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Original Research Article

Phytoscreening of Different Plants for their Repellent Activities against the Bite of *Simulium damnosum*

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Abstract

The leaves extracts of three plants, *Ocimum gratissimum* (scent leaf) *Psidium guajava* (guava leaf) and *Cymbopogon citratus* (lemon grass) were studied for their repellent activities against the bite of *Simulium damnosum*, vector for the transmission of *Onchocerca volvulus*. The leaves were extracted with 95% ethanol and the stocks were diluted with paraffin at a ratio of 9:1 extract and paraffin respectively. The repellent activities of the extracts were investigated using human baits at different locations in the campus of Abraham Adesanya Polytechnic, Ijebu North Local Government. The result showed that the leaf extract of *O. gratissimum* had the highest repellent potentials (80%) and *C. citratus* (56%) while *P. guajava* (40%). The air dried extract showed more efficacy than the oven dried with the results of 92%, 64% and 60% respectively. The results from this research had shown that the leaf extracts of some plants like *O. gratissimum, C. citratus* and *P. guajava* had repellent activities against the bite of *S. damnosum*.

Keywords

Efficacy
Insect repellent
Plant extracts
Simulium damnosum

Introduction

Onchocerciasis, commonly known as "River Blindness" still remains a significant public health burden in developing countries, especially in sub-Saharan African. Onchocerciasis in humans is caused by the filarial nematode parasite, *Onchocerca volvulus*, and is one of the leading infectious blinding disease agents of the developing world (Thylefors et al., 1995; WHO, 2005), second only to Trachoma. The infective larvae of the parasite is transmitted by *Simulium* species (blackflies) that breed in fast flowing rivers and streams (Duke, 1990; WHO, 2005). The prevalence of infection and disease in a community is related to proximity to riverine breeding sites of the blackflies with the highest burden of infection and disease in communities adjacent to the rivers (Taylor et al., 2010). Black flies have preferences for a wide range of individual host species. Adult females feed on the blood of humans, cattle, horses, sheep, goats, poultry, other livestock and wild mammals and birds. Each black fly species may prefer one type of host over another. Black flies are daytime

biters preferring low wind conditions. They are attracted to host from a distance by smell, heat and by sight (Hoerauf et al., 2003).

The bites of female black flies cause itching which may persist for several days. The flies bite by cutting into the skin and feeding on the pool of blood that forms in the hole they make. Anticoagulants injected into the feeding site by black flies can cause mild to severe allergies reaction in sensitive individuals. Strong reactions include fever, nausea, and allergic dermatitis (WHO, 2005).

Ivermectin is currently the sole drug approved by the World Health Organization (WHO) for use in onchocerciasis control programmes (Awadzi et al., 2003; Taylor et al., 2010; WHO, 2005). It is administered biannually or annually to reduce morbidity, disability and lower transmission (Boussinesq et al., 1997).

Materials and methods

Study area

The study took place at Abraham Adesanya Polytechnic (AAP) Ijebu-Igbo in Ijebu North area, Ogun State. AAP is situated along Dagbolu/Akanran/Ibadan Road. AAP has a population of about 5000 comprising of both student and staff. It lies in latitude 6º58′ 0" North, and longitude 40º 0′ 0" East.

Plant selection and extract preparation

Ocimum gratissimum (scent leaf), *Cymbopogon citratus* (lemon grass) and *Psidium guajava* (guava leaf) were selected based on their reported toxicity to insect vectors (Usip et al., 2006; Adeleke et al., 2009).

For each selected plant, the leaves were cut into shreds. One part was air-dried at room temperature, while the other was oven-dried at 35ºC to 40ºC for two hours.

Air-dried and oven-dried leaves of each plant (100 g) were soaked separately in 200ml of 95% ethanol in conical flasks and allowed to stand for 48h. Afterwards, each mixture was sieved using filter paper. The extracts were kept in refrigerator.

Fly catching and repellent test method

Five consented fly collectors aged between 18 and 30yrs were used to test the repellent activity of each of the selected plants in each site. Three of the fly collectors served as experimental subject and the remaining one acted as control. Each of the extracts was diluted with paraffin at 90mls of the extract to 10 ml of paraffin. The diluted extract of 3 ml was applied topically on the legs and forearms by the fly collectors. Each collector rubbed the extracts. The control fly collector applied the paraffin for the duration of the experiment. At each collecting site, the fly collectors were 5m apart and sat exposing their lower legs and forearms from 7a.m to 4p.m daily for 3 days. The collecting sites were near the stream which flows through the north part of AAP, the School of Science area and the Student Affairs Office area. Any fly that landed on the exposed legs and forearms was caught before it sucked blood by inverting a small catching tube over it. The tubes were then immediately covered. All tubes containing flies were labeled to indicate time, date and place of capture (Sam-Wobo et al., 2011).

