Review Article

EUCALYPTUS: A SUSTAINABLE SELF-DELIVERY MOLLUSCICIDE?

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ABSTRACT


Attention is drawn to the limitations of conventional methods of controlling important trematode infections such as schistosomosis and fasciolosis. Plant molluscicides could have a role in the future control of these infections. There are, however, major problems with most plant molluscicides in that their use is labour-intensive, in many cases relatively skilled workers are required, they must be applied regularly and arable land may be required for their cultivation. Thus, little progress is to be expected until plant species with sustainable self-delivery systems are identified. Eucalyptus is proposed as a likely candidate. The leaves of many species in this genus have molluscidal properties and their intermittent fall could effect self-delivery if the trees were planted in appropriate places. Relatively little work has been carried out on this possibility and much more is necessary, especially field trials. Before field trials are started, more laboratory testing is also necessary to determine the LC₅₀ values for different snail species and to study toxicity to non-target organisms.

Keywords: Eucalyptus, plant molluscicides, snails, sustainable, toxicity

Human and animal trematode infections such as schistosomosis and fasciolosis are problems of great socio-economic importance in most countries in the tropics. They are becoming even more important as water resources are developed and habitats for the intermediate snail hosts become more numerous. If possible, these infections should be controlled by procedures appropriate to national resources, minimizing, as far as possible, expenditure of hard currency.

Many snail-control programmes in rural communities in developing countries have been unsuccessful owing to the high foreign exchange cost of obtaining synthetic molluscicides. The lack of transport infrastructure in rural areas and of knowledge of the use of synthetic molluscicides has further affected their availability and effective use, thereby leading to programme failure.

There has been a growing interest in molluscicides that might overcome the above problems. One possibility is molluscicides of plant origin (McCullough et al., 1980). Kloos and McCullough (1987) reported 571 plants as having molluscidal properties. Such molluscidal plants are by their nature sustainable since they can be widely and continuously grown at relatively little cost. Sustainability is a concept that is increasingly recognized as a critical factor in the design of development initiatives, especially in developing countries. The concept encourages self-reliance, greater use
of renewable resources and the promotion of systems that require only low external inputs.

The most studied plant molluscicide is probably that derived from the berries of *Phytolacca dodecandra* (McCullough *et al.*, 1980). Various *Phytolacca* species are widespread in the tropics. But two major problems with this and most other plant molluscicides are that their use is labour-intensive and in many cases requires relatively skilled staff to carry out the extraction and application of the active agent; also, to be effective as control agents they must be applied regularly and, in most cases, this is difficult if not impossible. Focal and seasonal application on a wide scale would be dependent on the availability of arable land, well-organized cultivation, harvesting, processing and storage. Staff emoluments and logistic charges would be critical factors in using such molluscicides on a wide scale.

However, the leaves of some species of evergreen trees have been shown to have intrinsic molluscicidal properties and could overcome most of these problems if the trees were planted orientated to the prevailing winds so that the leaves fell directly into the target area. This need only be at the places where animals enter the water to drink and the immediate surrounds for the control of *Fasciola gigantica* but would have to be larger to control *Schistosoma* spp. Also, in the case of running water the trees should be planted along streams so that sufficiently long contact can occur between the snails and active principles diffusing out of the leaves. Costs would be confined to obtaining, planting and protecting the trees in the early stages of their growth. Some species of *Eucalyptus* meet this requirement, and possibly other trees such as *Schima argentea* (Cheng, 1971). It is likely that until molluscicidal species with such a ‘sustainable self-delivery’ system are used, little progress will be made in the use of plant molluscicides to control snail-borne diseases.

*Eucalyptus* originates from Australia. There are over 100 species that are now grown in many countries. They grow rapidly on most soil types and are found in tropical, sub-tropical and temperate countries, where their uses include firewood, timber, paper pulp production, wind breaks, soil conservation, shade and browse.

An early report of the molluscicidal properties of *Eucalyptus* was made by Mozley (1944), who found that extract of the bark, sawdust and leaves of *Eucalyptus* were lethal to *Biomphalaria* and *Physopsis* in Southern Rhodesia (now Zimbabwe), and accordingly suggested its use in the control of bilharzia, the snail-transmitted disease of man. This report was followed by that of Cowper (1948), who conducted *in vitro* experiments using boiled extracts of the leaves of various species of *Eucalyptus* to test their molluscicidal effect on *Planorbis corneus* snails. However, this work suggested that the molluscicidal action was negligible at any practical dilution. Nevertheless, both Coyle (1961) and Hammond (1970) observed low numbers or the absence of snails in otherwise apparently suitable aquatic habitats that were surrounded by *Eucalyptus* species or were fed by a stream running through a *Eucalyptus* plantation.

The most detailed study of the molluscicidal effect of *Eucalyptus* was that by Cheruiyot and colleagues (1981), in which 62 out of 68 different species of *Eucalyptus* found in Kenya were tested for their molluscicidal potency using *in vitro* methods. The leaves (fresh or dry) of 13 species were found to be potent against *Lymnaea, Biomphalaria* and *Bulinus* snails, with up to 100% snail mortality in 24–72 hours at concentrations between 500 and 1500 ppm. Cheruiyot and Wamae (1988) observed a more rapid molluscicidal effect on *Lymnaea* with the leaves of *E. globosus* when these were ground into a powder.