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Short communication

Screening of Uruguayan plants for deterrent activity against insects

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ABSTRACT

We evaluated the anti-insectan activity of extracts from different vegetative parts of ten plant species native to Uruguay. The selected plants belong to five families: Bignoniaceae: *Clytostoma callistegioides*, *Dolichandra cynanchoides*, *Macfadyena unguis-cati*; Sapindaceae: *Dodonaea viscosa*, *Allophylus edulis*, *Serjania meridionalis*; Lamiaceae: *Salvia procurrens*, *Salvia guaranitica*; Solanaceae: *Lycium cestroides*; and Phytolaccaceae: *Phytolacca dioica*. The extracts were evaluated in independent bioassays against four insect pests and one beneficial insect. Aphid settling inhibition was evaluated with a grass specialist, *Rhopalosiphum padi*, and a feeding generalist, *Myzus persicae* (both Hemiptera: Aphididae). Antifeedant activity was tested with adults of the specialist *Epilachna paenulata* (Coleoptera: Coccinellidae) and larvae of the generalist *Spodoptera littoralis* (Lepidoptera: Noctuidae). Finally, contact toxicity was assessed with honey bees, *Apis mellifera* (Hymenoptera: Apidae). Strong settling inhibition (SI) activity (expressed as %SI, where 100% means complete inhibition by the extract) was found only for the twig extracts of *A. edulis* (Sapindaceae) against *M. persicae* (%SI = 77 ± 4). Antifeedant activity (expressed as % of feeding reduction (FR), where 100% means no consumption on extract-treated diet) against *E. paenulata* was significant for the leaf extracts of *L. cestroides* (Solanaceae) (%FR = 100 ± 0) as well as of all Bignoniaceae and Sapindaceae species. No extracts were active against *S. littoralis* larvae, and most of them were innocuous to honey bees, with the exception of *L. cestroides* and *S. meridionalis* leaf extracts.

1. Introduction

The increasing world population has generated the need to raise yields of primary production, resulting in turn in an increased use of conventional pesticides to control pest damages in crops. The use of classical pesticides yields effective results in the short term, but it has different drawbacks, such as the development of resistance and the adverse

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environmental effects on the biotic and abiotic environment. The latest trend in agricultural production calls therefore for the implementation of alternatives to the use of conventional pesticides. Among other approaches to substitute conventional pesticides in Integrated Pest Management programs (pheromones, monitoring, and organic production), the developing of new pesticides from natural resources such as undamaged native plants ("botanical pesticides") has been attempted in the past (Isman, 2005).

Although many plant species have been tested in their capacity as anti-insect agents (Grainge and Ahmed, 1988), most efforts have concentrated in species from families that include either the most traditionally used botanical pesticides (Meliaceae, Piperaceae, Asteraceae and Fabaceae) (Isman, 2005), or species with high contents of essential oils including Apiaceae, Lamiaceae, Myrtaceae, Lauraceae and Myristicaceae (Oliveira and Spitzer, 1999).

We have recently implemented a program intended to search for new natural products with anti-insectan activity in plants that are native to the region that includes Uruguay, southern Brazil and Argentina. As additional criteria for selecting the plants to study, we have chosen plant species from families that have not been extensively studied in regards to their anti-insectan capacity, which were readily available within the study area, and showed no obvious damage, by herbivores. Here we present our results with plant extracts from ten species of the families Bignoniaceae, Sapindaceae, Lamiaceae, Solanaceae and Phytolaccaceae.

The extracts were evaluated against four pest species chosen to represent different feeding modes (chewing and sucking) and diet breadth (specialist and generalist). The four species are themselves important agricultural pests, either in conventional or organic production (Scatoni and Bentancourt, 1999). Furthermore, to assess the potential negative effect of the use of these plant extracts on the biotic environment, we performed contact toxicity bioassays against a beneficial insect (*Apis mellifera*).

2. Materials and methods

2.1. Plant material and extracts

The aerial parts (fruits, leaf and twigs) of the plants under investigation (Table 1) were collected in the fall of 2005, at two riverbanks nearby Montevideo city. *D. viscosa* was collected in late spring (November 2004) in Maldonado (south-eastern Uruguay). Species were identified by us (EAP & MJB), and Voucher specimens (numbers in Table 1) were deposited at the Herbarium of Facultad de Química, Montevideo, Uruguay. All plant material was air-dried before extraction (*S. meridionalis*, *A. edulis* twigs and *D. cynanchoides* were previously grounded). All fixed extracts were performed in Soxhlet with ethanol, then filtered and concentrated under vacuum to give a dried residue. Essential oils were only obtained for the two Lamiaceae (*S. guaranitica* and *S. procurrens*), by steam distillation in a Clevenger apparatus. Extraction yields are given in Table 1.

2.2. Insects

Epilachna paenulata Germar (Coleoptera: Coccinellidae): A laboratory colony was maintained on squash (*Cucurbita pepo* L.) under controlled conditions of temperature (20 ± 2 °C) and photophase (14L:10D). The colony was initiated with individuals collected on squash plants in organic farms nearby Montevideo, and new field-collected individuals have been added every year (Camarano et al., 2006).

Rhopalosiphum padi L. (Hemiptera: Aphididae) were reared on *Hordeum vulgare* L. foliage and maintained at 20 ± 1 °C, >70% relative humidity, with a photoperiod of (16L:8D) in a growth chamber.

Spodoptera littoralis Boisduval (Lepidoptera: Noctuidae) and *M. persicae* Sulzer (Hemiptera: Aphididae) colonies were reared on an artificial diet (Poitout and Bues, 1974) and bell pepper foliage (*Capsicum annuum* L.), respectively. Both colonies were

Table 1 – Plant species and parts evaluated in their anti-insectan activity, and extraction yields as percent of plant dry weight[a]

Family	Species (Voucher numbers)	Organ extracted	Yield	
			EE (%)	EO (%)
Lamiaceae	*Salvia guaranitica* St.Hilaire ex Benth. (4320 MVFQ)	Leaves	No	1.0
	Salvia procurrens Benth. (4319 MVFQ)	Leaves	7.8	NA
Bignoniaceae	*Clytostoma callistegioides* Bureau ex Griseb. (4311 MVFQ)	Leaves	5.1	–
	Dolichandra cynanchoides Cham. (4318 MVFQ)	Leaves	11.6	–
	Macfadyena unguis-cati (L.) A.H.Gentry (4312 MVFQ)	Leaves	8.8	–
Phytolacaceae	*Phytolacca dioica* L. (4313 MVFQ)	Fruits	12.9	–
Sapindaceae	*Allophylus edulis* (A. St.-Hil.) Radlk. ex Warm. (4316 MVFQ)	Leaves	10.3	–
		Twigs	9.4	–
	Dodonaea viscosa (L.) Jacq. (4314 MVFQ)	Leaves	19.6	–
		Twigs	3.4	–
		Fruits	20.5	–
	Serjania meridionales Camb. (4315 MVFQ)	Leaves	16.5	–
Solanaceae	*Lycium cestroides* Schldl. (4317 MVFQ)	Leaves	11.7	–

[a] EE, ethanolic extract; EO, essential oil; NA, yield not available; –: not obtained.