

Insecticidal and antifeedant properties of the medicinal plant *Cinnamosma fragrans* to control the mosquito vector *Aedes aegypti*

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ABSTRACT

Mosquitoes and arboviruses are of great concern to public health. Their control has been based on chemical insecticides that have led to resistance, and new insecticides are needed. Here we demonstrated that bark and root extracts from Madagascan plants of the genus *Cinnamosma* (Canellaceae) are toxic and antifeedant to *Aedes aegypti* mosquitos, and the isolated drimane sesquiterpene cinnamodial (CDIAL) is the primary driver of adulticidal activity. In addition to CDIAL, Polygodial (POLYG), cinnafraigrin A (CFRAG), and capsicodendrin (CPCD) contributed to the larvicidal activity, whereas polygodial and cinnamolide (CML) contributed to the antifeedant activity.

INTRODUCTION

The overuse of synthetic chemicals has led to:

- Insecticide resistance in insect pests
- Accumulation of harmful residues in the environment
- Health concerns
- Undesirable effects on non-target organisms (including beneficial insects and vertebrates).

These problems have highlighted the need for discovering safe insecticides and repellents to improve the control of mosquito vectors.

AIM

Here we focus on characterizing: Bioactivity of the main extracts (Bark, Leaves or Roots) and their major compounds of a traditional medicinal plants *Cinnamosma* species (family Canellaceae), against the yellow fever mosquito *Aedes aegypti*.

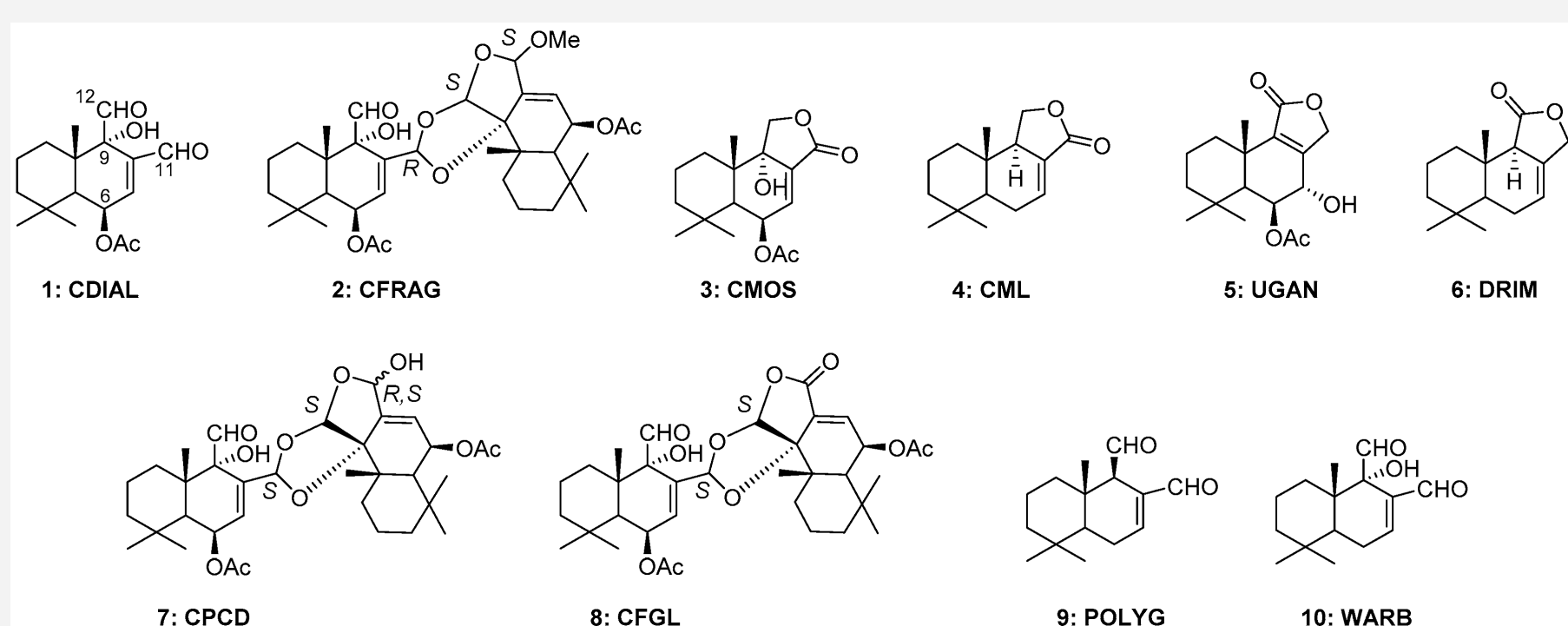
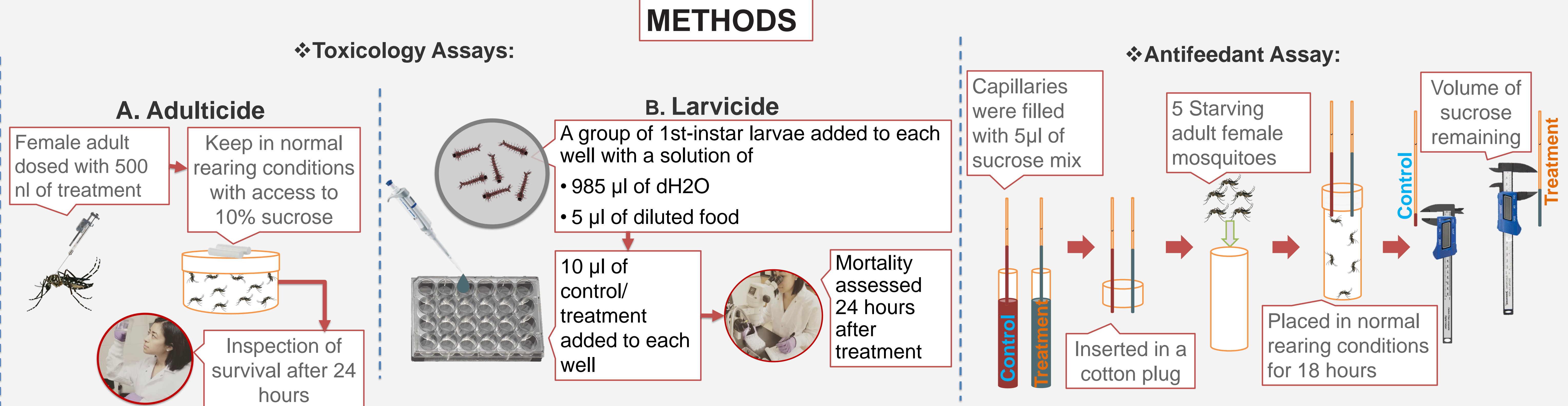


