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ANTIFUNGAL ACTIVITY OF FRACTIONS AND COMPOUNDS FROM *PTEROCARPUS ERINACEUS* POIR.1804, (FABACEAE) ON SELECTED WOOD FUNGI

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ABSTRACT

Extract fractions and compounds from the heartwood and stem bark of Pterocarpus erinaceus were evaluated for antifungal properties. Extraction of the dry and pulverized plant materials was carried out with hexane, ethyl acetate and then methanol. The extracts were fractionated and purified using column chromatography over silica gel to yield p-ethoxylphenylpropanoic acid, angolensin, mixture of sitosterol, stigmasterol and cycloeucalenol from heartwood while friedelane-3-one and lupeol were obtained from the stem bark. The fractions and compounds were active against the test fungi (Aspergillus fumigatus, Coniophora puteana, Fibroporia vaillantii, Fomitopsis pinicoca, Gloeophyllum sepiarium Phaeolus schweinitzii, Rhizopus sp., Serpula lacrymans and Sclerotium rolfsii) at zone of inhibition ranging from 17 – 24 mm. Fibroporia vaillantii showed resistance to the control antibiotic (Ketoconazole and Fluonazole) but was sensitive to five of the fractions. The minimum inhibitory concentration observed was 50 µg/mL against 9 test fungi while the minimum fungicidal concentration was 200 µg/mL.

Keyword: Antifungal, Extracts, Fractions, Fungi, *Pterocarpus erinaceus*

INTRODUCTION

Pterocarpus erinaceus Poir. (Fabaceae) or African teak is a native and endangered wood species common in the savanna and Semi-arid zones of West Africa and Central Africa (Barstow, 2018). It is also known as African rosewood, black cam wood, African kino, Senegal rosewood and Gambian kino (Duvall, 2008). In Nigeria local languages, it is called *Madobiya* or *Madrid* in Hausa, *Ngaji* in Tiv (Shomkegh *et al.,* 2016), *Apepo, Agbelosun, Osundudu* in Yoruba (Olowokudejo *et al.,* 2008) and *OhaOfia* in Igbo (Ezeja *et al.,* 2012).

Pterocarpus erinaceus is a deciduous small tree of up to 15 - 25 m in height with diameter from 1.2 - 1.8 m. It has a straight and cylindrical bole and branchless for up to 10 m under good conditions (Duvall, 2008). It is a multipurpose tree of huge interest for agroforestry systems and for its invaluable products such as wood, forage, fuel and medicine (Fontodji *et al.,* 2011). It is mostly used for furniture and also for heavy construction. It is also used as animal feedstock and various medicinal applications. The wood is good for fuel and charcoal production (Kokou *et al.,* 2009; Duvall, 2008). The heartwood is a source of a red dye, which

is used for dying cloth, the body or hair. The bark is occasionally used for tanning.

Traditionally, *P. erinaceus* is commonly used as medicine to treat internal diseases such as diarrhea (Kerharo and Adam, 1974), fever, dysentery, intestinal worm infections. It also reported to be used for external health challenge such as the treatment of eye complaints, sores and ulcers. *P. erinaceus* decoctions or infusions of the bark or roots have been used for the treatment of dysentery, bronchial infections, toothache, anaemia, gonorrhoea, post-partum haemorrhage, menstruation complaints, leprosy, wounds, tumours, ringworm infections, ulcers among others. The root preparations of *P. erinaceus* are administered to treat venereal diseases. Leaf decoctions are also in the treatment of fever, syphilis and as an aphrodisiac and insect repellent. Leafy branches are browsed by livestock, and are especially important towards the end of the dry season when not much else is available to eat (Duvall, 2008).

Several studies have been conducted on the medicinal values of *P. erinaceus*. Karou *et al., (*2003) reported that extract from the leaves of *P. erinaceus* demonstrated a moderate anti-malarial activity against *Plasmodium falciparum.* Stem bark and root extracts of *P. erinaceus* were reported to possess important anti- analgesic, anti-inflammatory activities as well as a strong antioxidant property. Extracts and compounds from roots of *P. erinaceus* have been reported to possess local anti-inflammatory activities, antioxidant effect and inhibitor properties against lipid peroxidation and lipoxygenase activities (Noufou *et al.,* 2021; Noufou *et al.,* 2017). *P. erinaceus* methanol leaf extract was said to produce a significant antidiarrheal activity on albino Wistar mice (Ezeja *et al.,* 2012). Studies have also shown that *P. erinaceus* has both antifungal and bactericidal properties. Root extracts of *P. erinaceus* exhibited antifungal activities against *A. fumigates* (Tittikpina *et al.,* 2019).

