*Chemistry of Natural Compounds, Vol. 46, No. 2, 2010*

# COMPOSITION AND LARVICIDAL ACTIVITY OF THE ESSENTIAL OILS OF *Lantana camara* AND *Lantana montevidensis*

**J. G. M. Costa,[1*] F. F. G. Rodrigues,[1] E. O. Sousa,[1]**
**D. M. S. Junior,[1] A. R. Campos,[1]**
**H. D. M. Coutinho,[1] and S. G. de Lima[2]**

UDC 547.913

*Lantana camara* Linn. and *Lantana montevidensis* Briq. (Verbenaceae) are native species from America′s rain forest. However, these species are cultivated as ornamental plants [1]. They might be poisonous to ruminants, but are largely used in popular medicine all over the world to treat fever, flu, asthma, bronchitis, and a variety of other illnesses [2–4]. Specially in Brazil they are used to treat rheumatism and pulmonary diseases [5]. Their leaves are rich in essential oils and phenolic compounds like aesulin, quercetin, isorhamnetine, fisetine, gossypetine, tricine and aesculetine, and triterpenoids. These chemical constituents are also found in some weeds presenting allelopathic and toxic properties [6]. *Aedes aegypti* is responsible for yellow fever transmission and is also a vector for hemorrhaging dengue (breakbone fever), an endemic disease in Southeast Asia, Pacific islands, Africa, and America [7]. Few published works associating larval infestation levels and socioeconomical characteristics, together with dengue endemic reality and urban infestation by *Aedes aegypti*, are available. As larvae radication is much easier than elimination of the adult mosquito, new strategies are necessary to control larvae proliferation. The most efficient and ideal way to control dengue would be the clearance of spots favorable to growth of the mosquito. The usual way to do it involves application of synthetic products, which results in resistance development by the mosquito [8]. Several studies have targeted natural products as insecticidal agents in order to control *A. aegypti* larvae due to the large number of compounds and medicinal plant essential oils exhibiting larvicidal activity [9].

The results of analysis of the chemical composition of the essential oils are presented in Table 1. The volatile components of both species revealed the predominance of terpenoids and sesquiterpenoids. The main component of *L. camara* essential oil was found to be bicyclogermacrene (19.51%), while in *L. montevidensis* it was $\beta$-caryophyllene (29.81%).

Twenty-one components (99.11%) were identified for *L. camara* leaves oil, and eighteen (95.83%) for *L. montevidensis*, with nine chemical constituents not common to both species. The oils were assessed against *Aedes aegypti* larvae at the third development stage to test the larvicidal potential. Results showed that both species have larvicidal potential: *Lantana camara* with $LD_{50}$ of 42.3 ± 0.85 μg/mL, and *Lantana montevidensis* with $LD_{50}$ of 117 ± 0.5 μg/mL. Additionally, both values are below the standard limit of $LD_{50} < 1000$ μg/mL.

On the face of preliminary bioassay results against *A. aegypti* larvae, it might be suggested that the essential oils from these species, especially *L. camara,* could be regarded as natural alternatives to eradicate *A. aegypti*.

*Lantana camara* and *Lantana montevidensis* leaves were collected in January, 2008 from the Small Aromatic and Medicinal Plants Garden of the Natural Products Research Laboratory (LPPN) at Cariri Regional University (URCA), City of Crato, Ceara State, Brazil. Exsiccates were deposited at the Dardaro de Andrade Lima Caririensis Herbarium, Biology Department, under registry No. 1662 and No. 1619, respectively for *L. camara* and *L. montevidensis*.

Fresh leaves (200 g) were submitted to the hydrodistillation process in a Clevenger-like apparatus for two hours, resulting in an essential oil yield of 0.05% for *L. camara* and 0.07% for *L. montevidensis*, which were subsequently dried by anhydrous sodium sulfate ($Na_2SO_4$) and kept refrigerated until they were analyzed.

