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Phytocoil production from the leaves of *Azadirachta indica* (neem) and *Hyptis suaveolens* (bush mint)

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Abstract

This study aims at the production of phytocoils from two plant leaves (neem and bush mint). Different compositions of the base materials (saw dust or candle), binders (potato or tapioca starch), insecticidal material (neem or bush mint) and burning aid (H_2O_2 or HNO_3 or KNO_3 or $NaNO_3$ or CH_3OH) were utilized and a comparative analogy of produced phytocoils done. These compositions were compounded and kneaded to a fine mixture, and crafted into an ideal mosquito coil. It was observed that formulation with candle, tapioca starch, insecticidal leaves (both fresh and dry) and H_2O_2 gave the best mosquito coil qualities (Smouldering ability; the formulations including saw dust and potato starch did not smoulder at all, while the ones with candle and tapioca starch smouldered in this trend with respect to the burning aid used as H_2O_2 > KNO_3 > 95%CH_3OH > HNO_3. All the coils produced were relatively strong enough with no microbial growth except for those with smaller mass of saw dust. This work has shown that Azadirachta indica and Hyptis suaveolens can be crafted into phytocoils and possibly serve as an effective natural mosquito repellent.

1. Introduction

The oldest known human enemies are mosquitoes. They represent a significant threat to human health because of their ability to vector pathogens that cause diseases that afflict millions of people worldwide (WHO, 1992). WHO has declared mosquitoes; "*Public enemy number one*" as they are responsible for the transmission of various dreadful diseases. Several species belonging to the genera Aedes, Anopheles and Culex are vectors for the pathogens of various diseases like Dengue fever, Dengue haemorrhagic fever, Malaria, Japanese encepahalitis and Filariasis (Arivoli and Samuel, 2011).

Globally, the malaria situation is serious and still deteriorating. Malaria predominantly affects the poor and underprivileged. About 90% of all malaria Deaths in the world today occurs in Africa and South of the Sahara. An estimated 1 million people in Africa die from malaria each year and most of these are children under 5 years old (Egunyomi *et al*., 2010). An 85% of estimated annual 225 million cases of malaria worldwide are caused by *Plasmodium falciparum* and *P. vivax,* and are recorded within the African region. In Nigeria, malaria is highly endemic accounting for 60% of outpatient visit (Idowu *et al*., 2013).

In an attempt to combat these mosquitoes and their effects, several methods have been employed especially the use of synthetic insecticides. These synthetic insecticides

though active in controlling mosquito activities, also tend to have adverse effects on humans in various ways. A known example of this synthetic insecticide is DEET which does not readily degrade by hydrolysis at environmental pHs and has been identified as a ubiquitous pollutant in aquatic ecosystem (Weigel *et al*., 2002). Concern about the deleterious effects associated with synthetic chemicals has revived interest to explore plants as a source of natural insecticides, acaricides, and repellents for medical, veterinary and crop protection (Jaenson *et al*., 2006). Among the plants that provide these insecticidal properties are neem which have been reported to have both parasitic, insecticidal, antimalaria, anticarcinogenic, (Kumar and Gupta, 2002; Saba *et al*.,2011; El-Mahmood *et al*., 2010; Kwasi *et al*., 2011) and bush mint which has been reported to have mycotoxic ability, antihelmintic, anti-inflammatory and antimicrobial activities etc. (Umedum *et al*., 2014).

Neem is a member of the Mahogany family. Neem and its leaves are used for the treatment of various diseases including eczema, ringworm, acne, anti-inflammatory activities, anti-hyperglycemic and also treat chronic wounds, diabetic foot and gangrene. It also removes toxins from the body; neutralize the free radicals present in body and used as blood purifier. Recently, it was reported as anticancer and used for hepato-renal protective activity and hypolipidemic effects (Kumar and Gupta, 2002). Neem is distributed widespread in the world. The Chemical constituents include alkaloids, flavonoids, tri-terpenoids, phenolic compounds, carotenoids, steroids and ketones. To clean wounds, soothe, swellings and erase skin problems, boiled Neem is used. Neem leaves have been demonstrated to have vast properties like as immunomodulatory, antiinflammatory, antihyperglycaemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, antioxidant, antimutagenic and anticarcinogenic (Saba et al.,2011). El-Mahmood et al., (2010) observed the anti bacterial effects of crude extract of Neem seed against pathogens involved in eyes and ear infections.