The bark of *P. erinaceus*is reported to contain antibacterial (Tittikpina *et al.,* 2018) constituents while the stem bark of *P. erinaceus* showed broad spectrum anti-microbial properties against *Bacillus subtilis, P. aeruginosa, E. coli, S. aureus* and *C. albicans* (Gabriel and Onigbanjo, 2010). In light of the potential medicinal and antimicrobial properties of *P. erinaceus,* this study investigates the activity of compounds from *P. erinaceus*on against selected wood decay fungi.

MATERIALS AND METHODS

Collection and preparation of material

Stem bark of *P. erinaceus* was collected from trees growing within the campus of Federal University of Agriculture, Makurdi using cutlass. They were dried for two weeks during harmattan under shed and thereafter pulverized. The sawdust from the heartwood was collected from a timber shed located at an Industrial layout, Naka Road, Makurdi. The sawdust was also dried under shed before extraction.

Extraction procedure

Column chromatography was used to extract compounds from the dried stem and heartwood portions of *P. erinaceus* using the procedure earlier described by Ekhuemelo *et al.* (2019a).

Antimicrobial and fungi Screening

The antifungal activity of the stem bark and heartwood extracts and compounds were carried out at the Nigerian Institute for Leather Science and Technology (NILEST), Zaria. The assays were carried out using fractions PES-50, PES-53, PES-43, PES-47, PES-24, PES-73, PE-15 and PE-26 against *Sclerotium rolfsii*. *Serpula lacrymans, Rhizopus* spp., *Phaeolus schweinitzii, Gloeophyllum sepiarium, Fomitopsis pinicoca, Fibroporia vaillantii, Coniophora puteana* and *Aspergillus fumigatus.* A disk diffusion method was adopted for the screening of the fractions as previously described by Ekhuemelo *et al.* (2019b).

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Determination of Minimum Inhibition Concentration (MIC)

Broth dilution procedure was used to determine MIC of fractions and compounds. Sabouraud dextrose broth was prepared as reported by Ekhuemelo *et al.* (2019a). The incubation period of test fungi was observed on various concentrations of 200*µg/mL*,100 *µg/mL*,50*µg/mL*,25*µg/mL, and* 12.5 *µg/mL* for 7 days at 30 ^{o}C to monitor fungal growth. The lowest concentration of the fraction in the sterilized broth that had no growth was recorded as the MIC.

Minimum fungicidal concentration (MFC)

For MFC, Sabouraud Dextrose agar were also prepared and sterilized at temperature of 121^{o}C as reported by Ekhuemelo *et al.* (2019b). The MFC was also examined on a range of 200*µg/mL,* 100 *µg/mL*,50*µg/mL*,25*µg/mL, and* 12.5 *µg/mL*concentrations at temperature of 30 ^{o}C for 7 days. The least concentration of the fraction without fungi growth was regarded as the MFC.

RESULTS

Characterization of PE-17 as Friedelane-3-one

Pterocarpus erinaceus stem bark fraction (PE17) was obtained as white needles. Its ^{1}H NMR (500 MHz, chloroform-*d*) (Figure 1) gave signals at δ_H 2.39 (ddd, *J* = 13.9, 5.1, 2.0 Hz, 1H), 2.34 – 2.27 (m, 2H), 2.24 (q, *J* = 7.0 Hz, 1H), 1.96 (ddt, *J* = 12.7, 6.9, 2.3 Hz, 1H), 1.76 (t, *J* = 2.6 Hz, 1H), 1.74 (d, *J* = 2.1 Hz, 1H), 1.68 (dd, *J* = 13.0, 5.1 Hz, 1H), 1.54 (d, *J* = 2.2 Hz, 1H), 1.48 (s, 1H), 1.39 (s, 1H), 1.34 (d, *J* = 2.6 Hz, 1H), 1.25 (s, 7H), 1.18 (s, 3H), 1.05 (s, 3H), 1.00 (d, *J* = 3.8 Hz, 6H), 0.95 (s, 3H), 0.88 (s, 2H), 0.87 (s, 6H), 0.72 (s, 3H). The compound was identified as Friedelane-3-one (Table 1).

Characterization of PE-28 as Lupeol

Pterocarpus erinaceus stem bark fraction (PE-28) was obtained as white needles. Its ^{1}H NMR (500 MHz, chloroform-*d*), (Figure 2) gave signals at δ_H 4.68 (s, 1H), 4.56 (s, 1H), 3.64 – 3.58 (m, 0H), 3.27 – 3.12 (m, 1H), 2.37 (td, *J* = 11.0, 5.8 Hz, 1H), 2.09 – 1.95 (m, 1H), 1.95 – 1.79 (m, 1H), 1.67 (s, 4H), 1.63 – 1.45 (m, 3H), 1.42 – 1.34 (m, 3H), 1.34 – 1.28 (m, 1H), 1.25 (s, 11H), 1.18 – 1.11 (m, 2H), 1.09 – 1.04 (m, 1H), 1.03 (s, 3H), 0.95 (d, *J* = 11.4 Hz, 6H), 0.87 (s, 1H), 0.82 (s, 3H), 0.78 (s, 3H), 0.75 (s, 3H) and was identified as Lupeol (Table 1).

