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Insecticidal Activity of Essential oil of *Parquetina nigrescens* (Afzel) Bullock

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Abstract: The essential oil obtained by hydrodistillation of the leaf of *Parquetina nigrescens* (Afzel) Bullock (Asclepiadaceae) was studied for the insecticidal activity using a conventional procedure. Different concentrations (50, 100, 150, 200 and 250 mg/mL) of *P. nigrescens* essential oil prepared separately and diluted in DMSO were tested on the maize weevil, *Sitophilus zeamais*. The essential oil displayed 100% mortality (fumigant toxicity) against *S. zeamais* adults at tested concentration of 150 mg/mL with lethal concentrations (LC_{50}) of 46.14 mg/mL air. This is the first report on the insecticidal activity of essential oil of *P. nigrescens* and may be explore as a potential natural herbal plant for the control of insect pest.

Keywords: Asclepiadaceae, Essential Oil, Insecticidal Activity, *Parquetina nigrescens, Sitophilus zeamais*

1. Introduction

In continuation of our studies on the biological activities essential oils from Nigeria flora [1], we report herein the essential oil constituents and insecticidal activity of *Parquetina nigrescens* (Afzel) Bullock (Asclepiadaceae). It is a perennial with twinning stem and woody base shortly tapering 10-15 cm long, 6-8 cm broad with a smooth long stem on the leaves. It is usually woody at the base and measures between 7-8 m in length. In Oyo State, Nigeria, the leaves have been reputed for treatment of helminthiasis (intestinal worm) and as repellant against insect pests, while the roots are used for the management of rheumatism [2]. Previous report indicated that *P. nigrescens* possess antioxidant properties that can protect against free radical induced ulcer [3, 4]. Extracts of the plant were reported to have exhibited antidiabetic [5, 6] and haematinic [5] effects. In addition, the analgesic, anti-inflammatory and antipyretic [7] activities as well as antisickling [8], antioxidant [9, 10], increases erythrocyte indices/ serum electrolytes [11], antimicrobial [12, 13], antityphoid [14] and antinociceptive [15] potentials of extracts of *P. nigrescens* have been documented.

Parquetina nigrescens has been found to contained cardenoides, glycosides and alkaloids. The phytochemical compounds of *P. nigrescens* included cymarin, strophanthidin, y-strophanthidin glycoside β-sitosterol-β-D-glucoside, α- and β-amyrins [16]. Some compounds such as γ-strophanthin and noradrenaline isolated previously from *P. nigrescens* have shown cardiotonic effect [17]. The only literature report on the essential oil of isolated previously from *P. nigrescens* identified citral (35.0% neral and 53.7% geranial) as dominant compounds [18]. The plant is a source of crude proteins [19]. However, there is no report on the biological activity of the essential oil of *P. nigrescens* in literature.

The aim of the present research was to isolate essential oil from *P. nigrescens* and investigate the insecticidal activity of the plant used as a natural method of protection against insect pest in Nigeria.

2. Materials and Methods

2.1. Plant Collection

Fresh leaves of *P. nigrescens* were obtained from Obafemi

Awolowo way, Konigba Junction, Ago-Iwoye, Ogun State, Nigeria, in May 2016. The plant was identified by Mr. Odewo of the Herbarium, Forestry Research Institute of Nigeria (FRIN), Ibadan, Nigeria. A voucher specimen, FHI 110568, was deposited at the herbarium for future references.

2.2. Hydrodistillation of the Oil

Briefly, 300 g of the pulverized sample were carefully introduced into a 5 L flask and distilled water was added until it covers the sample completely. Hydrodistillation was carried out in an all glass Clevenger-type distillation unit for 4 h according to the British Pharmacopoeia specifications [20]. The volatile oil distilled over water was collected separately in the receiver arm of the apparatus into a clean and previously weighed sample bottles. The oil was kept under refrigeration until the moment of analyses.

2.3. Determination of Insecticidal Activity

The insecticidal activity was evaluated as described previously [21] using the maize weevil (*Sitophilus zeamais*). Different concentrations (50, 100, 150, 200 and 250 mg/mL) of *P. nigrescens* essential oil prepared separately and diluted in DMSO were tested on *S. zeamais*. The appropriate concentrations were applied to filter paper (Whatman number 1, cut into 7 cm diameter) and immediately introduced into Petri dish and sealed. For the control group, the insects were placed in the Petri dish under the same conditions but without the essential oil. Each concentration and control was replicated three times. Insect mortality was determined by observing the recovery of immobilized insects in 12 h intervals up to 72 h. When no movements were observed, insects were considered dead.