1) Programa de Pos-Graduacao em Bioprospeccao Molecular-Laboratorio de Pesquisas de Produtos Naturais-Universidade Regional do Cariri-CEP 63105-000, Bairro Pimenta-Crato, Ceara, Brazil, fax: +55 88 3102 1212, e-mail: galberto@urca.br; 2) Departamento de Quimica-Universidade Federal do Piaui-Campus Universitario Ministro Petronio Portella-CEP 64049-550-Bairro Ininga, Teresina, Piaui, Brazil. Published in Khimiya Prirodnykh Soedinenii, No. 2, pp. 262–263, March–April, 2010. Original article submitted October 31, 2008.

0009-3130/10/4602-0313  

TABLE 1. Chemical Composition (%) of *Lantana camara* and *Lantana montevidensis* Fresh Leaves Essential Oils

| Compound | RI | *L. camara* | *L. montevidensis* | Compound | RI | *L. camara* | *L. montevidensis* |
|---|---|---|---|---|---|---|---|
| 3,5-Dimethylene-1,4,4-trimethylcyclopentene | 938 | – | 0.71 | *E*-Caryophyllene | 1416 | 16.71 | – |
| Thuja-2,4(10)-diene | 960 | – | 0.48 | $\alpha$-Humulene | 1451 | 2.17 | 2.68 |
| Sabinene | 971 | 4.80 | 0.55 | Alloaromadendrene | 1459 | 2.26 | 1.41 |
| $\beta$-Pinene | 983 | 0.31 | – | $\beta$-Selinene | 1489 | – | 1.56 |
| $\beta$-Myrcene | 989 | 0.41 | – | Bicyclogermacrene | 1500 | 19.51 | 14.14 |
| $\beta$-Ocimene | 1019 | 1.14 | – | $\gamma$-Cadinene | 1502 | – | 2.61 |
| *p*-Cimene | 1024 | 5.21 | – | Valencene | 1503 | 12.35 | 25.21 |
| 1,8-Cineole | 1026 | 1.35 | – | Germacrene A | 1507 | 12.98 | – |
| $\gamma$-Terpinene | 1064 | 0.61 | – | $\beta$-Cadinene | 1518 | 0.51 | – |
| Linalool | 1096 | – | 1.85 | Germacrene D | 1557 | – | 1.56 |
| Camphor | 1142 | – | 0.34 | Spathulenol | 1571 | 2.61 | 3.28 |
| Terpin-4-ol | 1180 | 0.59 | – | Caryophyllene oxide | 1579 | 7.75 | 2.61 |
| $\alpha$-Copaene | 1371 | 0.41 | 2.61 | Humulene oxide | 1609 | – | 1.31 |
| $\beta$-Elemene | 1389 | 1.20 | 3.11 | Cubenol | 1648 | 5.48 | – |
| *Z*-Caryophyllene | 1412 | – | 29.81 | Total identified | | 99.11 | 95.83 |

Volatile constituent analysis was carried out on a Shimadzu GC-17A/MS QP5050A system (GC/MS system) employing a nonpolar capillary column, DB-1, of fused silica (30 m × 0.25 mm i.d., 0.25 μm pellicle), pumped by helium gas at 0.8 mL/min and with split mode. Injector and detector temperatures were set to 260°C and 270°C, respectively. Column temperature was programmed from 60°C (1.0 min) to 180°C (for 4 min) at 4°C/min, then from 180°C to 260°C at 6°C/min. Mass spectra were recorded from 43–450 *m/z*. Individual components were identified by comparison of their mass spectra at 70 eV to the Wiley built-in database and two additional computers using retention indices as pre-selection parameters [10], as well as by visually comparing standard fragmentation to those in the literature [11, 12].

