Health care is a heavy economic burden for both rich and poor nations. In the case of schistosomiasis (bilharzia), a potential preventive cure is freely available in the backyard of people at risk.

Debilitating disease
Schistosomiasis (bilharzia) is a parasitic disease affecting an estimated 200-300 million people in the tropics and sub-tropics. Humans are directly infected through skin contact with water inhabited by vector snails. The disease is rarely deadly, but reduces the work capacity and increases susceptibility to other infections. It causes abdominal pain, fibrosis in liver and bladder, blood in the urine and diarrhea. The disease has spread as a consequence of increased use of wetlands, development of irrigation agriculture and higher mobility among people.

Schistosomiasis control is based on a combination of several treatments including spraying of human infection with non-toxic drugs like praziquantel (Biltricide™), hygienic measures and snail control. Controlling snails has been shown to be essential in order to prevent reinfection after treatment of humans. Water contact studies and focal snail surveillance and control have become favored methods also for ecological monitoring of schistosomiasis.

Traditional soap
Endod is the Ethiopian name of the soapberry plant Phytolacca dodecandra. It occurs throughout Sub-Saharan Africa and parts of South America and Asia. The plant is a rapidly growing climber with hanging branches and an average height of 2-3 m. Under favorable climatic conditions it bears fruit twice a year. The small berries have been used in Ethiopia as soap for centuries. The berries are dried, ground and mixed with water to develop a foaming detergent solution. P. dodecandra and other Phytolacca plants have long been recognized for their various medicinal and other uses.

Toxicological studies
The molluscicidal properties of endod was discovered in northern Ethiopia (Adwa) in 1964 by Akiliu Lemma, Addis Ababa University. Dead snails were observed in a river immediately downstream from where people washed clothes with endod whereas upstream and further downstream, live snails were abundant. Subsequent studies in Ethiopia by the Institute of Pathobiology have established endod as a potent plant molluscicide—killing all schistosomal snail vectors at concentrations similar to other known chemicals. In a project in Adwa from 1969 to 1973, an Ethiopian group of scientists demonstrated the effectiveness of the use of locally grown endod as a single schistosomiasis control method in a community based project. At a cost of USD 0.10 per year and head, the overall prevalence in the 17 000 inhabitants were reduced from 63 to 34 %. For 1-5 years old children the reduction was from 50 to 7 %. The prevalence remained unchanged in a nearby untreated village. Until 1994, the early Adwa project is the only large-scale schistosomiasis control experience with endod. Similar studies have awaited the results of toxicological investigations to assure the environmental safety of field application of endod.

Early toxicology studies in Ethiopia showed that endod did not have mutagenic or carcinogenic properties against a variety of plants and animals, and that the applied extracts were easily biodegradable. There was, however, as with all other known molluscicides, a toxic effect on small fish and tadpoles at molluscicidal concentrations. Because fish and frogs were seen to escape endod treated sites rapidly to avoid the discomfort of the chemicals, these negative effects were regarded as minimal. Egg masses were not found to be affected by endod. During the 5-year trial in Adwa, no apparent effects were noted by the monitoring of aquatic ecology. More recent toxicological studies in internationally recognized laboratories have
Internationally recognized laboratories have verified the absence of other undesirable environmental effects of endod. The recent toxicological studies have been guided by an endod Toxicology Expert Group that met in New York under the UN Development Programme in 1986. Chemical studies of the endod berries have led to the discovery of a new compound, an oleandric acid glucoside, named Lemmatoxin. Chromatographic separations of the crude saponins in endod demonstrated the presence of a dozen compounds similar to Lemmatoxin of which five now have been chemically characterized at the University of Copenhagen. The Endod Toxicology Expert Group developed a procedure for preparing a standard water extract of endod (endod-S) for testing chemical structures and toxicological effects.

