RESEACH NOTE

Screening of Asteraceae (Compositae) Plant Extracts for Molluscicidal Activity

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Schistosomiasis is an endemic disease caused by helminths belonging to the genus *Schistosoma.* According to the World Health Organization (WHO), this disease affects more than 200 million people and places other 600 million at risk of infection in more than 70 countries in the tropics (WHO 1994 *O controle da Esquistossomose*, Ed Fiocruz, Rio de Janeiro, Brazil). In Central and South America, *S. mansoni* causes intestinal schistosomiasis in 8-12 millions patients (JR Lambertucci et al. 1987 *Rev Soc Bras Med Trop 20*: 47-52). In view of its prevalence and morbidity this disease is a serious public health problem in Brazil and many other countries. The life cycle of this parasite involves the infection of some species of molluscs. In Brazil, snails of genus *Biomphalaria*, in special *B. glabrata*, are the most important intermediate hosts for *S. mansoni*. Snail's population control via molluscicide can play an important role in an integrated approach aiming at the control of this disease if the molluscicidal agent is made available to the affected communities. Thus, the development of efficient, cheap and environmentally safe molluscicides would result in an important complementary tool to minimize the impact of schistosomiasis. This demand has stimulated the involvement of many groups worldwide in the search of new compounds from plants that can be used as molluscicide.

In this paper we present the screening of 66 species belonging to Asteraceae (Compositae) family against *B. glabrata* adult snails aiming at finding molluscicidal plant extracts. The aerial parts of the plants were collected in the vicinities of Belo Horizonte, State of Minas Gerais, Brazil, from March 1989 to September 1991. The following species were identified and their exsiccates deposited at the Federal University of Minas Gerais Herbarium: *Acanthospermum australe** (Loef.) Kunt, *Achyrocline satureioides**(Lam.) D.C., *Actinoseris angustifolia* (Gardn.) Cabr., *Ageratum conyzoides** L, *Alomia myriadenia* Baker, *Aspilia foliosa* (Garder) Benth & Hook, *Baccharis dracunculifolia** D.C., *Baccharis helichrysoides* D.C., *Baccharis platypoda* D.C., *Baccharis serrulata* (Lam.) Pers., *Baccharis trimera** (L.) D.C., *Baccharis trinervis* (Lam.) Pers, *Bidens pilosa** L., *Bidens rubifolius* H.B.K., *Blainvillea biaristata* D.C., *Cetratherum punctatum* Cass., *Chaptalia nutans* (L.) Polak, *Cosmos sulfureus** Cav., *Dasyphyllum macrocephala* Baker, *Eclipta paniculata* Kuntz, *Elephantopus mollis** H.B.K., *Eremanthus glomerulatus* (D.C.) Less., *Eremanthus sphaerocephalus* Baker, *Erigeron bonariensis* L., *Erigeron canadensis* L., *Eupatorium amphidictyum* D.C., *Eupatorium bupleurifolium* D.C., *Eupatorium halimifolium* D.C., *Eupatorium laevigatum** Lam., *Eupatorium squalidum* D.C., *Gnaphalium spicatum* Hook, *Gochnatia polymorpha** (Less.) Cabr, *Hieracium* sp., *Jaegeria hirta* (Lag.) Less, *Jungia floribunda** Less., *Lychnophora pinaster* Mart., *Lychnophora pseudovillosissima* Semir & L.F., *Mikania cordifolia** (L.F.) Wild, *Mikania lutzelburghii* Mattf., *Mikania obtusata* D.C., *Mikania sessilifolia* D.C., *Piptocarpha rotundifolia* Baker, *Pluchea quitoc** L., *Pseudoginonoxis pohlii* (Sch. Bip.) L.F., *Pterocaulon alopecuroides* (Lam.) D.C., *Senecio brasiliensis* Less., *Senecio confusus* Britten, *Stenocline chionaea* D.C., *Symphyopappus polystachyus* Baker, *Tagetes minuta* L., *Taraxacum officinale** (With.)Wiggers, *Tithonia rotundifolia* Baker, *Trixis vauthieri* D.C., *Vanillosmopsis erythropappa* Sch. Bip., *Verbesina clausseni* Sch. Bip., *Vernonia condensata* Baker, *Vernonia crotonoides* (D.C.) Sch. Bip., *Vernonia ferruginea Less., Vernonia herbaceae* (Vell.) Rusby, *Vernonia linearis* Spreng., *Vernonia pedunculata* D.C., *Vernonia polyanthes* (Spreng.) Less., *Vernonia*

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remotiflora Rich., *Viguiera ovatifolia* Baker, *Wedelia paludosa* D.C., *Wulfia baccata* (L.F.) Kunt.

