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OVICIDAL AND LARVICIDAL EFFECTS OF SOME ORGANIC POLLUTANTS ON *AEDES AEGYPTI*

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ABSTRACT
Mosquito borne diseases constitute serious public health problems in the world. Source reduction (larviciding) has been known as one of the efficient measures to control the menace pose by the mosquitoes. The present study was therefore carried out to assess the ovicidal and larvicidal effects of some organic pollutants (cement, petrol, engine oil and detergent) against Aedes aegypti. A batch of 20 eggs and 20 mosquito larvae were tested in each pollutant along with the respective control of distill water free from pollutants. The experiments were thereafter replicated twice. Zero percent (0%) hatchability was observed in all the eggs placed in the detergent, petrol and cement. Though, 25% of eggs hatched in engine oil, none developed to adult stage. Larvae were found to be highly susceptible to the petrol, detergent and cement test concentrations as 100% mortality was observed within 24 hours of introduction into the pollutants. Engine oil only resulted in 100% mortality at day six. From the results of this study, it can be concluded that these organic pollutants are lethal and could be useful in source reduction (larviciding of breeding sites).
KEY WORDS: *ovicidal, larvicidal, organic pollutants, Aedes aegypti*

INTRODUCTION

Mosquitoes and its nuisance have constituted serious public health problems throughout the world (Adeleke *et al*., 2013). Mosquitoes serve as vectors for myriads of deadly and debilitating diseases such as malaria, elephantiasis, dengues fever, and yellow fever (Becker *et al.* 2010). Mosquitoes are found throughout the world apart from the Antarctic region (Mullen & Durden, 2009).

At present, no effective vaccine is available for the control of many mosquito-borne diseases; therefore, the only way of reducing the incidence of these diseases is mosquito control (Sarita *et al.,* 2012). Larviciding is a successful way of reducing mosquito densities in their breeding places before they emerge into adults. During the immature stage, mosquitoes are relatively immobile; remaining more concentrated than they are in the adult stage (Rutledge *et al.,* 2003).

The used engine oil, detergent, cement and petrol constitute some of the organic by-products in the environment (Richards *et al*, 1941, Hadi *et al.,* 2006). These organic products are most often washed away and pollute water bodies including mosquito breeding sites (Hadi *et al.,* 2006). The present study, therefore evaluated the potency of engine oil, detergent, petrol and cement against the eggs and larvae of *Aedes aegypti.*

MATERIALS AND METHODS

Collection of mosquitoes. Eight black containers half- filled with clean water were placed at shaded locations within the vicinity of Osun State University, Osogbo, Nigeria. The larvae recovered from the containers were transported to the Zoology laboratory of the University. The larvae were reared to adults in a net cage of 45 cm ×30 cm. The emerged adults were fed with mice blood and thereafter maintained with glucose soaked in cotton wool. Small plastic bowl having 250 ml of tap water lined with filter paper was kept inside the cage for oviposition of the mosquitoes. The eggs recovered were used to raise the colony eggs, larvae and pupae of *Ae. aegypti* in the laboratory.

Bioassay of eggs and larvae of *A. aegypti in organic pollutants (OP).* Stock solutions and serial dilutions were prepared starting with commercial solution of detergent, followed by cement, engine oil and petrol. A stock solution at 5% (cement and detergent) and 1% (petrol and engine oil) was prepared by mixing the corresponding volume of organic pollutants to distilled water. Test concentrations were prepared by serial dilution in distilled water to obtain a final test volume of a 100ml. A batch of 20 eggs and 20 mosquito larvae were tested in each pollutant along with the respective control of distilled water free from pollutants. The mortality of the larvae was monitored and recorded accordingly. Larval mortality was recorded from 1 hour to 120 hours after exposure. The ovicidal activities were measured through hatchability of the eggs in test containers and control. The number of eggs hatched in each container was recorded accordingly over 288 hours. The experiments were replicated twice under room temperature.

Statistical Analysis. The mean and standard error of mean were calculated using SPSS version 17.0

RESULTS AND DISCUSSIONS

Effects of organic pollutants on hatchability of the eggs of *Aedes aegypti.* The results presented in table 1 showed that all the eggs placed in petrol, cement and detergent recorded zero percent (0%) hatchability after 12 days (264 hours) of holding. The eggs placed in engine oil recorded 25% hatchability. However, all the larvae that emerged died within 264 hours without developing to pupae. The eggs in control recorded 75% hatchability and all emerged larvae developed to the adult stage.

Effects of organic pollutants on Larvae of Aedes aegypti. The results of the survival of the larvae in the test containers are presented in table 2. All larvae placed in petrol died within 1 hour, while the larvae introduced to detergent solution did not survive beyond 24 hours. The container with cement solution recorded 13.5% mortality within 24 hours but none of the larvae survived beyond 48 hours (100% mortality). The larvae in introduced to engine oil had the longest survival rate as 13% mortality was recorded 96 hours post exposure to the test containers. However, 100% mortality was recorded within 120 hours. No mortality was recorded in the control.