Can endod be cultivated?
Investigations of the agronomic aspects of endod to select and breed plants with favorable growth characteristics and molluscidal effects have been going on in Ethiopia since 1974. Among 65 different varieties of endod from different parts of Ethiopia, three strains have been selected for exceptional growth, molluscidal potency, yield and resistance to insects and drought. The E44 strain has proven to be the most favorable genetic material. One important discovery was that the green, unripe berries contain more active saponins than the pink ripe berries. Early harvest reduces the loss inflicted by birds eating the ripe berries. A problem that is still unsolved, is the attack by the Gitona (sp.) insect. Ongoing research focuses on endod varieties with particular resistance to the Gitona pest. Agronomic studies have been conducted in African countries, i.e., Ethiopia, Uganda, Zambia, Zimbabwe, Swaziland, to investigate the potentials of local varieties of endod versus the best Ethiopian strain (E44) under different agroclimatic constraints. The cost effective-ness of endod as a molluscicide has also been studied. In Ethiopia, the best strain (E44) has produced 3 000 kg of dried berries per hectare annually. Since plantation workers and their families where surface irrigation is practised are at risk of schistosomiasis infection, setting aside a small area for endod cultivation might be economical. One hectare of productive endod bushes would be sufficient to treat the water needed for 2 400 hectare of irrigated sugar cane in Ethiopia. In other words, improved health and work capacity can be achieved by sacrificing only 0.04 % of the sugar production. Compared to the expensive synthetic pesticide recommended by WHO, endod represents a cost-effective alternative for sustained schistosomiasis control.

Social status of endod
People of all ages in Ethiopia are familiar with the plant and its various uses. Some people have planted endod bushes along fences near their houses, but the plant is largely disappearing from unprotected areas due to land clearing. Regional differences in the distribution and use of the plant are apparent. Berries are used as soap in rural areas whenever available, but very little is traded at markets due to low social status of the endod soap. Common medicinal uses of the plant are treatment of skin itching (ringworm), abortion, gonorrhea, leeches, intestinal worms, anthrax, and rabies. An interview survey was performed in the highlands of Ethiopia to provide information about the distribution of Phytolacca dodecandra, people's traditional use of it, their perception of the plant, and the potential for increased production and use of endod as a soap for schistosomiasis control. The plant is largely disappearing from unprotected areas due to land clearing. Younger people appear to use endod for laundry whenever it is available, whereas older women prefer commercial soap. Common medicinal uses of the plant include treatment of skin itching (ringworm), abortion, gonorrhea, leeches, intestinal worms, anthrax, and rabies. Many people are positive to the idea of cultivating endod if supplied with rooted cuttings. Increased cultivation of endod and the use of berries for washing might be possible if information about schistosomiasis and its control is disseminated among the people. Substantial regional differences in people's knowledge and attitude towards endod are apparent.

Renewed interest
Many endod bushes were cut down in Ethiopia during the droughts in 1973/74 and 1984/85. It is therefore important to preserve the genetic variation that is still available and launch a breeding program to develop cultivars with high berry and saponin yields, pest resistance, and ability to grow under the agroecological conditions of lowlands. The genetic variation of endod and possible genetic markers for important plant characteristics are presently being investigated.

Endod plants grow best under direct sunlight in its natural habitat. In areas where the evapo-transpiration is very high, partial shade by other bushes or trees is necessary to avoid sunburn. Unfortunately, wilting of leaves is the main limitation for cultivation of endod at elevations below 1 600 m in Ethiopia where schistosomiasis is endemic.

The discovery of the effect of the endod soap on the vector snail for the schistosome parasite, has spurred our effort to find ways to reintroduce endod as a soap and promote its direct application in the locations where people get infected. Cultivation of endod and the use of berries for washing or direct application to streams have been successful after information about schistosomiasis and its control has been disseminated among people. Preference for commercial soap and lack of land for cultivation are major obstacles in increasing the use and availability of endod. The impact of endod on the schistosomiasis prevalence in school children in three villages in Ethiopia has been determined. The issue of institutional approach to endod-based control of schistosomiasis is presently under investigation.

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