Characterization of PES-30 as Angolensin

Pterocarpus erinaceus sawdust fraction (PES30) was obtained as white needles. Its proton nuclear magnetic resonance (^{1}H-NMR) gave the following data (Figure 3): ^{1}H NMR (500 MHz, Chloroform-*d*) δ 13.14 (d, *J* = 2.7 Hz, 1H), 7.72 (d, *J* = 8.9 Hz, 1H), 7.24 (d, *J* = 8.4 Hz, 2H), 6.87 (d, *J* = 8.4 Hz, 2H), 6.41 (d, *J* = 2.5 Hz, 1H), 6.36 (dd, *J* = 8.8, 2.6 Hz, 1H), 4.62 (q, *J* = 6.9 Hz, 1H), 4.16 (d, *J* = 7.1 Hz, 0H), 3.75 (d, *J* = 1.4 Hz, 3H), 1.53 (d, *J* = 7.0 Hz, 3H). *Pterocarpus erinaceus* sawdust fraction (PES30) was characterised as Angolensin (Table 1).

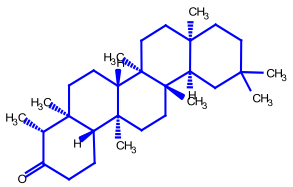
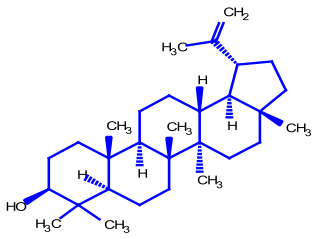
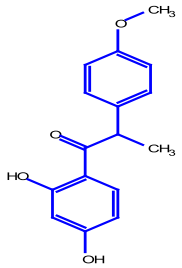
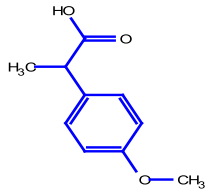
Characterization of PES39 as p-ethoxylphenylpropanoic Acid

Pterocarpus erinaceus heartwood fraction (PES39) was obtained as white needles. Its proton nuclear magnetic resonance (^{1}H-NMR) gave the following data (Figure 4) below: ^{1}H NMR (500 MHz, Chloroform-*d*) δ 12.68 (s, 0H), 7.09 (s, 1H), 7.07 (d, *J* = 8.4 Hz, 2H), 6.69 (d, *J* = 8.5 Hz, 2H), 3.62 (s, 3H), 3.59 (s, 1H), 3.52 (q, *J* = 7.2 Hz, 1H), 1.32 (d, *J* = 7.1 Hz, 3H). Characterisation of *Pterocarpus erinaceus* heartwood fraction (PES39) was characterised p-ethoxylphenylpropanoic acid (Table 1).

Characterization of PES23 as mixture of sitosterol, stigmasterol and cycloeucalenol

Pterocarpus erinaceus sawdust fraction (PES-23) was observed from its proton NMR spectrum (Table 1) to be a mixture of sitosterol, stigmasterol and cycloeucalenol.

Table 1: Identified and Characterized Compounds from *Pterocarpus erinaceus*

Plant part	Fraction	Identified compound	Class of organic compound	Structure of Compound
Stem bark	PE17	Friedelane-3-one	Terpenoid	
Stem bark	PE25	Lupeol ($C_{30}H_{50}O$)	Triterpenoid	
Heartwood	PES30	Angolensin ($C_{16}H_{16}O_4$); a-methyldeoxybenzoin	Isoflavonoid	
Heartwood	PES39	p-ethoxylphenylpropanoic acid	_	
Heartwood	PES23	A mixture of sitosterol, stigmasterol and cycloeucalenol similar to ESS37	Sitosterol and stigmasterol	_