The results from this study showed that experimented organic pollutants exhibited high ovicidal and larvicidal activities against the *Ae. aegpti*. Similar observations had also been reported by Fayeminwo *et al*. (2014) on the inhibitory roles of oils on the development and survival of water surface-dwelling insects.

TABLE 1. Mean hatchabilities (± Standard error) of the *Aedes aegypti* eggs exposed to Organic Pollutants

OP	Hatchability (mean ± standard error)												
	24hrs	48hrs	72hrs	84hrs	96hrs	120hrs	144hrs	168hrs	192hrs	216hrs	240hrs	264hrs	288hrs
Control	11±1.0	11±1.0	12.5±0.5	12.5±0.5	13 ± 1.0	13.5±0.5	14 ± 1.0	15±1.0	15.5±0.5	15.5±0.5	15.5±0.5	15.5±0.5	15.5±0.5
Engine oil	3± 3.0	3± 3.0	5± 1.0	5± 1.0	4.5 ±0.5	4 ± 1.0	3 ± 0	3 ± 0	2.5±0.5	2.5±0.5	2.5±0.5	2.5±0.5	0 ± 0
Detergent	0± 0	0 ± 0	0 ± 0	0± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Cement	0± 0	0± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Petrol	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0

TABLE 2: Mean mortalities (± Standard error) of the *Aedes aegypti* larvae exposed to Organic Pollutants

Organic pollutant	Mortality (mean ± standard error)						
	1hr	24hrs	48hrs	72hrs	84hrs	96hrs	120hrs
Control	0±0	0±0	0±0	0±0	0±0	0±0	0±0
Engine oil	0± 0	9± 7.0	10.5±5.5	11.5± 5.5	12 ± 5.0	13 ± 6.0	100 ± 00
Detergent	0± 0	100 ± 00	100 ± 00	100 ± 00	100 ± 00	100 ± 00	100 ± 00
Cement	0± 0	13.5± 6.5	100 ± 00	100 ± 00	100 ± 00	100 ± 00	100 ± 00
Petrol	100 ± 00	100 ± 00	100 ± 00	100 ± 00	100 ± 00	100 ± 00	100 ± 00

Of all the organic pollutants tested, petrol is the most potent causing o% hatchability and resulting in 100% mortality within 1 hour of exposure of larvae. The reasons associated with these lethal activities cannot be far-fetched. Petrol is known to contain complex mixtures of organic chemicals (benzene, toluene, xylene and sometimes lead) which normally penetrate the main tracheal system and completely block it to make passage of air impossible. This blockage, resultantly, does cause the mortality of the insects. Similar observations have also been reported by other researchers (Freeborn *et al*., 1918; Richards, 1941; Arimoro & Adamu, 2008).

The 0% hatchability and 100% mortality of larvae (within 24 hours) recorded in detergent bioassay is in consonance with the findings of Prasantong (1989), and Sudarmaja & Swastika (2015) who in different experiments also reported 0% hatchability of exposed *Aedes* eggs to different detergent solution. It has been reported that detergent usually contains surfactants, which consist of none ionic-surfactants, ionic surfactants and cationic surfactants (Prasantong 1989). The surfactants are known to obstruct oxygen supply in the water surface and thus resulting in the mortality of the mosquitoes (Hadi *et al.,* 2006). Detergents may also contain ethoxylated alcohol which normally interferes with air flow in the water and cause acute oxygen tension/shortage for the aquatic organisms (Sudarmaja & Swastika, 2015)

Though, there were no previous reports on ovicidal and larvicidal effects of cement on *Aedes*, the present study reported 0% egg hatchability and 100% mortality of larvae within 48 hours of exposure. Cement contains hazardous components such as crystalline silica and hexavalent chromium which most often interfere with normal physiological functioning, and could lead to tomour and respiratory disorders in higher animals (Oleru, 1984). Arising from this previous knowledge, it is not unlikely that cement would have interfered with the respiratory processes in the larvae thus resulting in their mortality.

The use of engine oil as larvicide has old age history in Africa and other parts of the world (Floore, 1998). The oil can cause suffocation, but only at the very high dosage. The inert ingredients include emulsifiers which help them spread over the water's surface and kill larvae when inhaled into the tracheae along with air. The activities of oil do occur at slow pace, taking four to seven days to achieve results (Floore, 1998). This may be the reason to explain the results obtained in bioassay with engine oil when compare with other organic solutions.

In conclusion, the results of the presents study have demonstrated that organic pollutants are lethal and could be explored for source reduction (larviciding of breeding sites). However, the impact and tolerable limits of these organic pollutants would be a subject for further studies.

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