

## Research Article

# Chemical Composition and Larvicidal Activity of Flower Extracts from *Clitoria ternatea* against *Aedes* (Diptera: Culicidae)

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Mosquitoes have always been a human health threat; the major global health problems caused by them are malaria, dengue fever, yellow fever, and *Zika* as well as several other vector-borne outbreaks. The major problems in controlling these vectors borne diseases are related to resistance to eradication measures. Different classes of insecticides used for controlling public health have raised the concern of resistant problems with mosquitoes and environmental pollution caused by the control measures. Thus, a search for alternative natural compounds is necessary for solving the insecticidal resistance problem using pesticides in the larval stage of vector development as well as creating a chemical-free environment for a healthy society. Hence, the major focus of this study is to identify the larvicidal mechanisms, metabolite, antioxidants, and chemical compounds and elucidate their structures from *C. ternatea* flower and to test their efficacies against early 4th instar larvae of *Aedes aegypti* and *Aedes albopictus*. *Clitoria ternatea* flowers were collected from the garden of the Faculty of Medicine in International Quest University, Ipoh, Perak, and thence used for crude extraction. Further on, the metabolite test, antioxidant test, and chromatography techniques were conducted to identify the chemical composition of extracts and their chemical structures were identified using GCMS-QP2010 Ultra (Shimadzu). Next, the extracts were evaluated against the early 4th instar larvae of *Aedes* mosquito vectors following the WHO procedures for larval bioassays. The larvicidal activity of *Clitoria ternatea* flower extracts evidently affected the early 4th instar larvae of *Aedes* mosquito vectors. The highest larvicidal activity was observed against the early 4th instar larvae of *Aedes aegypti* with the LC50 and LC95 values of 1056 and 2491 mg/L, respectively. Meanwhile, the larvae bioassay test for *Aedes albopictus* recorded the LC50 and LC95 values of 1425 and 2753 mg/L. Moreover, the results for nontarget organism test on guppy fish, *Poecilia reticulata*, showed no mortalities with flower extracts at 2500 mg/L, hence posing no toxic effects on fish. In this study, we have found a total of 16 chemical compounds and 6 chemical compounds have been reported to possess direct insecticidal, larvicidal, and pupicidal effects. Six chemicals with insecticidal properties were found to be glycerin, 2-hydroxy-gamma-butyrolactone, neophytadiene, *n*-hexadecanoic acid, *cis*-vaccenic acid, and octadecanoic acid with a total of 28.7% efficacy. *Clitoria ternatea* flower extracts also showed different types of phenols such as anthocyanins, flavonoids, and tannins. Our findings showed that the crude extract of *Clitoria ternatea* flower bioactive molecules is effective and may be developed as biolarvicide for *Aedes* mosquito vector control. Furthermore, this study also provided a baseline understanding for future research work in the field of applications of *Clitoria ternatea* flower extracts for their long-term effects on human health such as a food additive, antioxidant, and cosmetic.