Figure 1. Structures of isolated compounds. Carbons referred to in the text are numbered in cinnamodial (CDIAL). CFRAG = cinnafraigrin A; CMOS = cinnamosmolide; CML = cinnamolide; UGAN = ugandensolide; DRIM = drimenin; CPCD = capsicodendrin; CFGL = cinnafraigrinolide; POLYG = polygodial; WARB = warburganal.



HYPOTHESIS

Dichloromethane extracts of the bark, root and leaves of *C. fragrans* and their major compounds will have toxic and/or antifeedant effects against mosquitoes.

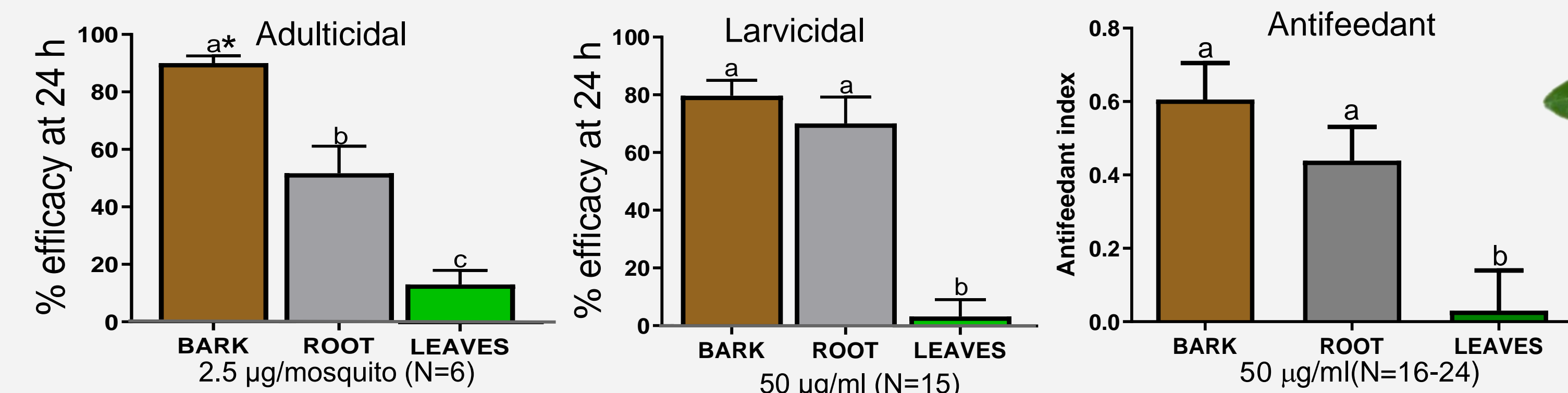


- Relative abundances of compounds CDIAL and CMOS in the extracts of *Cinnamosma* species. Percentages were estimated using the integration of the 1H signals.

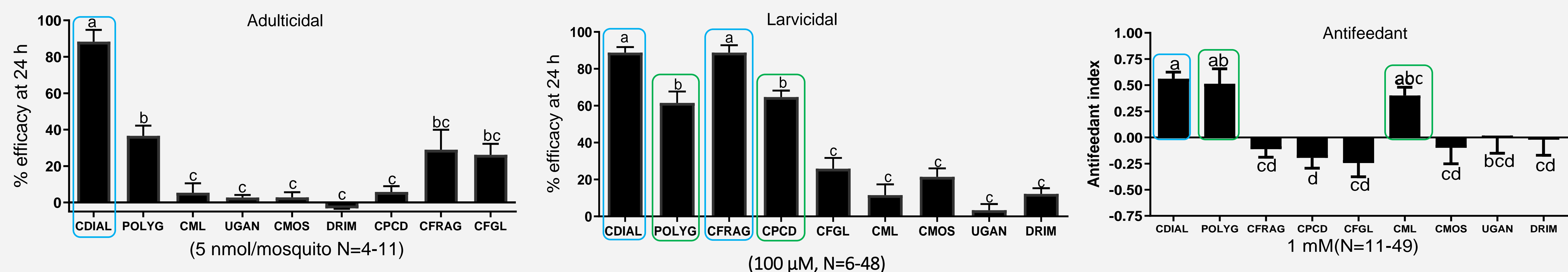
Plant Extract	Relative Abundance of Compound	
	CDIAL	CMOS
Bark	~60%	<5%
Root	~30%	~45%
Leaves	0	~30%

RESULTS

- Adulticidal results correlated with the abundance of CDIAL in the extracts, but larvicidal and antifeedant results suggest the presence of other active compounds in the root extracts.



- CDIAL was the only drimane sesquiterpene showing significant adulticidal activity, but several compounds showed significant larvicidal activity.
- CDIAL, POLYG, and CML showed significant antifeedant activity.



DISCUSSION

The *C. fragrans* plant is enriched with pungent drimane-type sesquiterpenes (Quéro, A. 2016), which are responsible for its strong insecticidal and antifeedant activity in this study.

Adulticidal results support the hypothesis that CDIAL is the primary active component on the bark extract, but larvicidal results suggest otherwise. Other compounds (e.g. CMOS and CFRAG) may enhance the larvicidal and antifeedant activity of the root extract by causing additive effects and/or synergizing the relatively low amount of CDIAL (Inocente et al. 2018; Inocente et al. 2019)

CONCLUSIONS

The results indicate that *C. fragrans* is a promising source for novel sesquiterpenes with insecticidal and antifeedant properties that may be used for the development of next generation, natural products for controlling mosquitoes.

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