GC analyses were performed on a Hewlett-Packard 5890 SERIES II instrument equipped with a flame ionization detector (FID) and a J & W Scientific DB-5 fused silica capillary column (30 m × 25 mm × 0.25 μm); column temperatures were programmed from 60°C for 1 min, raised to 180°C (for 4 min) at 4°C/min, then increased to 260°C at 10°C/min for integrating purposes. Injector and detector temperatures were 260°C and 270°C, respectively. Hydrogen was used as carrier gas, flow rate 1.5 mL/min, split mode (1:10). Injection volume, 1.5 μL, solution of about l0 mg of oil in ethyl acetate. The retention indices were obtained by co-injecting the oil sample with a $C_9$–$C_{24}$ linear hydrocarbon mixture.

Larvicidal assessment was carried out according to the recommended methodology [13]. Samples from the essential oils were tested, in concentrations ranging from 25 to 500 μg/mL and diluted in Tween 80/$H_2O$, against *Aedes aegypti* larvae in the third development stage. The experiment was triply run, accompanied by a Temephos® (*O*,*O*′-thiodi-4,1-phenylene) positive control and Tween 80/$H_2O$ negative control. After 24 h, dead larvae percentages were calculated and used to obtain the $LD_{50}$ by a linear regression method, in which a sample is considered active when $LD_{50} < 1000$ μg/mL.


## ACKNOWLEDGMENT

The authors would like to acknowledge financial support from CNPq and FUNCAP, UFPI-LAPETRO for the chromatograms and Fundacao Nacional de Saude for providing *Aedes aegypti* larvae.


## REFERENCES


1. V. R. Affonso, H. B. Bizzo, S. S. Lima, M. A. Esquibela, and A. Sato, *J. Braz. Chem. Soc.*, **18**, 1504 (2007).
2. A. A. Seawright, *Aust. Vet. J.*, **41**, 235 (1965).
3. C. H. Tokarnia, J. Dobereiner, A. A. Lazzari, and P. V. Peixoto, *Pesquisa Vet. Bras.*, **4**, 129 (1984).
4. C. H. Tokarnia, A. G. Armien, S. S. Barros, P. V. Peixoto, and J. Dobereiner, *Pesquisa Vet. Bras.*, **19**, 128 (1999).

5. H. Lorenzi and F. J. A. Matos, *Plantas Medicinais no Brasil: Nativas e Exoticas Cultivadas*, Instituto Plantarum, Nova Odessa, 2002.
6. O. P. Sharma, H. P. S. Makkar, R. K. Dawra, and S. S. Negi, *Clin. Toxicol.*, **18**, 1077 (1981).
7. G. Ciccia, J. Coussio, and E. Mongelli, *J. Ethnopharmacol.*, **72**, 185 (2000).
8. J. G. M. Costa, F. F. G. Rodrigues, E. C. Angelico, M. R. Silva, M. L. Mota, N. K. A. Santos, A. L. H. Cardoso, and T. L. G. Lemos, *Rev. Bras. Farmacogn.*, **15**, 304 (2005).
9. V. S. Rao, J. L. Maia, F. A. Oliveira, T. L. G. Lemos, M. H. Chaves, and F. A. Santos, *Nat. Prod. Commun.*, **2**, 1 (2007).
10. J. W. Alencar, A. A. Craveiro, and F. J. A. Matos, *J. Nat. Prod.*, **47**, 890 (1984).
11. R. P. Adams, Identification of Essential Oil Components by Gas Chromatography/Quadrupole Mass Spectroscopy, 4th Edition. Allured Publishing Corporation, Carol Stream, Illinois, USA, 2005.
12. E. Stenhagen, S. Abrahamson, and F. W. McLafferty, *Registry of Mass Spectral Data Base*. Government Printing Office, Washington, DC, 1974.
13. M. F. Oliveira, T. L. G. Lemos, M. C. Matos, T. A. Segundo, G. M. P. Santiago, and R. Braz-Filho, *An. Acad. Bras. Cienc.*, **74**, 211 (2002).