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Effect of ethylene bis isobutyl xanthate isolated from a marine green alga *Dictyosphaeria favulosa* on mosquito *Aedes aegypti**

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Ethylene bis isobutyl xanthate isolated from a marine green alga *D. favulosa* when tested against various aquatic developmental stages of mosquito *A. aegypti* exhibited larvicidal activity in a dose-dependent manner. As the larval age progressed, higher concentrations were required to bring the same degree of mortality. The effective concentrations (EC_{50}) required for 50% adult emergence were much lower in comparison to the concentrations which resulted in 50% mortality in the larvae.

Marine organisms provide a very potential source for biologically active compounds, and inter disciplinary approach by biologists and chemists can pay rich dividends in the exploitation of this source to derive many active compounds. Usefulness of marine flora and fauna as anti-bacterial[1], anti-viral[2], anti-tumor[3] and other biologically active agents[4] have been reported. Comparatively the utilization of these sources to explore the possibility for pesticidal activity is minimum. A new sulphur compound, ethylene bis isobutyl xanthate (an alkylxanthate) has recently been isolated from a marine green alga *Dictyosphaeria favulosa*[5]. The present communication reports the activity of this isolated compound against a mosquito species *Aedes aegypti*, that transmits yellow fever, dengue, chikungunya, etc.

The green alga, *D. favulosa*, was collected at Chidiatapu, Andaman Islands, India (Lat.11°41'N, Lon. 92°46'E); from both inter-tidal and sub-tidal regions upto 6 feet depth and kept in methanol until process. Compound ethylene bis isobutylxanthate (Fig. 1) was isolated from the dichloromethane/methanol (1:1) extract[5].

The compound was tested on laboratory reared early stages of different larval instars (II to IV) and pupae, according to World Health Organization (WHO) bioassay method[6]. Observations were made after 24 hr of treatment for larvicidal activity and for EC_{50} activity, regular observations (larval, pupal mortalities if any) were made every day until adult emergence (14:10 hr light : dark period, 28°±1°C). Corrected mortality, if any was calculated using Abbot's formula[7]. LC_{50}, EC_{50}, standard error and fiducial limits at 95% confidence were calculated by probit analysis[8].

The results indicate that the compound possessed larvicidal and growth regulatory activities when the treatment was effected to different larval stages of *A. aegypti*. Data on LC_{50} and EC_{50} are summarized in Table 1.

As the larval age progressed, higher concentrations were required to bring the same degree of mortality (Table 1). LC_{50} of IV instar was 1.64 times more in comparison to II instar larvae. The effective concentrations (EC_{50}) required for 50% adult emergence were much lower in comparison to the concentrations which resulted in 50% mortality in the larvae. EC_{50} values were over two times lower than the LC_{50} values in II, III and IV instars. In EC_{50} experiments, mortality occurred only at the pupal stage irrespective of different time periods required to reach pupal stage. The dead pupae exhibited blackening of the body. In pupal treatment, the morphological differences observed in dead pupae

Table 1—LC_{50} and EC_{50} data of ethylene bis isobutyl xantate against *A. aegypti*

	II instar	III instar	IV instar	Pupa
LC_{50}±SE (mg/litre)	4.91±0.18	6.42±0.25	8.06±0.22	8.51±1.79
Fiducial limits				
UL	5.26	6.92	8.50	8.86
LL	4.55	5.92	7.61	8.15
EC_{50}±SE (mg/litre)	2.32±0.08	2.89±0.08	3.77±0.08	8.51±1.79
Fiducial limits				
UL	2.49	3.05	3.93	8.86
LL	2.15	2.73	3.61	8.15

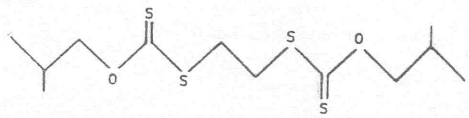

Fig. 1—Structure of ethylene bis isobutylxanthate

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were blackening of the head and decoiling of abdominal segments.

The present results suggest that alkyl xanthates can be used as a new lead for developing novel larvicides. However, to increase the penetration rate through the insect cuticle more lipophilicity may be provided to the molecule. In addition, mode of action should be studied especially, effect on enzymes like phenol-oxidase, chitinase, and hormonal interactions to optimize activity. Studies on the biochemical aspects, activity on other insect pests and synthesis of the compound and its analogs are in progress.

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References

1 McCaffrey E E & Endean R, *Mar Biol,* 89 (1985) 1.
2 Kamat S Y, Wahidulla S, D'Souza L, Naik C G, Ambiye V, Bhakuni D S, Goel A K, Garg H S & Srimal R C, *Botanica Marina,* 35 (1992) 161.
3 Schmitz F J, Gunasekera S R, Yalamanchili G, Hussain M B & Vander Helm D, *J Am Chem Soc,* 106 (1984) 7251.
4 Numata A, Kanbara S, Takahashi C, Fujiki R, Yoneda M, Usami Y & Fujita E, *Phytochemistry,* 31 (1992) 1209.
5 Venkateswarlu Y, Venkata Rami Reddy M, Farooq Biabani M A, Venkateswara Rao J & Ravi Kumar K, *Tetrahedron Lett,* 34 (1993) 3633.
6 World Health Organization, Unpublished document, WHO/VBC/81.807 (1981).
7 Abbot W B, *J Econ Entomol,* 18 (1925) 265.
8 Finney D J, *Probit analysis,* (Cambridge University Press, Cambridge) 1971, 20.