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# Bioacaricidal properties of *Passiflora edulis* (Passifloraceae) vine methanol extract on two species of cattle ticks

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**ABSTRACT**

**Background:** Cattle tick infestations, particularly those caused by *Amblyomma variegatum* and *Argas argas*, pose a significant challenge to livestock productivity in tropical regions. Overdependence on synthetic acaricides has led to widespread resistance, environmental pollution, and toxic residues in animal products, highlighting the need for safer, environmentally friendly alternatives. This study examined the bioacaricidal activity of *Passiflora edulis* (Passifloraceae) vine methanol extract against two economically important cattle tick species.

***Methods*:** Fresh vines were collected, authenticated, shade-dried, ground, and soaked in absolute methanol. The crude extract was prepared in concentrations of 10, 20, 40, and 80 mg/mL, and applied topically (20 µL) to groups of ten ticks per species in triplicate. Mortality was recorded over 24 hours, and results were analyzed using Two-way ANOVA followed by Dunnett's post hoc test.

**Results:** The extract showed strong, concentration-dependent activity against both tick species. Complete mortality of *A. variegatum* was achieved at 10 mg/mL within 3 hours, while *A. argas* required 20 mg/mL to reach 100% mortality within 2 hours. At lower concentrations, mortality increased gradually, with significant differences ($p < 0.001$) compared to the control group.

***Conclusion:*** These results represent the first report of acaricidal activity of *P. edulis* vine extract, emphasizing its potential as a sustainable alternative to synthetic acaricides in integrated livestock parasite control. Further research should focus on isolating active compounds, understanding their mechanisms, and conducting field validation.

***Keywords***: *Passiflora edulis*, bioacaricide, *Amblyomma variegatum*, *Argas argas*, ethnoveterinary medicine

## 1 INTRODUCTION

*Passiflora edulis* Sims (Passifloraceae), commonly known as passion fruit, is a tropical vine highly valued for its nutritious fruits and diverse therapeutic uses. In ethnomedicine, it has been used to treat hypertension, hepatoprotective, and lung-protective activities, as well as antidiabetic, sedative, antidepressant, and anxiolytic-like effects [1]. Phytochemical analysis has identified various bioactive compounds, including flavonoids (orientin, isoorientin, vicenin-2), phenolic acids, triterpenes [2], tannins [3], and glycosides [4], which are linked to antioxidant, anti-inflammatory, hepatoprotective, and neuroprotective effects [5]. Cattle tick infestations, primarily caused by *Amblyomma variegatum* and *Argas argas*, pose significant challenges to livestock production in tropical regions [6]. These ectoparasites cause blood loss, transmit diseases, and reduce productivity [7]. Control is primarily achieved through synthetic acaricides; however, repeated and unrestricted use has resulted in acaricide resistance, environmental pollution, and chemical residues in meat and milk [8,9]. Plant-based acaricides, containing biodegradable bioactive compounds, are increasingly regarded as safer and eco-friendly alternatives [10]. While *P. edulis* has been extensively studied for its pharmacological properties, its potential as an acaricide remains largely unexplored. This study evaluates the bioacaricidal efficacy of *P. edulis* vine methanol extract against *A. variegatum* and *A. argas*, aiming to support ethnoveterinary approaches for sustainable cattle tick management.

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## 2 MATERIALS AND METHODS

### 2.1 Materials

*2.1.1 Biological Materials*

*A. variegatum* and *A. argas*

*2.1.2 Chemicals and Reagents*

Methanol (99.9%) and distilled water

*2.1.3 Equipment and Apparatus*

Glass petri dishes, micropipette, micropipette tips, 50 mL beakers, 250 mL conical flask, glass funnel, and sample bottles

### 2.2 Methods

**2.2.1 Plant collection and authentication:**

Fresh vines (0.5 kg) of *P. edulis* were collected in July 2023 from Ibesikpo Asutan Local Government Area, Akwa Ibom State, Nigeria. Authentication was conducted by Prof. Margaret Bassey (Department of Botany and Ecological Studies, University of Uyo), and a voucher specimen (UUH4422) was deposited in the departmental herbarium.