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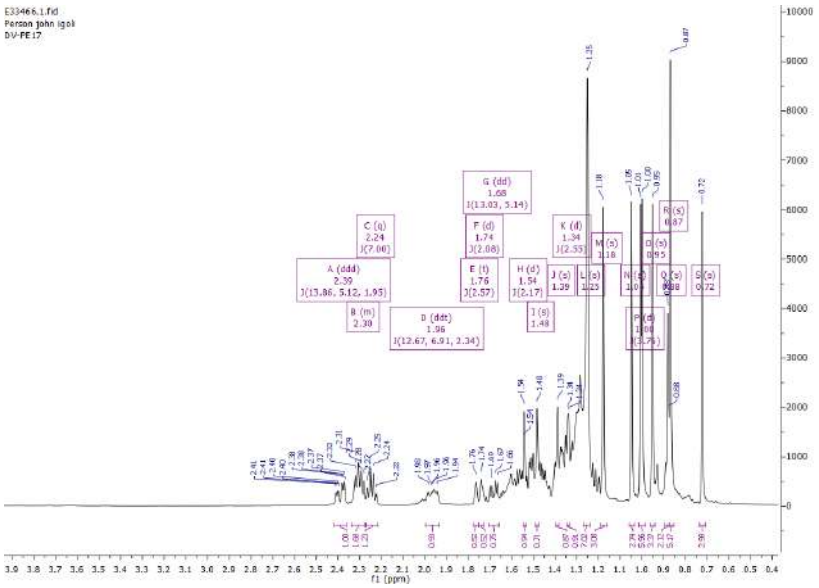

Figure 1: Proton NMR Spectrum of *Pterocarpus erinaceus* Stem Bark Fraction (PE-17) Characterized as Friedelane-3-one

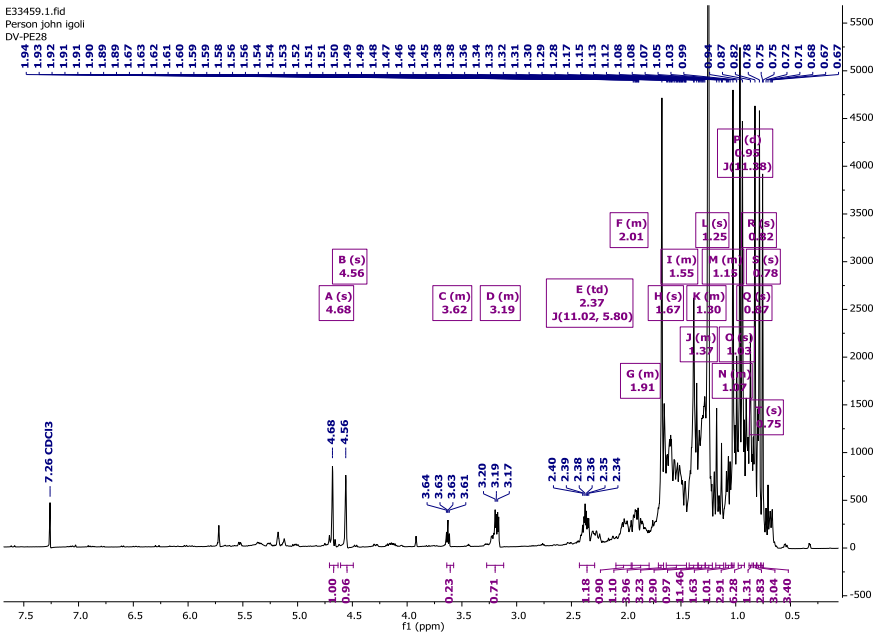

Figure 2: Proton NMR Spectrum of *Pterocarpus erinaceus* Stem Bark fraction (PE-25) Characterized as Lupeol

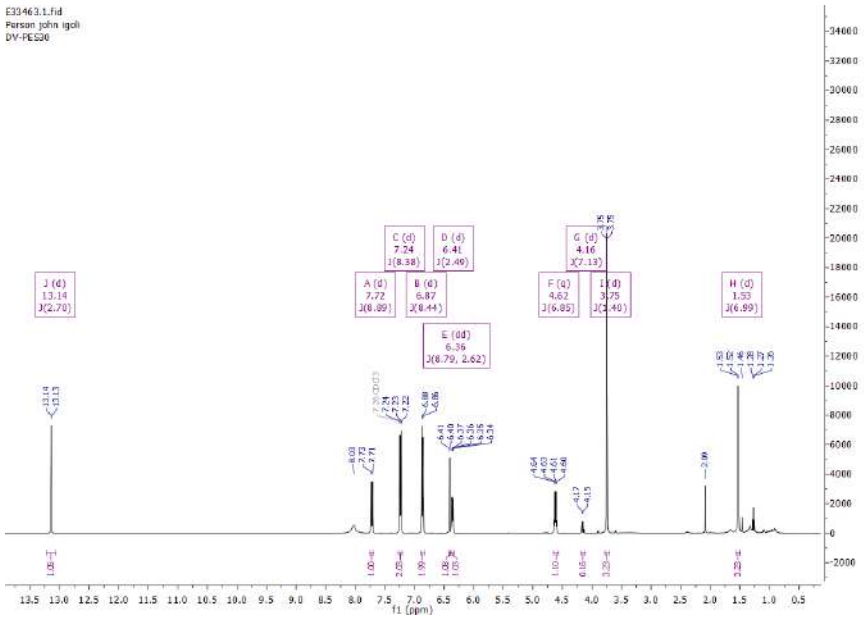

Figure 3: Proton NMR Spectrum of *Pterocarpus erinaceus* heartwood Fraction (PES-30) Characterized as Angolensin