Results and discussion

The results from this research had shown that the leaf extracts of the plants like *O. gratissimum*, *C. citratus* and *P. guajava* had repellent activities against the bite of *S. damnosum*. The result showed that the leaf extract of *O. gratissimum* had the highest repellent potentials (80%) and *C._citratus* (56%) while *P. guajava* (40%). The air dried extract showed more efficacy than the oven dried with the results of 92%, 64% and 60% respectively. The results of the present study are given in Tables 1-6 and Figs. 1 and 2.

Table 1. Repellent activities of some oven-dried plant extracts [at the river Odo-poly (7.00 AM–4.00 PM)]

Plants extract used	Number of flies collected		% Protection
	Control bait	Experimental bait	
O. gratissimum	125	25	80
C. citratus	145	55	56
P. guajava	165	75	40

Table 2. Repellent activities of some air-dried plant extracts [at the river Odo-poly (7.00 AM–4.00 PM)]

Plants extract used	Number of flies collected		% Protection	Time spent
	Control Bait	Experimental Bait		
O. gratissimum	125	10	92	25 seconds
C. citratus	145	45	64	50 seconds
P. guajava	165	50	60	60 seconds

Table 3. Repellent activities of some oven-dried plant extracts [at School of Science (7.00 AM–4.00 PM)]

Plants extract used	Number of flies collected		% Protection	Time spent
	Control Bait	Experimental Bait		
O. gratissimum	125	25	80	60 seconds
C. citratus	125	55	56	90 seconds
P. guajava	125	75	40	100 seconds

Table 4. Repellent activities of some air-dried plant extracts [at School of Science (7.00 AM–4.00 PM]

Plants extract used	Number of flies collected		% Protection	Time spent
	Control Bait	Experimental Bait		
O. gratissimum	125	10	92	25 seconds
C. citratus	125	45	64	50 seconds
P. guajava	125	50	60	60 seconds

Table 5. Repellent activities of some oven-dried plant extracts [at Student Affairs Office (7.00 AM–4.00 PM)]

Plants extract used	Number of flies collected		% Protection	Time spent
	Control Bait	Experimental Bait		
O. gratissimum	125	25	80	60 seconds
C. citratus	125	55	56	90 seconds
P. guajava	125	75	40	100 seconds

Table 6. Repellent activities of some air-dried plant extracts [at Student Affairs Office (7.00 AM–4.00 PM)]

Plants extract used	Number of flies collected		% Protection	Time spent
	Control Bait	Experimental Bait		
O. gratissimum	125	10	92	25 seconds
C. citratus	125	45	64	50 seconds
P. guajava	125	50	60	60 seconds

Fig. 1: Total number of flies caught during the study period in air dried extract application.

