different plants at Crop unit, Gandhi College of Agriculture in Rajasthan, India and sent to the department of Biological Sciences, Sumitra Research Institute, Gujarat for proper identification by a certified taxonomist (Mr. Singh Prakesh). Thereafter, it was assigned a voucher number (DT/009T/2024/08A). Collected leaves were shade dried for 10 days to retain their bioactive components and pulverized using an electric blender before extraction.

Extraction of Abrus Precatorious Oil and Analysis Using Gas Chromatography-Mass Spectrometry

Extraction of oil was done using hydro-distillation method earlier outlined by (Alagbe, 2024). Briefly, 300 g Abrus precatorious powder was measured into a round bottom flask, placed on a heating mantle and heated at 70°C for 20 minutes the steam produced is collected in a glass condenser then into a round bottom flask. Mixture of oil and water was separated using a laboratory separator to obtain Abrus precatorious oil.

Analysis of bioactive compounds in Abrus precatorious oil was done using DAF Triple gas chromatography and mass spectrometry (GC-MS ADF/08/20), China). To obtain precision in results, the machine was set at a control range between 0 to 300 mL/min (N2), ionization energy (0-240 eV), ion source temperature (50 to 350 °C) and transfer line temperatures of 50 to 400 °C. Identification of bioactive components in the oil was based on comparison with their retention time and mass spectra by matching with those of the National Institute of Standard and Technology (NIST, 2011) database.

METHODOLOGY

Study Area

The study was carried out at the department of Animal Biochemistry at Gandhi College of Agriculture, Rajasthan India. All laboratory procedures were done were done according to the official method of analysis of Association of Analytical Chemist. Machine/kits were operated strictly adhering to the Manufacturers Recommendation.

Equipment/Reagent Required

Round bottom flask, heating mantle, condenser, clavenger apparatus, seperatory funnel and beaker.

RESULTS AND DISCUSSION

Result on gas chromatography- mass spectrometry (Table 1) revealed the various components which were identified using National Institute of Standard and Technology (NIST) library by comparing the retention time and their peak area. The most prominent compound includes, D-allose (31.06 %), n-hexadecanoic acid (14.50 %), p-cymene (10.06 %), γ-terpinene (7.93 %), 3-pyridinol (5.90 %), β-caryophyellene (5.14 %), α-pinene (4.95 %), limonene (4.80 %) and α-terpineol (4.08 %). Dibutyl phthalate (1.61 %), oleic acid (1.41 %), terpinene-4-ol (1.15 %), 2-heptadecanone (0.96 %), 1-hexadecyne (0.58 %), methylparaben (0.40 %), di-hydroxypropyl ester (0.07 %), 9,17-octadecadienal (0.03 %) and octadecanoic acid ethyl ester (0.02 %) were found at a lower concentration. However, all these compounds possess numerous pharmacological or medicinal properties (Singh et al., 2021; Musa et al., 2020). Shivam (2022) reported a lower concentration of 8.25 % for n-hexadecanoic acid, dibutyl phthalate (1.92 %), D-allose (10.98 %) and 3- pyridinol (1.60 %) in Abrus precatorious extract. Solanki and Zaveri (2012) recorded a higher concentration of 1.25 % for limonene found in Abrus precatorious oil. Results obtained in this study is in agreement with the reports of Gnanavel and Mary (2013).