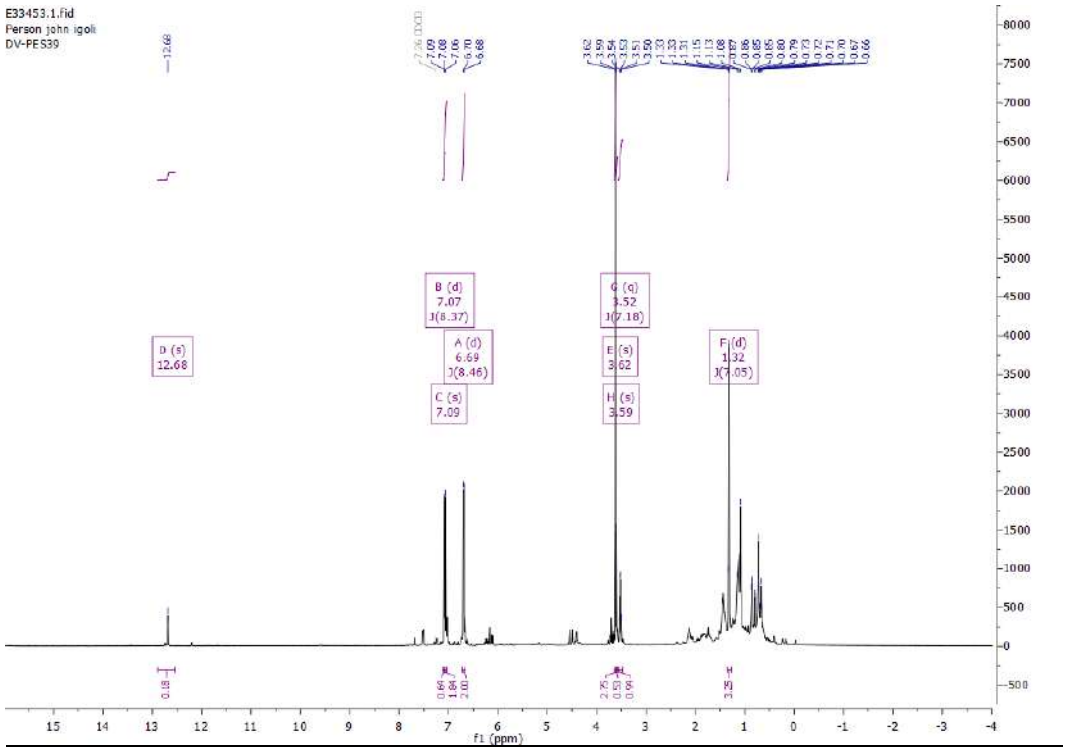

Figure 4: Proton NMR Spectrum of *Pterocarpus erinaceus* heartwood fraction (PES-39) Characterized as p-ethoxylphenylpropanoic acid

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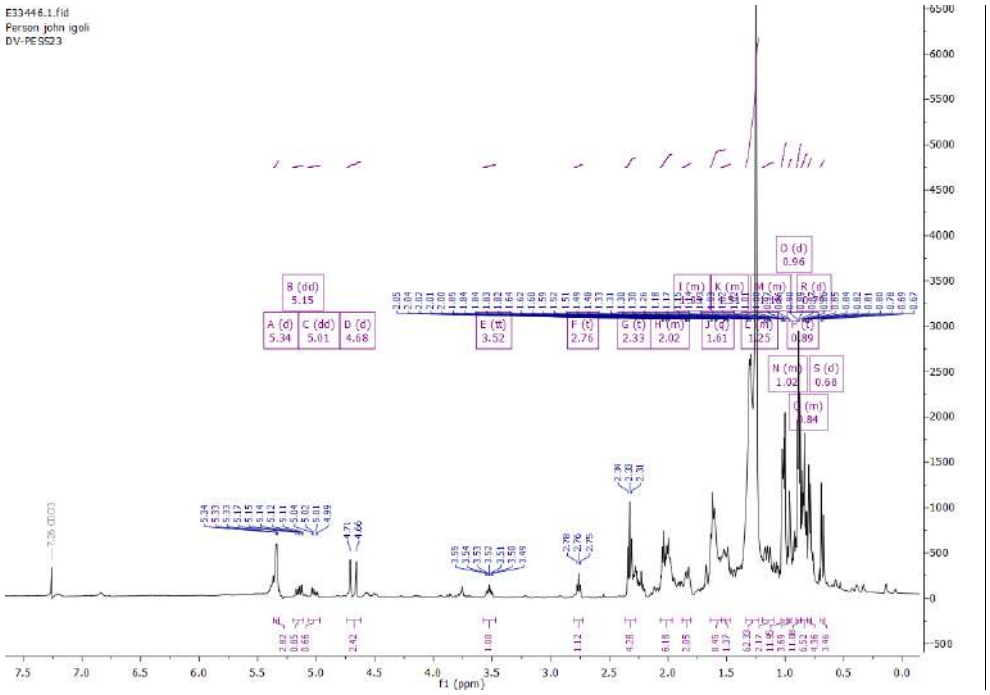

