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THE USE OF LARVAOILS FOR THE ERADICATION OF THE MALARIA VECTOR

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ABSTRACT
Oil samples which include diesel, kerosene, fresh engine oil and used engine oil were collected from fuel stations in Kano metropolis. Oil blends were prepared and analyzed for density, viscosity, surface tension, spreading diameter on water surface and extermination time. Five blends A:B (Kerosene: Diesel) 250:20(cm^3);A:B (Kerosene: Diesel) 250;40(cm^3); B:A (Diesel: Kerosene) 250:80(cm^3) B:A (Diesel: Kerosene) 250: 60(cm^3) and ***D:B (Fresh Engine Oil: Diesel) 250:60(cm^3) with spreading diameter of 9cm, 8cm, 8cm, 9cm and 8cm and extermination time of 20mins, 26mins, 28mins, 38mins and 46mins respectively were found to spread effectively on water surface and exterminate mosquito larvae by asphyxia.***

Keywords: Density, Viscosity, surface tension, spreading diameter, extermination time.

INTRODUCTION
Malaria: Known to the Indians as the 'King of Infections|' is caused by infection with one or more of four species of blood inhibiting protozoa belonging to the genus *plasmodium.* (Salako, 2000) All four human malaria parasites are transmitted by *Anopheles* mosquitoes. (Lane and Crosskey, 1993).

Malaria causes yearly 300-500 million cases of clinical illness and 1.5 – 2.7 million clinical deaths. Most of the fatalities are children (Najera, 1998 and Warrell, 1998). In areas of highest risk exposure to malaria, parasites is so persistent that children develop a functional immunity to the parasite by the age of five or they simply do not survive. (Callison, 2003)

Mosquito belongs to the family *cullicidae* which at present contains about 3,450 species and sub-specie. They are the sole vectors of the pathogens causing human malaria. Mosquitoes have perhaps attained greater public notoriety than any other arthropod. They are almost unrivalled as irritating biting pests (Harwood and James, 1979). Mosquitoes lay their eggs in water but different species have different and often very specific requirement for a suitable site.(Tukur, 2006) The implementation of control measures aimed at eliminating breeding places involve the identification of the principal vector and its breeding habits.(Caincross and Feachem,1979) Unfortunately, many health staff are unaware of the entomology and epidemiology of malaria. It is not uncommon for health workers to advice household members to clear refuse dumps that contain broken tins and bottles, which when filled with water serve as breeding sites for *Aedes aegypti* not the *Anopheline* specie that transmits malaria. (Brieger, 2000)

Over the centuries malaria has brought down empires, decimated armies and depopulated vast tracks of land, especially in equatorial countries. In the 1950's global campaigns were launched to stamp out the disease and its pesky mosquito vector. After 35 years, and billions of dollars malaria it seems, is sending us a very modern warning about nature's capacity for retaliatory strikes. (Discover Magazine, 1992) The realities and difficulties of malaria control over the past century have all been too apparent; and. Attempts at eliminating mosquito and reduction transmission met with limited success and frequent failure (Alilio *et al*. 2004).

One of the older control methods is to spray mineral oil on the water surface to kill mosquito larvae by suffocation and poisoning. Addition of organophosphates or carbamate insecticides greatly enhances their toxicity (Lane and Crosskey, 1993). Efficient oil shall consist of mineral oil in the form of a homogeneous mobile liquid, free from dirt, water and other extraneous impurities and must spread thinly over the water surface. (WHO, 1979)

The successful campaigns of vector specie eradication, such as that of *A. gambiae* from Brazil (1940) and from upper Egypt (1945) and the eradication of *A. sergenti* in the oasis of Dakhala and of Kharga (1946-7) was based on larval control using Paris Green and 5% DDT solution in mineral oil (Pampana, 1969) Onochukwu *et al.* (2001) asserts that it may be economically convenient to replace house spraying with anti larval measures when breeding places are very limited during dry weather; and then added that, in the 1940's and 1950's mosquito eradication campaign in Nigeria, the main focus was directed at reducing mosquito density by the application of Larvaoils on stagnant water and drains.

In spite of the effort by the WHO aimed at total eradication of mosquito, malaria is making a deadly comeback. (Irin, 2004) The failure of the campaign programmes and the rebounce of the disease means that search for other control techniques must continue. This study is aimed at reverting to one of the old method of mosquito eradication, the use of larvaoils to attack mosquito at the weakest stage of its life cycle (the larva stage).

MATERIALS AND METHODS
The oil samples, kerosene, diesel, used engine oil and fresh engine oils were collected from fuel station in Kano metropolis and were designated A, B, C and D respectively.

The oils were blended in a ratio A:B, B:A, C:A, C:B, D:A and D:B with the former being kept constant at 250cm^3 and the latter being successively increased from 20cm^3 to 100cm^3 in each ratio. Various physical parameters of the oil blends were analyzed which include, density, viscosity, surface tension and spreading diameter on water surface.