Discrepancies in results could be attributed to processing method, age of plant as well as geographical location (Adewale et al., 2021; John, 2024a). D-allose, hexadecanoic acid, γ-terpinene and β-caryophyellene have been reported to have anti-inflammatory, antioxidant, antimicrobial, anti-helminthic as well as immuno-modulatory activities (John, 2024b; John, 2024c). α-pinene, 9,17-octadecadienal, octadecanoic acid ethyl ester and p-cymene are known to have antifungal (Shanmugapriya et al., 2015) and antibacterial activity against pathogenic organisms such as, Staphylococccus spp, Salmonella spp, Candida albicans, Streptococcus spp amongst others (Simlai and Roy, 2012; Klavina et al., 2015). Di-hydroxypropyl ester, 2-heptadecanone and 1-hexadecyne have been suggested to possess anti-allergic (Shittu et al., 2024; Alagbe et al., 2022), anti-carcinogenic (John, 2024d; Omokore and Alagbe, 2019), antiviral (Gawali and Jadhav, 2011; Prabhu and Guruvayoorappan, 2012), anti-inflammatory (Daniel et al., 2023); Alagbe, 2022, cytotoxic (John, 2024e), anti-mutagenic and anti-carcinogenic properties (Nurdiani et al., 2012; Namkeleja et al., 2014). (James and Mom, 2021; Olajuyige et al., 2011) reported that oleic acid are important antibacterial agents. They are also capable of inhibiting the release of autacoids, prostaglandins and promote immune functions (Odozi et al., 2014; Doughari, 2012; John, 2024c).

CONCLUSIONS AND RECOMMENDATIONS

The efficacy of essential oils can be attributed to the presence of bioactive compounds which have the capability to defend against pathogenic organisms and provide other health benefits to the body. Analysis of the natural compounds in Abrus precatorious oil showed that it has infinite pharmacological benefits and can be used as potential alternative to antibiotics.

Table 1. Major Bioactive Compounds Identified in Abrus Precatorious Essential Oil

SN	Compounds	Reaction time (min)	Peak area (%)
1	γ-Terpinene	2.492	7.93
2	β-Caryophyellene	3.454	5.14
3	Methylparaben	3.858	0.40
4	3- Pyridinol	4.794	5.90
5	Dibutyl phthalate	5.800	1.61
6	α-Terpineol	6.091	4.08
7	D-allose	6.475	31.06
8	Limonene	7.104	4.80
9	α-Pinene	7.642	4.95
10	Terpinene-4-ol	9.025	1.15
11	p-Cymene	9.379	10.06
12	n-Hexadecanoic acid	10.221	14.50
13	1-Hexadecyne	14.050	0.58
14	Octadecanoic acid ethyl ester	14.218	0.02
15	2-methoxy-4-vinaylphenol	15.553	9.72
16	Di-hydroxypropyl ester	16.139	0.07

17	9,17-Octadecadienal	16.782	0.03
18	Oleic acid	17.108	1.41
19	2-Heptadecanone	17.858	0.96

FURTHER STUDY

This research still has limitations related to it, so it is necessary to conduct further research on the topic of Bioactive Profiling of the Essential Oil from the Leaves of Abrus Precatorious in Rajasthan India in order to perfect this research and increase insight for readers.

REFERENCES

Abdulkabir Oladele Oladimeji, Oluwatoyin Babatunde, Rukayat Titilayo Musa, Fausat Adeola M'civer, Abdulazeez Tunbosun Lawal, Isiaka Ajani Ogunwande (2016). GC-MS analysis and cytotoxic activity of essential oils from the leaves of Abrus precatorius L. Gaertn. Asian Pacific Journal of Tropical Disease, 6(5): 372-375

Adewale, A.O., Alagbe, J.O., Adeoye, Adekemi. O. (2021). Dietary Supplementation of Rauvolfia Vomitoria Root Extract as A Phytogenic Feed Additive in Growing Rabbit Diets: Haematology and serum biochemical indices. International Journal of Orange Technologies, 3(3): 1-12.

Alagbe Olujimi John (2024). Novel phytogenics' impact on weaned pigs growth performance, haematology and serum biochemical indicators. Black Sea Journal of Agriculture, 7(2): 82-89.

Alagbe, J.O (2022). Use of medicinal plants as a panacea to poultry production and food security: A review. Gospodarka I Innowacje 22(2022): 1-12.

Alagbe, J.O., Shittu, M.D and Tanimomo, Babatunde K. (2022). Influence of Anogeissusleio carpus stem bark on the fatty acid composition in meat of broiler chickens. European Journal of Life Safety and Stability 14(22): 13-22.

AOAC, 1997. Official Methods of Analysis, 16th ed. Association of Official Analysis Chemists International. AOAC International, Washington DC.