Figure 5: Proton NMR Spectrum of *Pterocarpus erinaceus* heartwood fraction (PES-23) Characterized as a Mixture of Sitosterol, Stigmasterol and Cycloeucalenol

Antifungal activities and zone of inhibition (ZOI) of *P. erinaceous* fractions on test fungi

The results of antifungal activities and zone of inhibition of *P. erinaceous* fractions (PES-50, PES-53, PES-43, PES-47, PES-24, PES-73, PE-15 and PE-26) on test fungi are presented in Table 2. *Aspergillus fumigatus, Fibroporia vaillantii, Fomitopsis pinicoca, Phaeolus schweinitzii, Rhizopus* sp. and *Sclerotium rolfsii were* sensitive to PES50 at ZOI of 20 mm, 18 mm, 20 mm, 18 mm, 21 mm, and 20 mm, respectively.

Minimum inhibition concentration (MIC) of *P. erinaceous* fractions against test fungi

The minimum inhibition concentration (MIC) of *P. erinaceous* fractions (PES50, PES53, PES43, PES47, PES24, PES73, PE17 and PE25) against test fungi (Table 3) reveals that at 50 *µg/mL,* PES50 inhibited the growth of *Aspergillus fumigatus, Fomitopsis pinicoca, Rhizopus* sp., and *Sclerotium rolfsii,* while at 100 *µg/mL, Fibroporia vaillantii* and *Phaeolus schweinitzii* growth were inhibited. At MIC of 50 *µg/mL*, PES53 compound stopped the growth of *Aspergillus fumigatus, Fibroporia vaillantii, Phaeolus schweinitzii*, and *Rhizopus* sp., and *Serpula lacrymans* pathogens.

Minimum fungicidal concentration (MFC) of *P. erinaceous* fractions against test fungi

The Minimum fungicidal concentration (MFC) of *P. erinaceous* fractions on test fungi (Table 3) reveals that at 200 *µg/mL, P. erinaceous* heartwood fractions (PES50, PES53, PES43, and PES47) completely inhibited *Aspergillus fumigatus, Fibroporia vaillantii, Fomitopsis pinicoca, Phaeolus schweinitzii, Rhizopus* sp. and *Sclerotium rolfsii* whereas it was only PES47 fraction that was able to kill *Coniophora puteana*. Minimum fungicidal concentration (MFC)of 200*µg/mL was the most potent concentration necessary to kill the test pathogens by any of the fractions.*

Table 2: Sensitivity and zone of inhibition of *Pterocarpus erinaceous* fractions against test fungi

S/N	Test fungi	Zone of Inhibition (mm) of *Pterocarpus erinaceus* Fractions (100*µg/mL*)								Zone of Inhibition (mm) of Antifungal (100*µg/mL*)		
		PES 50	PES 53	**PES 43**	**PES 47**	**PES 24**	**PES 73**	**PE 17**	**PE 25**	**Fulcin**	**Ketoconazole**	**Fluonazole**
1	*Aspergillus fumigatus*	20	23	23	22	20	23	20	0	29	25	0
2	*Coniophora puteana*	0	0	0	23	23	22	0	18	31	0	0
3	*Fibroporia vaillantii*	18	20	20	0	0	0	19	24	0	0	0
4	*Fomitopsis pinicoca*	20	0	21	20	22	19	18	20	28	0	0
5	*Gloeophyllum sepiarium*	0	0	22	20	21	0	20	0	0	28	29
6	*Phaeolus schweinitzii,*	18	21	0	18	20	21	20	18	25	0	0
7	*Rhizopus* sp.	21	20	20	0	0	0	0	20	29	27	0
8	*Serpula lacrymans*	0	22	0	19	0	0	0	0	30	30	0
9	*Sclerotium rolfsii*	20	0	22	17	0	20	21	0	0	25	0

Key: PE = *Pterocarpus erinaceous* stem bark, PES = *Pterocarpus erinaceous* sawdust, ZOI < 10 mm is inactive; 10 -13 mm is partially active; 14 -19 mm is active, and >19 mm is very active *(Guevara, 2005)*

Table 3: Minimum Inhibition Concentration and Minimum Fungicidal Concentration of *P. erinaceous* against test fungi

