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 (LC₅₀) 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 repellent 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 antinoiceptive [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, γ-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
Nigeria, in May 2016. The plant was identified by Mr. Odewo previously [21] using the maize weevil (Sitophilus zeamais) 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 toxicity 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 Table 1, it could be seen that the essential oil of P. nigrescens after 24 h at all tested concentrations displayed weak lethal concentrations (LC50) of 145.15 mg/mL air towards S. zeamais. Also, the fumigant toxicity of the essential oil improved significantly after 48 h with a total LC50 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 LC50, was calculated to be 46.14 mg/mL air. A comparison of the result with standard insecticidal compounds Allethrin (LC50 7.40 mg/mL air) and Permethrin (LC50 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 LC50 < 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.

3. Results and Discussion

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 (LC50) values for the insecticidal activity were calculated using probit analysis program, version 1.5.

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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.

2.2. 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

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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*

<table>
<thead>
<tr>
<th></th>
<th>LC50 (95 CI)</th>
<th>24h</th>
<th>48h</th>
<th>72h</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. nigrescens</em></td>
<td>145.15 (89.30 – 207.20)</td>
<td>51.87 (0.00 – 92.33)</td>
<td>46.14 (0.00 – 75.37)</td>
<td></td>
</tr>
<tr>
<td>Allethrin</td>
<td>-</td>
<td>-</td>
<td>7.4 (2.01 – 14.65)</td>
<td></td>
</tr>
<tr>
<td>Permethrin</td>
<td>-</td>
<td>-</td>
<td>11.10 (6.03 – 23.19)</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) (n= 3, X ± SEM; \(^2\) LC50 - Lethal concentrations with 50% mortality; \(^3\) Time h; \(^4\) Control

4. Conclusion

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

References