*2.2.2 Drying and preparation*

The collected vines were cleaned, chopped, and shade-dried for 10 days, then pulverized to fine powder and stored in airtight polyethylene bags until extraction.

*2.2.3 Extraction*

The powdered plant material was macerated in absolute methanol for 72 hours, filtered, and concentrated. The crude extract was weighed, labelled, and stored at 4°C until use.

*2.2.4 Tick collection and identification*

Ticks were obtained from infested cattle at the Nasarawa cattle market in Akwa Ibom State, with assistance from local herders. Specimens were handpicked and placed in aerated containers. Morphological identification differentiated *A. variegatum* (hard tick) and *A. argas* (soft tick).

*2.2.5 Bioassay protocol*

Serial dilutions of the extract (10, 20, 40, 80 mg/mL) were prepared in distilled water. Ten ticks per species were placed in Petri dishes, and 20 µL of extract was applied topically using a micropipette. Controls received 20 µL of distilled water. Mortality was recorded over 24 hours. Each treatment was conducted in triplicate [11].

### 2.3 Statistical analysis

Data are expressed as mean ± SEM. Two-way ANOVA followed by dunnett and Tukey's post hoc tests were used to compare treatments (GraphPad Prism v6.01), with significance set at $p < 0.05$.

## 3 RESULTS

### 3.1 Tick identification

The tick species employed in this study were identified through morphological comparison with standard taxonomic keys and reference images. The identified species included *Amblyomma variegatum* (Figure 1) and *Argas argas* (Figure 2)

Figure 1: *A. variegatum*

Figure 2: *A. argas*

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### 3.2 Acaricidal effect against *A. variegatum*

No mortality was detected in the water-treated controlgroup. Conversely, the plant extract demonstrated a significant ($p < 0.001$) concentration and time-dependent acaricidal effect against *A. variegatum*. At 5 mg/mL, the extract caused 40.00 ± 5.77% mortality within 0.5 h, which rose to 86.70 ± 3.33% after 3 h. Complete mortality (100%) was recorded at concentrations of 10, 20, and 40 mg/mL within the 3 h exposure period (Figure 3).

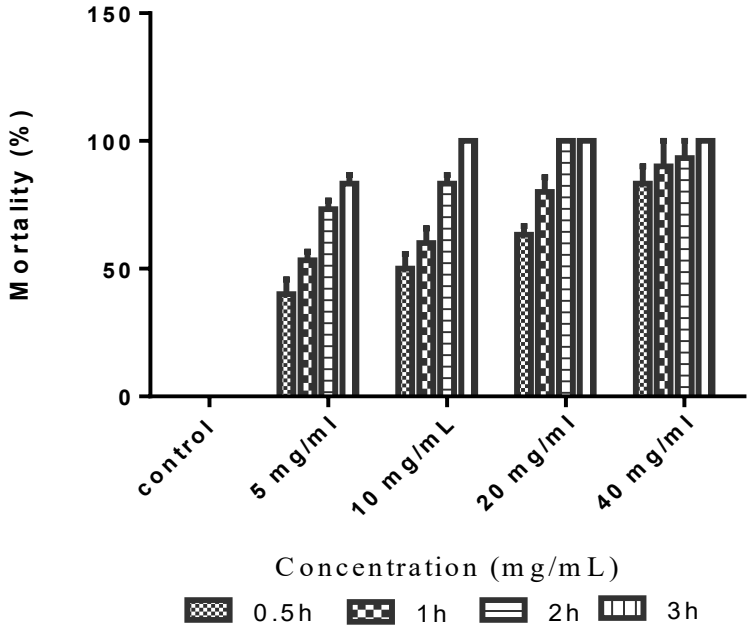


**Figure 3:** Effect of *Passiflora edulis* vine methanol extract on *A. variegatum*.
Each bar represents the mean ± SEM. Results are significant at $p<0.001$. n=10