S/No.	Test Fungi	PES50 (*µg/mL*)		PES53 (*µg/mL*)		PES43 (*µg/mL*)		PES47 (*µg/mL*)		PES24 (*µg/mL*)		PES73 (*µg/mL*)		PE17 (*µg/mL*)		PE25 (*µg/mL*)	
		MIC	**MFC**	**MIC**	**MFC**	**MIC**	**MFC**	**MIC**	**MFC**	**MIC**	**MFC**	**MIC**	**MFC**	**MIC**	**MFC**	**MIC**	**MFC**
1	*Aspergillus fumigatus*	50	200	50	200	50	200	50	200	**50**	200	**50**	200	**50**	200	100	R
2	*Coniophoraputeana*	R	R	R	R	R	R	50	200	**50**	200	**50**	200	R	R	**50**	200
3	*Fibroporia vaillantii*	100	200	50	200	50	200	R	R	R	R	R	R	100	200	**50**	100
4	*Fomitopsis pinicoca*	50	200	R	R	50	200	50	200	**50**	200	100	200	100	200	R	200
5	*Gloeophyllum sepiarium*	R	R	R	R	50	200	50	200	**50**	200	R	R	**50**	200	R	R
6	*Phaeolus schweinitzii,*	100	200	50	200	R	R	100	200	**50**	200	**50**	200	**50**	200	100	200
7	*Rhizopus* sp.	50	200	50	200	50	200	R	R	R	R	R	R	R	R	**50**	200
8	*Serpula lacrymas*	R	R	50	200	R	R	100	200	R	R	R	R	R	R	R	R
9	*Sclerotium rolfsii*	50	200	R	R	50	200	100	200	R	R	**50**	200	**50**	200	R	R

Key: PE = *Pterocarpus erinaceous* stem bark; **PES** = *Pterocarpus erinaceous* sawdust; **R** = Resistance; **MIC** = Minimum inhibition concentration, **MFC =** Minimum fungicidal concentration

DISCUSSION

Angolensin, p-ethoxylphenylpropanoic acid; and a mixture of sitosterol, stigmasterol and cycloeucalenol were characterised from *P. erinaceus* heartwood fractions. Meanwhile friedelane-3-one and lupeol were characterised from *P. erinaceus* stem bark fractions. To the best of our knowledge, p-ethoxylphenylpropanoic acid has not been reported previously in *P. erinaceus.*

Tittikpina *et al.* (2018) isolated friedeline, 2, 3 dihydroxypropyloctacosanoate, a mixture of β-sitosterol, stigmasterol and campesterol and β-sitosteryl-β-D-glucopyranoside compounds from the leaves, trunk bark and roots of *P. erinaceus.* In India, friedelane-3-one compound was reported in *Tragia involucrate*, *Ficus mysorensis* leaves and in the root bark of *Terminalia avicennioides* (Sundaram *et al.*,

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2009; Mann *et al.,* 2011Abbass *et al.,* 2015). In Nigeria, friedelane-3-one was reported from the stem bark of *Prosopis africana*, *Hymenocardia wallichii*, *Garcinia polyanta* and *Hymenocardia acida* as well as stem bark of *P. erinaceus* and roots of *Pterocarpus erinaceus* (Yenjai *et al.,* 2005; Meli *et al.,* 2005; Igoli and Gray 2008; Igoli and Gray 2008; Noufou *et al.,* 2012; Abah *et al.,* 2014; Noufou *et al.,* 2017). Friedelin had previously been described to possess anti-feedant and anti-inflammatory properties (Duke, 1992); hepatoprotective (ability to prevent damage to the liver) activity in rat (Dzubak *et al.* 2006); anti-bacterial and anti-candida (antifungal) activities at MIC of 19.53 µg/mL (Kuete *et al.,* 2007).

Angolensin was reported in the spectral data of *Erythrina poeppigiana* roots; heartwood (sawdust) of *Pterocarpus angolensis* and heartwood (sawdust) of *Pterocarpus indicus* and possess active antifungal properties (Bezuidenhoudt *et al.,* 1980; Pilotti *et al.,* 1995; Sato *et al.,* 2003). Angolensin with a systematic name as 1-(2,4-dihydroxyphenyl)-2-methoxyphenylpropan-1-one, is a flavonoid of exceptional structure which has been confined to *Pterocarpus* and *Pericopsis* species. Beta-sitosterol was reported to inhibit the growth of *Staphylococcus aureus* at a concentration of 32 µg/mL. Stigmasterol isolated from the stem bark of *Neocarya macrophylla* had an active and broad-spectrum antifungal and antibacterial agent. Plant sterols are considered as an increasingly essential function in the healthcare industry (Mbambo *et al.,* 2012; Doğan *et al.,* 2017; Yusuf *et al.,* 2018).