2.4. Statistical Analysis

The mean and standard deviation of three experiments were determined. Statistical analysis of the differences between mean values obtained for experimental groups were calculated using Microsoft excel program, 2003. Data were subjected to one way analysis of variance (ANOVA). P values ≤ 0.05 were regarded as significant and P values ≤ 0.01 as very significant. Mortality percentages were calculated by the correction formula for natural mortality in the untreated control [1]. The Lethal concentrations (LC_{50}) values for the insecticidal activity were calculated using probit analysis program, version 1.5.

3. Results and Discussion

The percentage yield of the colourless oil was 0.08% (v/w), calculated on a dry weight basis. Figure 1 (Percentage mortality) and Table 1 (lethal concentrations) displayed the fumigant insecticidal effects of essential oil of *P. nigrescens* against the adults of *S. zeamais*. The results showed the essential oil to be concentration dependent with some inhibitory action on adults of *S. zeamais* after 72 h. At the tested concentrations of 200 and 250 mg/mL and after 24 h, the oil of *P. nigrescens* displayed toxicity towards *S. zeamais* with mortality rate > 80%. At a concentration of 100 mg/mL, the essential oil of *P. nigrescens* showed appreciable toxicicity against *S. zeamais* with mortality rate of 80% after 72 h. However, after 48 h and 72 h and at concentration of 150 mg/mL, *P. nigrescens* oil exhibited toxic to *S. zeamais* with mortality rate of 80% and 100% respectively. In addition, similar mortality rate of 100% were achieved at both 48 h and 72 h with the concentrations of essential oil maintained at 200 and 250 mg/mL, when compared with the controls (Fig 1).

From Tabel 1, it could be seen that the essential oil of *P. nigrescens* after 24 h at all tested concentrations displayed weak lethal concentrations (LC_{50}) of 145.15 mg/mL air towards *S. zeamais*. Also, the fumigant toxicity of the essential improved significantly after 48 h with a total LC_{50} value of 51.87 mg/mL air. Finally, the essential oil showed potential fumigant toxicity against *S. zeamais* adults with 100% mortality at concentration (150 mg/mL). The lethal concentrations $LC_{50,}$ was calculated to be 46.14 mg/mL air. A comparison of the result with standard insecticidal compounds Allethrin (LC_{50} 7.40 mg/mL air) and Permethrin (LC_{50} 11.10 mg/mL air) revealed that the essential oil of *P. nigrescens* to have exhibited reasonable toxicity against *S. zeamais* adults. Although, literature information is devoid of insecticidal potential of *P. nigrescens* essential oil, however, insecticidal effects of some essential oils from other plants against the adults of *S. zeamais* and other insect pests have been reported [1, 21, 22].

Therefore, this study showed that *P. nigrescens* essential oil with $LC_{50} < 50.00$ mg/mL air to have a notable insecticidal action on *S. zeamais* adults and may be explore as a potential natural herbal plant.

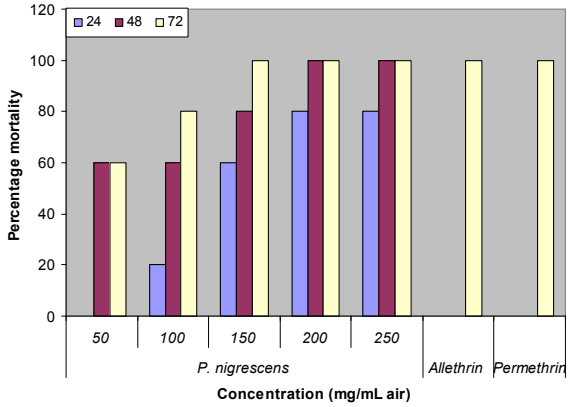

Figure 1. *Percentage mortality of S. zeamais adults at different concentrations of P. nigrescens essential oil over 72 h.*

It is well known that the biological activity of an essential oil may depend on the effect of the major constituents or synergy between the major constituents and some minor compounds [1, 21]. The observed insecticidal activity of essential oil of *P. nigrescens* may be attributed to the compounds present therein. Previously citral (neral and geranial) were identified as the main components of the essential oil of this plant [18]. Essential oil with high contents

of citral [23, 24], geranial and neral [25] have displayed potential insecticidal activity.

Table 1. *Insecticidal activity of P. nigrescens essential oil against S. zeamais*[a]

	LC_{50} (95 CI)[b]		
	24[c]	**48**	**72**
P. nigrescens	145.15 (89.30 – 207.20)	51.87 (0.00 – 92.33)	46.14 (0.00- 75.37)
Allethrin[d]	-	-	7.4 (2.01 – 14.65)
Permethrin[d]	-	-	11.10 (6.03 – 23.19)

[a] (n= 3, X ± SEM; [b]LC_{50} - Lethal concentrations with 50% mortality; [c] Time h; [d] Control

4. Conclusion

The present study provides information on the insecticidal activity of essential oil *P. nigrescens*. The result revealed that *P. nigrescen* oil possessed moderate insecticidal activity relative to the controls and may be use for the control of the insect pest.

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