Molluscicidal Compounds of Plant Origin*

JEROME D. MSONTHI
Chancellor College
University of Malawi
P.O. Box 280
Zomba, Malawi

There is great impetus among phytochemists to develop molluscicides which are lethal to the snail intermediate hosts of bilharzia. They search for plant-derived, water-soluble compounds that are cheap to isolate, specific to target animals, easily biodegradable, non-toxic to other biota and to which snails are unlikely to become resistant (Hostettmann 1984). This paper reports on some medicinal plants from Malawi that have been studied in the hope of isolating compounds for the control of bilharzia.

In Malawi, the root-bark of the plant *Diospyros usambarensis* (Ebenaceae) is used traditionally to cure bilharzia. Recent studies on the root-bark of this plant also indicate strong molluscicidal activity. Extraction of the root-bark, guided by an appropriate bioassay, isolated 7-methyljuglone. This simple naphthoquinone was toxic to *Biomphalaria glabrata*, the snail intermediate host of *Schistosoma mansoni*, at concentrations as low as 5 ppm. An isomer of

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Plants screened for molluscicidal activity in Malawi.

Family	Scientific name	Local name	Plant part	Local use	Reference
Polygalaceae	*Securidaca logipedunculata* Fresen	bwazi	leaves	wounds, coughs, venereal diseases, bilharzia	Kamwendo et al. 1985
Papilionoideae	*Naerotanenia mitis*	dema	tuber	Newcastle disease in chicken, bilharzia	Chiotha and Msonthi 1986
Guttiferae	*Psorospermum febrifugum* Spach	mdima	root-bark	heartburn, high blood pressure	Chiotha and Msonthi 1986
Rubiaceae	*Xeomphis obovata* (Hochst) Keay	chipembere	root-bark	bilharzia	Chiotha and Msonthi 1986
Curcubitaceae	*Lagenaria abyssinica* C. Jeffrey	chipucha mphonda	fruit pulp	fish poison, soap substitute	Msonthi and Chiotha 1986
Mellaceae	*Khaya nyasica* Stapf	mbawa	stem bark	quinine substitute, antihelminthic	Msonthi and Chiotha 1986
Labiatae	*Ocimm canum*	kaphabvumba mpungabwi	whole plant	mosquito repellant, smell disguiser	Msonthi and Chiotha 1986

7-methyljuglone (plumbagin) as well as vitamin K_3 was even more active and killed the snails at concentrations of 2 and 3 ppm, respectively. Fungicidal activity by TLC assay using *Cladosporium cucumerium* (an assay for biologically active compounds) was detected at 0.0025 µg/ml of 7-methyljuglone. Plant species which biosynthesize naphthoquinones are worth investigating for their molluscicidal activity (Marston et al. 1984a).

The roots of *Clerodendrum uncinatum* (Verbenaceae) have a reputation among traditional healers in Malaŵi as a cure for bilharzia and intestinal parasites. The infusion of the roots has a very bitter taste. Screening for biologically active compounds showed that the lipophilic extracts of *Clerodendrum uncinatum* had antifungal activity against *Cladosporium cucumerium*. Fractionation of active petroleum ether and chloroform extracts led to the isolation of a hydroquinone diterpene, uncinatone. Uncinatone inhibited the growth of *Cladosporium cucumerium* spores on a TLC bioassay at a minimum concentration of 0.5 µg/ml. In addition to further studies on the strong fungicidal activity of uncinatone, tests are underway to evaluate its possible *in vitro* and *in vivo* effects against schistosomes in humans (Dorsaz et al. 1985).

The tubers of *Talinum tenuissimum* (Portulacaceae) are used in Malaŵi, according to traditional healers, for the treatment of bilharzia. Aqueous extracts of *Talinum tenuissimum* also kill *Biomphalaria glabrata* within 24 hours, at concentrations as low as 25 ppm. This observation led to the isolation of a monodesmosidic saponin of oleanolic acid with a xylosyl (glucosyl uronic acid) moiety identified as 3-0-(O-β-D-xylopyranosyl)-(1>3)-0-(β-D-glucopyranosylcuronic acid) oleanolic acid. The methanol extract of the fresh tubers was suspended in water and partitioned with chloroform and n-butanol. The active butanol extract was submitted to flash chromatography on silica gel with $CHCl_3$/MeOH/H_2O 65:40:5, followed by preparative reversed-phase chromatography on RP-8 with methanol/water mixtures to yield the active saponin. The saponin killed *Biomphalaria glabrata* at a concentration of 1.5 ppm within 24 hours. Direct water extraction afforded a highly active solution killing the snails at a concentration of 25 ppm. The water extract contained mainly saponin and only traces of the saponin-oleanolate were detected. Thus the molluscicidal activity of saponin-containing plants depends essentially on the extraction process since the genuine inactive bidesmosidic saponins are easily base-hydrolyzed to very active monodesmosidic saponins in the course of the water extraction (Gafner et al. 1985).

The leaves and seeds of *Tephrosia vogelii* (Leguminosae) are used in Malaŵi to stupefy fish. The plant could also be investigated as a molluscicide. The petroleum ether extract of *Tephrosia vogelii* leaves was active against *Biomphalaria glabrata* snails at 400 ppm. After flash chromatography and low pressure chromatography (both on silica gel), two rotenoids, dequelin and tephrosin, were isolated. However, due to insolubility in water, the pure rotenoids were both inactive as molluscicides (Marston et al. 1984b).

Researchers in Malaŵi are currently screening medicinal plants for molluscicidal activity and many plants show activity against *Bulinus (Physopis) globusus* (see box) (Kamwendo et al. 1985; Msonthi and Chiotha 1986; Chiotha and Msonthi 1986).

Further phytochemical studies to isolate the active compounds from these plants are underway.

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Constraints to Aquaculture Extension in Rural Africa

JASTON MUTAMBO
Malaŵi Department of Fisheries
c/o MAGFAD, P.O. Box 206
Zomba, Malaŵi

The Learning Process: Constraints to a Participatory Approach to Extension

Recently, there was a strong advocacy for a participatory approach to aquaculture extension. In this, we may be chasing an illusion because of the structure and function of a farming society. Malaŵi affords an example. There is a traditional social structure at both village and higher levels with clearly defined lines of command and communication. People expect information and instructions to come from a particular source through some customary or approved route.

Education in Malaŵi's large rural population is traditionally passive at lower levels. Pupils receive information from teachers, and have little active