Among these plants, 15 (23%) are reputed as medicinal by some populations in Brazil (CL Zani 1995 *Phytomedicine 2*: 41-44) and are indicated in the above list with an asterisk. Each plant material was dried in the shade, ground in a knife mill and extracted twice (24 hr) with ethanol at room temperature. After filtration, the ethanol was removed by rotary evaporation under reduced pressure and temperature below 45ºC. The resulting crude extract was kept in the dark in a freezer at -20º C until assayed.

A preliminary screen to detect extracts with molluscicidal activity was run using a simple bioassay employing 10 adult *B. glabrata*. They were kept submersed during 24 hr in beakers containing 250 ml of a 100 ppm solution of each extract in dechlorinated water. Control without drugs and with niclosamide (0.3 ppm, 100% mortality) were run in parallel. Only the extracts from *A. angustifolia*, *A. myriadenia*, *A. satureioides*, *V. clausseni*, *P. rotundifolia* and *V. erythropappa* killed 100% of the snails after 24 hr exposure. Their LC_{90} were then determined according to the WHO guidelines (1983 Report of Scientific Working Group of Plant Molluscicide, TDRS/SCH-SWESWE4/83.3) and are shown in the Table. The extracts from *A. angustifolia*, *A. myriadenia* and *A. satureioides* were the most active, showing LC_{90} of 43, 33 and 33 ppm, respectively. According to WHO, crude organic extracts should present LC_{90} bellow 20 ppm to be considered a good molluscicide candidate for direct application in infested water (WHO *loc. cit.*). However, it is possible that extracts active between 20 and 100 ppm could contain small amounts of very active components, which could be isolated and/or concentrated using simple procedures, or even obtained from other plants known to produce it in larger amounts. Therefore, the above active extracts deserve further studies in order to identify and characterize their molluscicidal components.

TABLE

Molluscicidal activity of Asteraceae plant species against *Biomphalaria glabrata* snails[a]

Plant species	LC_{90} (ppm)
Achyrocline satureioides (Lam.) D.C.	43
Actinoseris angustifolia (Gardn.) (Cabr.)	33
Alomia myriadenia Baker	33
Piptocarpha rotundifolia Baker	99
Vanillosmopsis erythropappa Sch. Bip.	99
Vanillosmopsis erythropappa Sch. Bip.	99
Verbesina clausseni Sch. Bip.	78

a: niclosamide at 0.3 ppm killed 100 % of the molluscs after 24 hr exposition.

Among the plants used in our screening 17 had already been tested for their molluscicidal activity by other research groups and all were confirmed as inactive. CP Souza et al. (1984 *An Acad Brasil Cienc 56*: 333-338) used a sequential extraction of *A. Satureioides* and *P. rotundifolia* with hexane-ethyl acetate followed by ethanol and showed that only the less polar extracts were active. However, our results showed that a direct extraction with ethanol is also effective to extract the molluscicidal component(s). Concerning the chemical composition of these two species, *A. satureioides* was the object of several phytochemical investigations that disclosed the presence of terpenoids, phenylpropanoids and flavonoids, among other classes of compounds. On the other hand, *P. rotundifolia* was not yet investigated for its chemical composition and thus is entitled for a bioassay-guided fractionation to identify its molluscicidal components.

The molluscicidal activities of *A. angustifolia*, *A. myriadenia*, *V. erythropappa* and *V. clausseni* are reported here for the first time. Furthermore, except for *V. erythropappa*, the chemical composition of these species is completely unknown and further investigations to identify the compounds responsible for the observed molluscicidal activity is needed. Extracts of *V. erythropappa* were also shown to inhibit *S. mansoni* cercarial penetration in mice tails and to kill the larvae of several parasitic helminths (B Gilbert 1970 *An Acad Bras Cienc 42*: 397-400, PM Baker 1972 *J Pharmacol 24: 853-857*, B Gilbert 1972 *An Acad Bras Cienc 44* suppl: 423). Previous phytochemical study of this species (JN Lopes 1991 *An Acad Brasil Cienc 63*: 21-22) disclosed the presence of several terpenoids and sesquiterpene lactones that could account for the above mentioned biological activities.

In conclusion, our screening revealed the molluscicidal activity of six plant species, four of them not previously known to present such activity. Among them, *A. angustifolia* and *A. myriadenia* should be prioritized for further investigations, as they were the most active and their chemistry is still unknown. In this respect, *A. myriadenia* is currently the object of a bioassay-guided fractionation in our laboratory aiming at the isolation and structural elucidation of its molluscicidal component(s).

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