Choi, J., Park, N., Hwang, S., Sohn, J., Kwak, I., Cho, K.K and Choi, I. (2013). The antibacterial activity of various saturated and unsaturated fatty acids against several oral pathogens. Journal of Environmental Biology, 34, 673- 676

Daniel Nnadozie Anorue, Friday Ubong and Alagbe Olujimi John (2023). Investigating the effects of pawpaw (Carica papaya) essential oil dietary supplementation on the growth performance and carcass characteristics of broilers. Research in: Agricultural and Veterinary Sciences, 7(3): 164 - 174.

Doughari, J.H. (2012). Phytochemicals: Extraction Methods, Basic Structures and Mode of Action as Potential Chemmotherapeutic Agents- A Global Perspective of Their Role in Nutrition and Health. Dr. Venketeshwer Rao. Ed). ISBN: 978- 953-51-0296-0. Intech.

Gawali, P and Jadhav, B.L. (2011). Antioxidant activity and antioxidant phytochemical analysis of mangrove species Sonneratia albaand Bruguiera cylindrical. Asian Journal of Microbiology, Biotechnology & Environmental Sciences, 13 (2), 257-261.

Gnanavel, V and Mary Saral, A. (2013). "GC-MS analysis of petroleum ether and ethanol leaf extracts from abrus precatorius linn," International Journal of Pharmaceutical and Biological Science, 4(3): 21-24

Greay SJ, Hammer KA. (2015). Recent developments in the bioactivity of mono- and diterpenes: anticancer and antimicrobial activity. Phytochem Rev 2015; 14(1): 1-6.

Gul MZ, Ahmad F, Kondapi AK, Qureshi IA, Ghazi IA. (2013). Antioxidant and antiproliferative activities of Abrus precatorius leaf extracts--an in vitro study. BMC Complement Alternative Medicine, 2013; 13: 53.

Huang M, Sanchez-Moreiras AM, Abel C, Sohrabi R, Lee S, Gershenzon J, et al. (2012). The major volatile organic compound emitted from Arabidopsis thaliana flowers, the sesquiterpene (E)-β-caryophyllene, is a defense against a bacterial pathogen. New Phytol 2012; 193(4): 997-1008

James, H.D and Mom Saa-Aondo (2021). Phytochemical analysis of crude methanol extracts and antimicrobial activity of n-hexane fractions of methanol seed and pod extracts of Prosopis africana on some selected microoganisms. Pharmacology Online, 2: 121-137.

Jang DH, Hoffman RS, Nelson LS. (2010). Attempted suicide, by mail order: Abrus precatorius. J Med Toxicol 2010; 6(4): 427-30.

John, A.O. (2024a). Impact of dietary supplementation of Rhamnus prinoides leaf extract on the growth performance, nutrient retention and intestinal microbial count of Japanese quails. Brazilian Journal of Science, 3(5): 40-50.

John, A.O. (2024b). Clerodendron splendens leaf extract supplementation in weaner rabbits: impact on growth performance, haematology and intestinal microbial population. Cerrado: Agricultural and Biological Research, 1(1): 21-31.

John, A.O. (2024c). Effect of coconut shell extract on the growth performance and some haemato-biochemical parameters of broiler chicken. Brazilian Journal of Science, 3(6): 82-95.

John, A.O. (2024d). Effect of performance, serum biochemistry and heamatological components of feeding Japanese quails phytogenic feed additions comprising Megaphrynium macrostachyum leaves. Brazilian Journal of Science, 3(5): 51-64.

John, A.O. (2024e). Growth performance, haemato-biochemical indices of broiler chicken fed Aristochia indica as a phytogenic feed additive. Cerrado: Agricultural and Biological Research, 1(1): 42-53.

Kim NC, Kim DS, Kinghorn AD. (2022). New triterpenoids from the leaves of Abrus precatorius. Nat Prod Letters, 16(4): 261-6.

Klavina, L., Springe, G., Nikolajeva, V., Martsinkevich, I., Nakurte, I, et al., (2015). Chemical composition analysis, antimicrobial activity and cytotoxicity

screening of moss extracts (moss phytochemistry). Molecule, 20, 17221-17243.

