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# SCIENTIFIC NOTE

# THE USE OF ANDIROBA *CARAPA GUIANENSIS* AS LARVICIDE AGAINST *AEDES ALBOPICTUS*

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ABSTRACT. Andiroba *Carapa guianensis* Aubl. Meliacea is known to possess repellent activity against many mosquito species. We evaluated the larvicidal effect of dry-scratched seed kernels of andiroba against a sylvatic F1 progeny and a laboratory-colonized population of *Aedes albopictus* (Skuse). The 3rd instar of F1 treated with 0.5 to 2% of *C. guianensis* for 24 and 48 hours, had mortality with $LC_{50}$ of 0.74 (0.56–0.90%) and 0.68 (0.53–0.84%), respectively, and the 4th instar 0.66 (0.52–0.80%) and 0.55 (0.20–0.91%), respectively. For the 3rd instars of laboratory-colonized larvae, the treatment with 0.5 to 4% of *C. guianensis* induced mortality after 24 hours with $LC_{50}$ of 1.81 (1.39–2.22%), and an $LC_{50}$ of 1.82 (1.57–2.07%) to the 4th instar. This is the 1st report of the larvicidal effect of *C. guianensis* on mosquitoes.

**KEY WORDS** *Aedes albopictus, Carapa guianensis,* dengue fever, yellow fever, larvicide

*Aedes albopictus* (Skuse) is known to transmit the arboviruses that cause dengue fever and dengue hemorrhagic fever in several countries on the Asian continent (Chung and Pang 2002). In addition, this mosquito species is broadly distributed across the world, where its importance extends beyond dengue to include Rift Valley fever, eastern equine encephalitis virus, and others (Moore and Mitchell 1997, Kramer et al. 2002). In Brazil, its distribution covers all regions, and its primary importance relates to epidemics of yellow fever (Mondet et al. 1996, Gomes et al. 1999). Under laboratory conditions, *Ae. albopictus* has shown the capacity to transmit the flavivirus of dengue and yellow fever, as well as eastern equine encephalitis (Miller and Ballinger 1988). The ability of this exotic mosquito to occupy a wide variety of habitats in urban, rural, and sylvatic environments enhances its role as an important vector species (Ali et al. 1995). Its wide distribution and potential capacity as a vector of several species of *Flavivirus* promote *Ae. albopictus* as a target of study and control effort. Because of the high resistance of mosquitoes to pesticides (Rodriguez et al. 2001, Kumar et al. 2002), the use of control methods based on plant extracts has become increasingly important. The most prominent phytochemical pesticides found to date are those from the seed kernel of the neem tree *Azadirachta indica* A. Juss. Meliacea (Mulla and Su 1999). Some of the effects of neem on mosquitoes include larvicidal activity and growth regulation (Boschitz and Grunewald 1994), suppression of fecundity, male sterility, immunosuppression, and blocking the development of pathogens in arthropod vectors (Mulla and Su 1999).

The Amazon andiroba tree *Carapa guianensis* Aubl. belongs to the same family as neem, and its seeds have been empirically used for some time as a vermifuge, antibacterial, emollient, and natural insect repellent and to treat insect bites, primarily in the Amazon region of Brazil. The ethnopharmacological significance of this plant was confirmed by Hammer and Johns (1993), who conducted field and laboratory tests. According to Taylor (1984), the active ingredient responsible for the effect on insects is probably attributed to the presence of limonoids in the seeds. Gilbert et al. (1999) describe the use of andiroba oil in candles produced by the Oswaldo Cruz Foundation, which are used as repellents and antifeedant against mosquitoes.

To verify a larvicidal effect of *C. guianensis* against mosquitoes, we tested the sensitivity of *Ae. albopictus* larvae (3rd and 4th instars) to different concentrations of andiroba seeds under laboratory conditions.

We used F1 progeny of *Ae. albopictus* collected from the field and a laboratory colony of *Ae. albopictus* that had been maintained in our insectary for 2 years (after being collected in the wild) and reared with a photoperiod of 14:10 h light:dark. Larvae were reared on puppy food (Royal Canin do Brasil, 0.2 g/100 ml, 3 times a week). Adult males and females were continuously provided with a 5% honey solution, whereas females were blood-fed on BALB/c mice twice a week to obtain eggs for colony development. Seeds of *C. guianensis* were manually scratched and separated in portions to obtain 0.5–4 g/100 ml of boiled water. For each

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concentration tested, we used 20 larvae of 3rd and 4th instars of F1 progeny of sylvatic and laboratory-reared *Ae. albopictus.* Larvae (F1) were incubated with different concentrations of *C. guianensis* (0.5–2% and 0.5–4%, respectively). The seeds remained in the solution throughout the bioassay.

Five experiments were performed at each concentration, and larval mortality was determined at 24 and 48 h of exposure by prodding and teasing larvae with a needle to confirm whether movement could be observed. Larval mortality also was analyzed in controls during the tests. Mortality was obtained as the total number of *Ae. albopictus* larvae killed in each bioassay. The $LC_{50}$ values were calculated with the Graph Pad Prism computer program (Graph Pad Software 1995, San Diego, CA) and are reported as geometric means accompanied by their respective 95% confidence limits.

For the F1 progeny of *Ae. albopictus* 3rd instars, we observed that the dry-scratched kernels of *C. guianensis* at concentrations ranging from 0.5% to 2% induced mortality with an $LC_{50}$ of 0.74 (0.56–0.90%) and 0.68 (0.53–0.84%) for a period of 24 and 48 h, respectively. Likewise, the same concentrations against 4th instars at 24 and 48 h produced mortality with an $LC_{50}$ of 0.66 (0.52–0.80%) and 0.55 (0.20–0.91%), respectively. No mortality was observed in control larvae at 24 or 48 h. The use of 3 and 4 g/100 ml produced 100% mortality only 12 h into the treatment period.

When laboratory-reared 3rd instars were treated with 0.5–4% *C. guianensis* for 24 h, we observed that andiroba induced mortality with an $LC_{50}$ of 1.81 (1.39–2.22%). Likewise, the same concentrations against the 4th instar of *Ae. albopictus* at 24 h produced mortality with an $LC_{50}$ of 1.82 (1.57–2.07%). No mortality was observed in control larvae at 24 or 48 h. Sylvatic *Ae. albopictus* larvae appeared to be more susceptible to andiroba seed kernel than their laboratory-reared counterparts, probably because the sylvatic *Ae. albopictus* have a lower tolerance to biological compounds than those reared in a laboratory, but this characteristic must be studied.

Currently, we are investigating whether sylvatic *Ae. albopictus* larvae, as well as *Ae. aegypti* (L.) and *Culex quiquefasciatus* Say, are also sensitive to the andiroba oil and ethanolic extract of the seeds. The results so far are promising for mosquito larvae control. We believe that this work will contribute to studies on vector control programs that use natural products. This is the 1st report of the larvicidal activity of *C. guianensis* on mosquitoes, which raises the possibility of the use of this plant in the control of these mosquito species, particularly in Brazil.

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