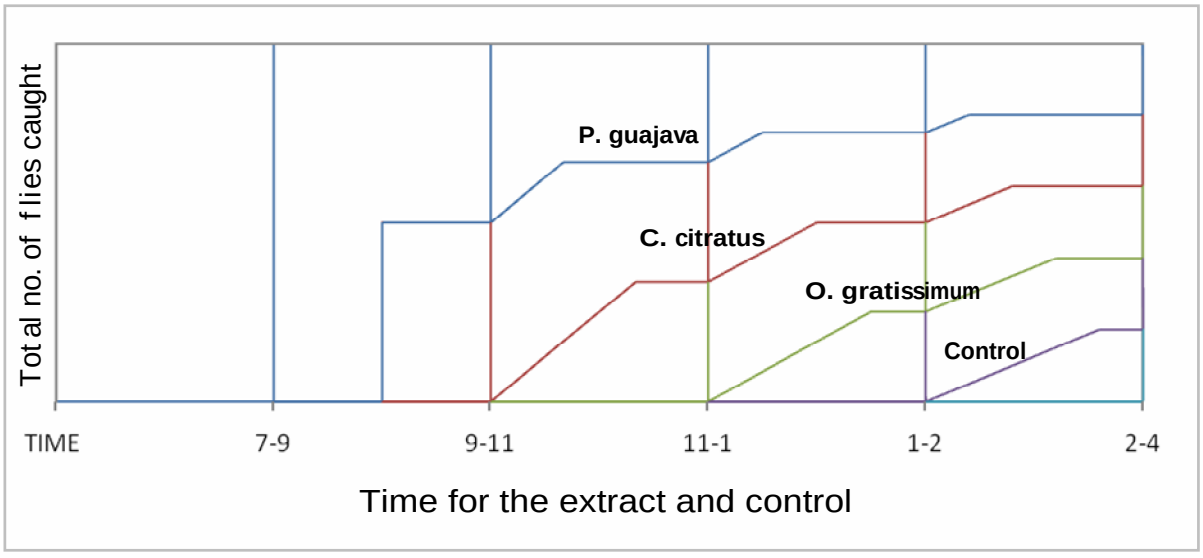
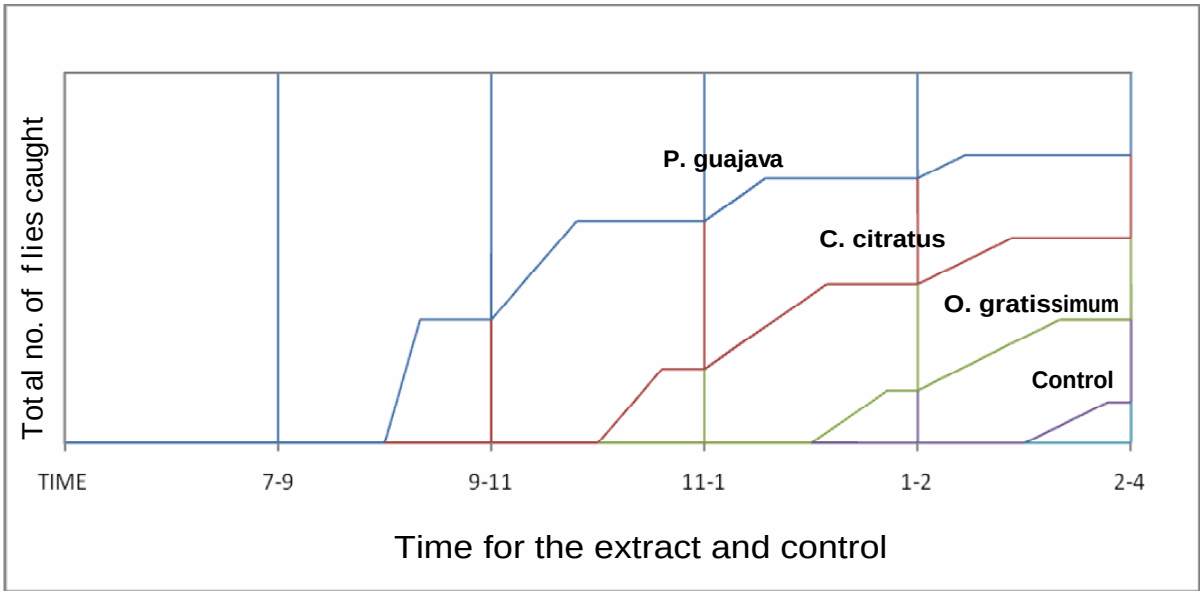


Fig. 2: Total number of flies caught during the study period in oven dried extract application.



The air dried leaf extracts showed high percentage of protection and protection time compared to oven dried. It was also observed that *O. gratissimum* had the highest percentage protection and protection time which exhibit substantial repellent activities against *S. damnosum* followed by *C. citratus* in both air-dried and oven-dried extracts. This observation was similar to the earlier reports on toxicity of these plants against insect vectors (Usip et al., 2006).

The percentage protection and protection time of these two plants extracts, especially the *O. gratissimum* could appreciably serve as great relief to the people living in onchocerciasis endemic areas where black flies constitute both nuisance and vector of the disease (onchorcerasis). The application of these plants extracts would reduce the vector access to the already reduced microfilaria load achieved through ivermectin treatment, thereby reducing disease transmission and the discomfort from bites (Sam Wobo et al., 2011).

However, the low percentage protection and protection time observed for *P. guajara* showed that it has poor repellent activities against the bite of *S. damnosum*, but said to be toxic to the larvae of mosquito and high protection.

Conclusion

In conclusion, the study had shown that the air dried plants extracts are more effective than the oven dried. *C. citratus* and *P. guajava* showed a gradation of repellent activities against the bite of *S. damnosum*. The results obtained most importantly on *O. gratissimum* and *C. citratus* partially are very appreciable in formulation of potent and affordable natural product in the prevention of onchocerciasis in endemic communities.

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