Musa, B., Alagbe, J.O., Adegbite Motunrade Betty, Omokore, E.A. (2020). Growth performance, caeca microbial population and immune response of broiler chicks fed aqueous extract of Balanites aegyptiaca and Alchornea cordifolia stem bark mixture. United Journal for Research and Technology, 2(2):13-21.

Namkeleja, H.S., Tarimo, N.T.C. & Ndakidemi, P.A. (2014). Allelopathic Effects of Argemone Mexicana to Growth of Native Plant Species. American Journal of Plant Sciences, 5 (9), 1336- 1344

Nurdiani, R., Firdaus, M and Prihanto, A.A. (2012). Phytochemical and pharmacological studies of ethanolic extract from the leaf of mangrove plant (Rhyzophoramucronata) from Porong River Estuary. Journal of Basic Science and Technology, 1 (2), 27-29

Odozi, B.E., Ibeh I N., Odozi P.I., Osakwe, A.A & Otoikhian, C.S.O. (2014). Antimicrobial activity of aqueous and methanol extract of Prosopis africana on selected bacteria isolates. IndoAmerican Journal of Life Science and Biotechnology, 2 (2), 10-14.

Olajuyige, O.O., Babalola, A.E. & Afolalayan, A.J. (2011). Antibacterial and phytochemical screening of crude ethanolic extracts of Waltheria Linn. African Journal of Microbiology Research, 5 (22), 3760-3764.

Omokore, E.O and Alagbe, J.O. (2019). Efficacy of dried Phyllantus amarus leaf meal as an herbal feed additive on the growth performance, haematology and serum biochemistry of growing rabbits. International Journal of Academic Research and Development. 4(3): 97-104.

Prabhu, V.V and Guruvayoorappan C. (2012). Phytochemical screening of methanolic extract of mangrove Avicennia marina (Forssk.) Vierh Der Pharmacia Sinica, 3 (1), 64-70

Russo A, Formisano C, Rigano D, Senatore F, Delfine S, Cardile V, et al. (2013). Chemical composition and anticancer activity of essential oils of Mediterranean sage (Salvia officinalis L.) grown in different environmental conditions. Food Chem Toxicol 2013; 55: 42-7

Shanmugapriya, R., Ramanathan, T and Renugadevi, G. (2012). Phytochemical Characterization and Antimicrobial Efficiency of Mangrove Plants Avicennia marina and Avicennia officinalis. International journal of Pharmaceutical & Biological Archives, 3 (2), 348-351.

Shittu, M.D., Alagbe, J.O., Alaba, O., Okanlawon, E.O., Adelakun, F.A., Emmanuel, E.O and Adejumo, D.O. (2024). Effect of ginger, garlic and Negro pepper on the gut microbes, gut histomorphometry and pathological assessment of selected organs of broiler chickens. Association of Deans of Agriculture in Nigerian Universities, 5: 105-121.

Shivam V. (2022). Phytochemical analysis of Abrus precatorius and leaf extract and its application. International Journal of Creative Research Thoughts, 10(11): d529-d538.

Simlai, A. & Roy A. (2012). Analysis of and correlation between phytochemical and antimicrobial constituents of Ceriops decandra, a medicinal mangrove plant, from Indian Sundarban estuary. Journal of Medicinal Plants Research, 6 (32), 4755-4765

Singh Sharma., Alagbe Olujimi John., Liu Xing., Sharma Ram and Kumar Amita (2022). Comparative analysis of ethanolic Juniperus thurifera leaf, stem bark and root extract using gas chromatography and mass spectroemetry. International Journal of Agriculture and Animal Production, 2(6): 18-27.

Solanki, A and Zaveri, M. (2012). "Pharmacognosy, phytochemistry and pharmacology of Abrus precatorius leaf: A review," Int. Journal of Pharmaceutical Science and Research, 13(2): 71–76.

Xiao ZH, Wang FZ, Sun AJ, Li CR, Huang CG, Zhang S. (2011). A new triterpenoid saponin from Abrus precatorius Linn. Molecules 2011; 17(1): 295-302