Purnima, (2006) wrote that Hyptis has good medicinal value owing to the presence of essential oil, a characteristic feature to the family Lamiaceae. After hydro distillation of its leaves, an average yield of 0.1 % is obtained. Main constituents of the distillate are 1, 8-cineole (32%) and o-caryophyllene (29%). Hyptis is known to be used in traditional medicine for the treatment of various illnesses and has been found to possess significant pharmacological, anti-cancerous properties and tumorigenic properties. In addition to above, it also has mycotoxic activity against fungus *Candida albicans*, antimicrobial activity against both gram positive *Staphyloccus aureus* and *Basillus cereus* and negative strains of *E. coli, Pseudomonas*. Also Umedum et al., (2014) have reported the antidiarrhoeal, antihelmintic, anti-inflammatory and antimicrobial activities of this plant. Besides all these properties it also has insecticidal properties and said to be a mosquito repellent.

The above properties formed the basis of this work which is geared towards utilizing the insecticidal properties of these plants in the production of phytocoils.

2. Experimentals

2.1. Sample Collection

The Neem and Bush mint leaves were collected from Nnamdi Azikiwe University, Awka Campus and identified by a taxonomist of the Campus Herbarium.

2.2. Sample Preparation

The leaves were dried under shade for 7 days and ground to obtain the dry sample while the fresh leaves were collected and ground as at when needed. To obtain the binder (potato starch), fresh potatoes were peeled, washed and grated. Then, they were sieved with water as sieving aid and sun dried after draining off the water. The candles and Saw dust were pulverized into fine tiny particle size.

3. Compounding Using Different Formulations

Different compositions of the base material (Saw dust or candle), binders (potato or tapioca starch), insecticidal material (neem or bush mint) and burning aid (H_2O_2 or HNO_3 or KNO_3 or $NaNO_3$ or CH_3OH) were utilized and a comparative analogy of produced phytocoils equally done.

3.1. Method 1: Saw Dust as Base Material and Potato Starch as Binder

About 100ml of water was boiled to a temperature of 85-90^oC (above the gelling point of potato starch), and poured into the weighed starch (42g). Different masses of saw dust (100g, 70g and 20g) were used to prepare three different formulations of the phytocoils respectively. In each formulation, 6g of the ground dry leaves and 1.5g of $NaNO_3$ were added and kneaded properly.

The kneaded mixture were then placed on a metal lid with an aluminum foil underlay and carefully crafted into the shape of an ideal mosquito coil.

3.2. Method 2: Candle as Base Material and Tapioca Starch as Binder

2 table spoonfuls each of four different burning aids (H_2O_2, HNO_3, KNO_3, $NaNO_3$ and CH_3OH) were used in the compounding of four formulations. Added equally were 2 table spoonfuls each of pulverized dry and fresh leaves, pulverized candle and tapioca starch into each formulations. Then after proper kneading, the paste was then transferred to a metal lid with an aluminum foil underlay and carefully crafted into the shape of a mosquito coil. The biophysico properties such as strength, smouldering ability and microbial growth of the phytocoils were obtained.

4. Results and Discussion

Table 1. *The Biophysico Properties of Coils Using Method 1*

Formulations	Compositions	Smouldering Ability	Strength of the Coil	Microbial Growth
1st	100g of saw dust 42g of potato starch 6g of ground dry leaves 1.5g of $NaNO_3$	None	Strongest	None
2nd	70g of Saw dust 42g of Potato Starch 6g of ground dry leaves 1.5g of $NaNO_3$	None	Stronger	Microbial growth found
3rd	20g of saw dust 14g of Potato Starch 6g of ground dry leaves 3g of $NaNO_3$	None	Strong	Microbial growth found

As amount of saw dust decreases other properties decreases but its smouldering ability was not affected as the coil produced from these various formulations did not smoulder at all.

This observation could be attributed to the binder (potato starch) used which is not a good flammable material.

Table 2. *The Biophysico Properties of Coils Using Method 2*

Formulations	Compositions	Smouldering Ability	Strength of the Coil	Microbial Growth
1st	2 table spoonfuls each of: -Ground dry leaves -Ground fresh leaves -Pulverized candle -95% Methanol	Good	Strong	None
2nd	2table spoonfuls each of: -Ground dry leaves -Ground fresh leaves -Pulverized candle - HNO_3	None	Not Strong	Undetectable
3rd	2table spoonfuls each of: -Ground dry leaves -Ground fresh leaves -Pulverized candle -H_2O_2	Best	Strong	None
4th	2table spoonfuls each of: -Ground dry leaves -Ground fresh leaves -Pulverized candle -KNO_3	Better	Strong	None

From the above results, it was observed that using the above method, the third formulation, gave the overall best quality coil with the longest smouldering time, strength of the coil, and longer resistance to microbial growth.