Lupeol was isolated as an amorphous white powder in *Ficus mysorensis* leaves, from the stem barks of *Lonchocarpus sericeus* and *Faidherbia albida,* in the flower of banana and banana peel, in the root bark of *Ficus sycomorus* (Abdullahi *et al.,* 2013; Ramith *et al.,* 2014; Hongmei *et al.,* 2015; Abbass *et al.,*2015; Kashimawo *et al.,* 2017). Lupeol is pharmacologically active in treating various diseases such as wound healing, diabetes, cardiovascular disease, kidney disease, and arthritis; it exhibits antimicrobial properties against a range of common pathogen and possesses anti-hyperglycemic activities. Lupeol also play a role in wound healing (Ahmed *et al.,* 2010; Siddique and Saleem, 2011; Ramith *et al*., 2014).

Pterocarpus erinaceus fractions were active against the nine test fungi at zone of inhibition ranging from17 – 24 mm. Although *Fibroporia vaillantii* fungus was resistant to the 3 antifungal agents used as control in this study, they were sensitive to 5 out of the 8 fractions extracted from stem bark of *P. erinaceus* at zone of inhibition of 18 – 24 mm. These values compare with the zones of inhibition of 25 – 30 mm recorded for the 3 antifungal agents. Guevara (2005) reported the standard zone of inhibition of antibiotics and its corresponding inferences values as < 10 mm inactive, 10 - 13 mm partially active, 14-19 mm active, and >19 mm very active. It therefore implies that all fractions from *P. erinaceus* were very active against test wood fungi. The ZOI of all fractions in this study were within 21 mm and 29 mm reported by Ogwuche *et al.* (2014) for *Sesamum indicum* isolates. Omachi (2015) recorded ZOI of 20 mm - 21 mm for isolates from *Morinda lucida* leaf against fungi and 25 - 30 mm against fungi for isolates from *Uapaca togoensis*s stem bark.

Minimum inhibition concentration (MIC) *of P erinaceous* fractions was active at *50 µg/mL against Aspergillus fumigatus, Coniophora puteana, Fibroporia vaillantii, Fomitopsis pinicoca, Gloeophyllum sepiarium, Phaeolus schweinitzii* and *Rhizopus* sp. At *200 µg/mL, test wood fungi were all dead.* This finding agrees with MIC of 50 µg/mL and MFC of 200 µg/mL reported by Ekhuemelo *et al.* (2019b) from heartwood and stem bark of *E. suaveolens* fraction and compounds on *Coniophora puteana, Aspergillus fumigatus, Fibroporia vaillantii, Gloeophyllum sepiarium, Fomitopsis pinicoca, Rhizopus* spp. and *Phaeolus schweinitzii* fungi. Minimum fungicidal concentrations were defined as the least drug concentrations that yielded < 3 colonies (approximately 99 to 99.5% killing activity). *Mitracarpus scaber* 80% MeOH

extract on *Candida albicans, Candida tropicalis* and *Trichophyton rubrum* fungi had MIC and MFC less than 65 µg/mL (Cimanga *et al.,* 2004). Cimanga *et al.* (2004) also reported MIC of 62.5 µg/mL against *Microsporum canis* with a fair fungicidal effect of MFC equals 250 µg/ml while its fungicidal effect against *Aspergillus fumigatus* was moderate as 125 with MIC less than 250 µg/ml. N hexane extract of *Mitracarpus scaber* recorded an active antimycotic activity against *Aspergillus flavus,C. albicans, C. tropicalis, M. canis* and *Trichophyton rubrum* at MIC and MFC < 65 µg/ml (Cimanga *et al.* (2004). Cimanga *et al.* (2004) reported MFC of 125 µg/mL and 62.5 µg/ml for 80% MeOH and n-hexane crude extract of *Mitracarpus scaber,* respectively on *Aspergillus flavus.* The researchers also reported MFC of MFC of 31.25 µg/mL from diethylether isolate of *Mitracarpus scaber.* The effectiveness of *Pterocarpus erinaceous* fractions could be due to the presence of Friedelane-3-one, lupeol, steroids and p-ethoxylphenylpropanoic acid.

CONCLUSION

The present study reported a novel compound of p-ethoxylphenylpropanoic acid from heartwood of *Pterocarpus erinaceus* as well as Friedelane-3-one, lupeol, and a mixture of sitosterol, stigmasterol and cycloeucalenol in both stem bark and heartwood *P. erinaceus* species. The results highlighted anti-fungal activities of compounds from *P. erinaceus* selected wood fungi. This study has provided additional data to encourage the production of wood based preservatives as alternative to synthetic chemicals in the treatment of wood deterioration caused by wood decay fungi.

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