### 3.3 Acaricidal effect against *A. argas*

The control group that received water treatment showed no mortality. However, the plant extract demonstrated a significant ($p < 0.001$) time- and concentration-dependent acaricidal effect against A. argas. Within 0.5 hours, the extract caused 33.30 ± 3.33% mortality at 5 mg/mL, and after 3 hours, this increased to 90.00 ± 00.00%. During the 2 h exposure, complete mortality (100%) was observed at doses of 20 and 40 mg/mL (Figure 4).

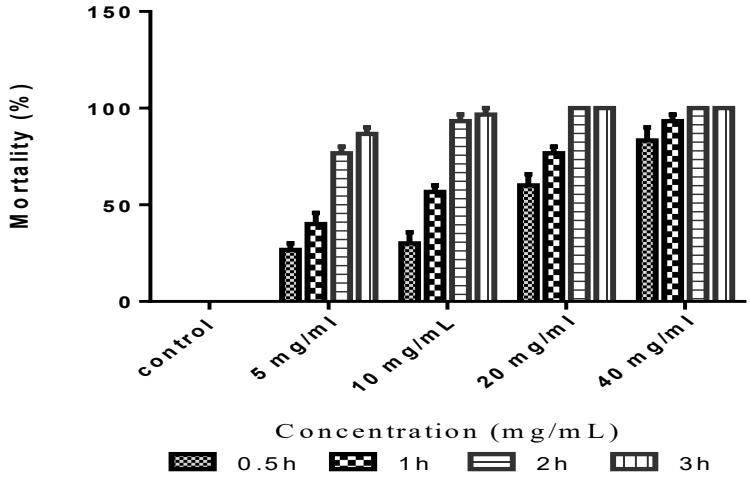


**Figure 4:** Effect of *Passiflora edulis* vine methanol extract on *A. argas*.
Each bar represents the mean ± SEM. Results were significant at $p < 0.001$( n=10).

## 4 DISCUSSION

The present findings demonstrate that the methanol extract of *P. edulis* vine demonstrates significant acaricidal activity against both *A. variegatum* and *A. argas*, with mortality rates strongly dependent on both dose and exposure time. The difference in sensitivity between species may be due to variations in cuticle composition, penetration resistance, and physiological responses [12]. The intense activity is likely due to the plant's secondary metabolites, such as flavonoids, alkaloids, and tannins, which have been reported to disrupt neuromuscular functions, inhibit acetylcholinesterase, and weaken tick cuticular integrity [13]. This finding aligns with previous reports on plant extracts from *Azadirachta indica, Tephrosia vogelii* [14], and *Lippia javanica* [15], which have demonstrated similar acaricidal effects. Given its rapid onset, biodegradability, and low environmental toxicity, *P. edulis* extract could serve as an environmentally friendly alternative to synthetic acaricides. Its potential use includes organic livestock farming and managing acaricide-resistant tick strains.

## 5 CONCLUSION

The methanol extract of *Passiflora edulis* vine showed potent acaricidal activity against both hard and soft cattle ticks, achieving complete mortality at comparatively low concentrations. These findings highlight its potential for development as a plant-based acaricide. Future research should focus on isolating active constituents, elucidating mechanisms of action, and assessing effectiveness in field conditions.

## DECLARATIONS

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**Conflict of Interest**

The authors declare no conflict of interest.

**Authors' Contributions**

Daniel Ambe – conceived and designed the study, performed data analysis, interpretation and drafting of the manuscript; Toro-Abasi Hogan – carried out the experimental work and data collection; Offiong Effiong – identified the ticks and contributed to the literature review. All authors critically reviewed the manuscript and approved the final version.

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