Analytical Procedures:
The density was determined by measuring a known volume of the oil blend in a pre-weighed density bottle. The viscosity of the oil blends was measured using a typical capillary tube viscometer (BSS no. 188, 1957) at 25^{0}C. A stopwatch was used to measure the flow rate and viscosity was calculated using the equation as reported by James and Prichard, (1974)

$$\frac{\eta_1}{\eta_2} = \frac{\rho_1 t_1}{\rho_2 t_2}$$

Where η_1, ρ_1, t_1 are the viscosity, density and time of flow of the samples. η_2, ρ_2, t_2 are viscosity, density and time of flow of water respectively.
The surface tension of the oil blends was determined by measurement of capillary pull and capillary rise using molecular weight apparatus (James and Prichard, 1974) The oil blends were then subjected to spreading diameter measurement in a 1000cm^3 capacity beaker. Five drops of the oil samples were allowed to spread on the water surface. The spreading diameter of the oil was measured in cm using a transparent ruler (Felix, 1989)
T.he measurement of extermination time of mosquito larva was done using a 5000cm^3 capacity beaker filled with water (Onochukwu *et al,.* 2001 and WHO Specifications, 1979)). Five pieces of mosquito larvae were dropped into the beaker and 2cm^3 of the oil blends was pipetted into the water surface drop by drop and extermination time of the larvae recorded by means of a stopwatch.

RESULTS AND DISCUSSION
The time of flow, density, viscosity, surface tension and spreading diameter on water surface of the oil samples, kerosene, diesel, used and fresh engine oils were determined (Table I) and found to correspond to the literature values (James and Prichard, 1974). All the samples do not show appreciable spread and therefore fail to exterminate mosquito larvae (Table II). This may be due to poor physical characteristics such as viscosity, density, surface tension, spreading diameter on water surface (Table I) The oil samples were then successively mixed together to give oil blends of different ratio. The blending of the oil samples improve such physical characteristics (Table IV) thereby making the oil blends effective for use as larva oil.(Pampana, 1979).
Oil blends of the ratio B:A - 250:60; 250:80 , A:B – 250:20; 250:40 and D:B – 250:60 were found to exterminate mosquito larvae at different time interval (Table III) However, all the other oil blends failed to exterminate the larvae because they have poor spreading diameter on water surface.(Felix, 1989) The result indicates that only diesel samples show appreciable spread on water surface(Table IV).This is in line with the specifications for pesticide (WHO, 1979) and Pampana (1969) and hence its popular use as larvaoil.
In the larva stage of the mosquito life cycle, the larva uses its trunk to get oxygen from the water surface. When oil blends spread on the water surface, oxygen ingress into the water was restricted and the larva cannot therefore survive. Oil blends mixtures that have good spreading diameter cover the water surface and hence exterminate the life of the mosquito larva in its natural habitat.

The result of this paper clearly shows that the blending of the oil samples have served the purpose of making the oils neither too viscous nor too volatile (Felix, 1989) and hence were able to spread effectively on water surface (Table IV) thereby blocking oxygen ingress into the water and hence exterminating mosquito larvae by asphyxia.

Table 1: Time of flow, density, viscosity, surface tension and spreading diameter o f oil sample

Sample	Time of Flow (sec)	Density (g/cm^3)	Viscosity NSm^{-2} (x10^{-3})	Surface Tension Nm^{-3} (x10^{-2})	Spreading Diameter (cm)
Kerosene	8.5	0.8308	1.158	2.989	5.0
Diesel	30.2	0.8708	4.312	4.699	8.5
Used Engine Oil	272	0.8545	38.24	4.610	3.1
Fresh Engine Oil	1290	1.913	193.13	4.927	3.5

Table 2: Extermination Time of Mosquito Larva (In Minutes) For Oil Samples

Sample	Volume (cm^3) of oil added	Results
Diesel	2	Nil
Fresh engine oil	2	Nil
Used engine oil	2	Nil
Kerosene	2	Nil

Table 3: Extermination Time of Mosquito Larva (In Minutes) For Different Oil Blends

Blends	Volume Added (cm^3)	Result (cm^3)				
		250:20	250:40	250:60	250:80	250:100
B:A	2	Nil	Nil	38mins	28mins	Nil
C:A	2	Nil	Nil	Nil	Nil	Nil
C:B	2	Nil	Nil	Nil	Nil	Nil
D:A	2	Nil	Nil	Nil	Nil	Nil
D:B	2	Nil	Nil	46mins	Nil	Nil
A:B	2	20mins	26mins	Nil	Nil	Nil

A:B - Kerosene: Diesel, B:A - Diesel: Kerosene, C:A - Used Engine Oil: Kerosene, C:B - Used Engine Oil: Diesel, D:A - Fresh Engine Oil: Kerosene, D:B - Fresh Engine Oil: Diesel

Table 4: Extermination Time, Spreading Diameter, Density, Viscosity, and Surface Tension of Some Oil Blends

Blends (cm^3)	Extermination Time (mins)	Spreading Diameter	Viscosity (NSm^{-2}) (10^{-2})	Surface tension Nm^{-3} (10^{-3})	Density (g/cm^3)
A:B – 250:20	20	9	0.94	4.41	0.8171
A:B – 250:40	26	8	1.09	3.73	0.8306
B:A – 250: 80	28	8	2.19	3.96	0.8767
B:A – 250:60	38	9	2.38	4.69	0.8691
D:B – 250:60	46	8	72.5	4.85	0.8986

A:B - Kerosene: Diesel, B:A - Diesel: Kerosene, D:B - Fresh Engine Oil: Diesel

CONCLUSION

In spite of the efforts by the WHO and other governing bodies, malaria remains one of the endemic diseases of the tropics. Mosquito eradication campaign should not focus on one strategy alone, rather, different strategies should be concurrently employed at a time. The use of Larvaoils is one alternative method that has been found to help in attacking the vector at the weakest stage of its life cycle – the larva stage.

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