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Research Note

Laboratory bioefficacy of CREEK 1.0G (temephos) against *Aedes* (*Stegomyia*) *aegypti* (Linnaeus) larvae

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Abstract. The bioefficacy of a commercial formulation of temephos, Creek® against *Aedes aegypti* larvae was studied in the laboratory. Earthen jars were filled with 10 L tap water each. One g of temephos (Creek®) sand granule formulation was added into each earthen jar as recommended by the manufacturer. The final test concentration of Creek® was 1 mg a.i./L. One earthen jar was filled with 10 L tap water and served as a test control (untreated). Thirty late 3rd or early 4th instar of lab-bred *Ae. aegypti* larvae were added into each earthen jar. Mortality of the larvae was recorded after 24 hours and percent mortality was calculated. Test was repeated every week. The results showed that complete larval mortality was achieved after 24 hours. The residual effect lasted 15 weeks (105 days), indicating that Creek® is effective at the dosage recommended by the manufacturer which is 1 mg a.i./L.

Dengue fever (DF) and dengue haemorrhagic fever (DHF) are considered the most important and disseminated vector-borne disease of public health importance in tropical, subtropical and temperate regions of the world (Gubler *et al.*, 1998). Millions of people are infected by DF and DHF annually (Jacobs, 2000). *Aedes aegypti* and *Aedes albopictus* play a crucial role in the transmission of these infections (Rebecca, 1987; Lam, 1993; Lee & Inder, 1993; Nogueira *et al.*, 1999).

Malaysia has suffered DF and DHF since the first major national DF and DHF outbreak which occurred in 1973 during which 969 cases and a case fatality ratio of 5.6/100 were reported by Ministry of Health (Lee, 1994). Currently, an effective dengue vaccine is not available and the only method of controlling or preventing DF and DHF is to combat the vector mosquitoes. Dengue control is still heavily dependent on the use of chemical insecticides. Thus, insecticide resistance represents a threat for effective vector control. The use of chemical agents is one of the most important methods of controlling vectors of medical importance. Larviciding is the first step in chemical mosquito control, since the mosquitoes are killed at the breeding site, prior to dispersing and infesting a community. Since early 1970, WHO has recommended temephos (0,0,0'0'-tetramethyl-0,0'-thiodiphenylene phosphorothiorate) for the control of *Aedes* mosquitoes (WHO, 1985) and it has been used extensively in the past 30 years for the control of *Ae. aegypti* and *Ae. albopictus* in Malaysia.

Temephos is an organophosphorus (OP) compound with very low mammalian toxicity. The LD_{50} of temephos on rat is about 8600 mg/kg and is not harmful to humans when used at operational dosages (Laws *et al*, 1967). Temephos has been used for the control of mosquito larvae (*Ae. aegypti*, *Culex* spp and *Anopheles* spp) in drinking water since the early 1970s. It has been found useful in the control of dengue and dengue

haemorrhagic fever, malaria and filariasis (WHO, 1991).

The objective of this study is to evaluate the bioefficacy of a commercial formulation of temephos, Creek® against *Ae. aegypti* larvae in the laboratory.

As this was a small scale laboratory bioassay, prior to a bigger scale study, only 2 earthen jars were used for the study. Earthen jar with the opening of 35 cm in diameter, base diameter of 28 cm and 15 cm in height was used. The 2 earthen jars were filled with 10 L tap water each. One g of temephos (Creek®) sand granule formulation was added into each earthen jar as recommended by the manufacturer. This is equivalent to a final total release dosage of 1 mg active ingredient per liter (1 mg a.i./L). Another earthen jar was filled with 10 L tap water and served as a control (untreated). All the earthen jars were placed in the laboratory and kept covered to prevent any *Aedes* adults in the vicinity from ovipositing in the earthen jars. Lab-bred *Ae. aegypti* larvae (F970 – F975) which was colonized in the Medical Entomology Unit, Institute for Medical Research for the past 30 years was used in this study. Thirty late 3rd or early 4th instar *Ae. aegypti* larvae were added into each earthen jar. Mortality of the larvae was recorded after 24 hours and percent mortality was calculated. Test was repeated every week.

The results obtained from this study showed complete larval mortality was achieved after 24 hours. The residual effect lasted 15 weeks (105 days), indicating that Creek® is effective at the dosage recommended by the manufacturer which is 1 mg a.i./L.

This was similar to a study by Lee & Winita (1993). Their study found that earthen jars treated with 1 mg/L of temephos (Abate®) were effective in causing complete larval mortality of *Ae. albopictus* up to 91 days post-treatment.

According to WHO (1999), 1% temephos sand granules (Abate®) are applied to containers using a calibrated plastic spoon to administer a dosage of 1 ppm (ad 1 mg a.i./L). This dosage has been found to be effective for 8 to 12 weeks, especially in porous earthen jars, under normal water use patterns.

Zairi (2003, cited by WHO, 2003) reported that in the laboratory, temephos formulation at 0.11 g/L was effective against *Ae. aegypti* and *Ae. albopictus* released in earthenware and glass jars with and without replenishment of water, causing more than 90% larval mortality throughout 11 weeks experimental period. He also reported that in the trial against natural mosquito population in household containers, 100 % of larval reduction was recorded up to 65 days in all the jars.

Mulla *et al.* (2004) tested efficacy of temephos sand granules (1%) and temephos zeolite granules (1%) at operational rate of 5g / 50L (= 1 mg a.i./L) against *Ae. aegypti* in glazed clay water storage jars (200 L) with replenishment of water, were equal in efficacy yielding almost 100% control for more than 6 months. Thavara *et al.* (2004) reported that a single application of temephos zeolite granules at 1 mg a.i./L can provide highly satisfactory control of *Ae. aegypti* larvae in water storage containers for period of at least 3 months in field under normal water use practices.

Thavara *et al.* (2005) tested the efficacy of temephos 1% GR at 1 and 10 g per 200 L water in jars (0.05 and 0.5 mg a.i./L). Their results showed that even at 1 g / 200 L water, which is 1/20 of the recommended dosage used in the control program, the level of control was about 100% for up to 5 months (20 weeks) or longer.

Beside using temephos to control dengue vectors, temephos also provided significant mortality of immature stages of anopheline species in different types of breeding habitats tested (i.e., roadside ditches, rivers and river bed pools, and ponds) (Shililu, 2001; Awad & Shimaila, 2003; Parvez & Al-Wahaibi, 2003). Kerdpibule *et al.* (1984) also reported Abate® 1% sand granules can also be used against species that breed in natural water collection, such as *Mansonia* and *Culex*.

In conclusion, the effectiveness and residual activity of temephos Creek® 1.0G is comparable to temephos Abate® 1.1G, if the proper dosage is used.

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