The second formulation however posed a unique feature as the coil started to melt hours after production, which could be associated with the strong activity of the nitric acid (burning aid) used in the formulation.

5. Conclusion

Method 2 gave better mosquito coil qualities than method 1, while the third composition in method two gave the best quality. So candle, tapioca starch and insecticidal leaves (both fresh and dry) with the addition of H_2O_2 as the burning aid can be an effective natural mosquito repellent. This work shows that plants such as neem and bush mint with proven insecticidal repellent activities have been shown to be susceptible to fabrication into phytocoils for the prevention of mosquitoes and other insect bites and their associated effects.

Method 2 (2nd Formulation) that is 2 table spoonfuls each of dry and fresh leaves both neem and bush mint pulverized candle and H_2O_2 has proven to produce coil with best biophysico properties. Therefore *Azadirachta indica* and *Hyptis suaveolens* have shown to have repellency activities due to the emitted scent of the leaves when smouldered and thus justify their ethanbotanical use as repellents.

The plants can be used alone or combined for effective protection against mosquitoes. They can also be used for control of mosquito breeding under integrated disease vector control programme in various situations. They also offer safer alternative to synthetic insecticide and can be obtained by individuals and communities easily at a very low cost.

Recommendations

Standard procedures to test the efficacy of these phytocoils and others are highly recommended.

References

[1] Arivoli, S. and Samuel, T. (2011). Mosquitocidal Activity of *Hyptis Suaveolens* (L.) Poit (Lamiaceae) Extracts Against *Aedes Aegypti*, *Anopheles Stephensi* and *Culex Quinquefasciatus* (Diptera: Culicidae). *International Journal of Recent Scientific Research,* 2(5):143 -149.

[2] Egunyomi, A., Gbadamosi, I.T. and Osinama, K.O. (2010). Comparative Effectivness of Ethanobotanical Mosquito Repellants Used in Ibadan, Nigeria. *Journal of Applied Biosciences,* 36: 2383-2388.

[3] El-Mahmood, A.M., Ogbonna, O.B. and Raji, M. (2010). The antibacterial activity of Azadarichta indica (neem) seeds extracts against bacterial pathogens associated with eye and ear infections. *Journal of Medicinal Plants Research*, 4(14) :1414-1421.

[4] Idowu, E.T., Aimufua, O.J., Ejovwoke, Y., Akinsanya, B. and Otubanjo, A.O. (2013). Toxicological effects of prolonged and intense use of mosquito coil emission in rats and its implications on malaria control. *International Journal Tropical Biology,* 61 (3): 1463-1473.

[5] Jaenson, T.G.T., Palsson, K., Borg-Karlson, A.K. (2006) Evaluation of extracts and oils of mosquito (Diptera: Culicidae) repellent plants from Sweden and Guinea-Bissau. *Journal Medical Entomology*, 43(1): 113-119.

[6] Kumar, R.V., and Gupta, V.K. (2002). Thrust on Neem is need of today. *Chembiochemistry,*5: 408-421.

[7] Kwasi, O. B., Samuel K. T., Michael, A. A., Jerome D. K. (2011). Production of natural insecticide from Neem leaves (Azadirachta indica). *Asian Journal of Plant Science and Research,* 1 (4):33-38.

[8] Purnima, R. (2006). Ecological and vegetative characteristics of a potent invader, Hyptis suaveolens Poit. L. from India. *Lyonia*, 11(2):115-120.

[9] Saba, I., Muneeba, B. and Hira Y. (2011). In-Vitro Antibacterial Activity of Two Medicinal Plants Neem (Azadirachta indica) and Peppermint. *International Research Journals of Pharmaceuticals,* 1(1): 9-14.

[10] Umedum, N.L., Nwajagu, U., Udeozo, I.P., Anarado, C.E. and Egwuatu, C.I. (2014). The Efficacy of Hyptis Suaveolens: A Review of its Nutritional and Medicinal Applications. *European Journal of Medicinal Plants*, 4(6):661-674.

[11] Weigel, S. Kuhlmann, J. Huhnerfuss, H. (2002). Drugs and personal care Products as ubiquitous pollutants: occurrence and distribution of clofibric acid, caffeine and DEET in the North Sea. *Science Total Environment*, 295: 131-41.

[12] WHO. 1992. Vector resistance to pesticides. Fifteenth report of the WHO expert committee on vector biology and control. Technical Report Series, 818: 1-62.