Weeds may be key to wiping out bilharzia

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Photo: WHO

The waters of the ancient Nile bring fertility to the land, and provide a place to wash dishes, but they also harbour the snails that carry the bilharzia parasites.

Researchers in Egypt are pitting a common weed against a chronic, debilitating disease that currently affects over 200 million people in Africa, Asia, and Latin America. The disease is bilharziasis, which next to malaria, is considered the greatest threat to human health in the tropic and subtropic regions of the world today. The weed is *Ambrosia maritima* (damassissa as it is known in Arabic), part of the ragweed family.

Biharziasis is caused by parasitic worms, or blood flukes called schistosomes, that live and breed in the blood vessels of the intestines or urinary tract of humans. But the parasite's life cycle takes it out of the human body into water, and into certain snails, hence the popular name of its disease — "snail fever". Outside the human host, the parasite is very vulnerable. Damassissa naturally manufactures a substance that is deadly to the snails that carry the bilharziasis parasites.

Turning this natural phenomena to the advantage of millions of disease sufferers is the goal of Dr M. M. El-Sawy and his team of researchers at the Department of Tropical Public Health of the High Institute of Public Health in Alexandria, Egypt. Aided by an IDRC grant, Dr El-Sawy has begun a program of field tests to develop this plant into a cheap, safe, and easily applicable method of control over the snails and the disease they harbour.

Bilharziasis is an ancient enemy in Egypt. Scientists have discovered the evidence of schistosome eggs in mummies nearly four thousand years old. The disease is particularly aggressive in Egypt because of the extent and importance of irrigated agriculture, and the innumerable waterways that go with it. Current estimates place bilharziasis incidence as high as 40-50 percent of Egypt's population of 40 million.

The disease is a debilitating one. Initial symptoms of irregular fever, loss of appetite, headaches, tenderness in the abdomen, and general malaise are often masked by those of other conditions, or are not generally recognized as this specific disease. In its later stages, bilharziasis damages the ureters (ducts that carry the urine from the kidney to the bladder), kidneys, bladder, and liver. Symptoms akin to acute dysentery appear. Cirrhosis (hardening and shrinking) of the liver and enlargement of the spleen develop, as well as tissue damage in other parts of the body, according to the severity and spread of the disease. The sufferer becomes emaciated and weak. In chronic and complicated stages, the disease kills, if not directly, then by lowering resistance to other infections. Because of its progressive, slowly developing nature, bilharziasis drains the energy of the host, and destroys the ability to function productively.

It is perhaps this debilitation that is the disease's greatest toll. The social and economic burden that is produced when millions are incapacitated and unable to work in fields, factories, or homes is enormous. It represents a major obstacle to development, one that impedes every effort to improve well-being.

The best hope for controlling bilharziasis may be in breaking into the life cycle of the parasite at some point to destroy it. There are three major species of *schistosoma* (The disease is often called schistosomiasis.) that infest humans: *Schistosoma haematobium, Schistosoma mansoni*, and *Schistosoma japonicum*. The male schistosome is a flat worm about 1 cm long, the sides of its body inverted to form a groove in which the female is carried. After mating the pairs move to the veins of the bowel (in the case of *S. mansoni* and *S. japonica*) or the bladder (*S. haematobium*). The females periodically leave the males and deposit eggs in the small portal veins in these areas. Most eggs penetrate the walls of the veins: some become trapped in the tissues there, scarring and hardening it. Others work their way into the bladder and bowels and are eliminated. Eggs eliminated in the urine or feces must reach water to survive.

Once in water, the eggs split and the larvae (known now as miracidia) penetrate the bodies of freshwater snails, which then become the intermediate hosts. Inside the flesh of the snail host the miracidia develop into a type of reproductive cyst. Some weeks later, depending on the species, these cysts produce numerous minute free-swimming larvae called cercariae. In this tadpole-like stage, the parasite swims vigourously upwards and drifts downwards in the water, searching for its principal host...humans.

After contact with the human host, the cercariae penetrate the skin (shedding their tails in the process) and move through the lymphatic system to the arteries, through the heart and lungs, and eventually appear in the liver. The complete process is not yet understood. The larvae grow rapidly in the blood vessels of the liver, then migrate to the bowel or bladder. There the mature worms mate and begin laying eggs.

Egg production usually begins about 40 days after penetration of the skin. The female can lay hundreds (and in the case of *S. japonica*, thousands) of eggs per day. Infection has been known to last as long as 28 years, although it is generally of much shorter duration.

Bilharziasis is primarily a rural disease. The snails that transmit it prefer slow-moving or still, shallow water. The shores of lakes, ponds, streams, swamps, irrigation waterways, and rice paddies are their habitat. Thus, farmers who work their land with irrigation, women who wash clothes at a stream or pond, and children who play along the shorelines of lakes and canals constantly risk contracting the disease. It is an everyday sickness, tied to normal human activity.

The situation is unfortunately complicated by poor sanitation practices — schistosome eggs are transmitted when people urinate or defecate in or near water, or when wastes are disposed of in water. Often the body of water contaminated in this way is the only source for cooking, drinking, bathing, laundry, and agricultural needs in a community. A vicious cycle of infection and reinfection forms from water use patterns.

In attempting to control bilharziasis, health workers have taken a number of approaches. These include preventing human contact with infected water, controlling the snails that act as intermediate hosts, preventing the eggs from reaching pure water by improved sanitation, and by working toward the treatment of all human cases of the disease to eliminate its source. A combination of these methods is most likely to be successful, but to date a great deal of effort has been concentrated on the eradication of the snail host as the most effective means of breaking the disease cycle.

The damassissa weed Dr. El-Sawy is experimenting with is common throughout Egypt and the Mediterranean, and has had a place in folk medicine in Egypt for some time. Taken as a tea, it is held to be beneficial as a stimulant, an aid to digestion and the heart, and in eliminating kidney stones. However, if Dr. El-Sawy's hypothesis is correct, damassissa may have a much greater impact on health when applied externally...in waterways to kill snails.

The plant produces a powerful molluscicide in its leaves and flowering tops. Under laboratory conditions, infusions of 1:1000 part damassissa to water effectively killed all the common snail hosts of bilharziasis exposed to it. The plant's potency lasted two days, and also had a lethal action on the eggs and larval stages of the schistosome parasite. The active snail-killing agent of the plant is water soluble, and therefore does not have to be extracted by any special process.

Dr. El-Sawy's research suggests that farmers need only grow damassissa along the banks and shores of waterways, and when the plant matures and flowers, simply bend or cut them into the water. The weed is thus a cheap molluscicide that is safe to handle, has an established place in the local ecology, and does not appear to have any harmful side-effects on either fish or livestock. It even matures at an opportune time during the summer, coinciding with the peak snail breeding period.

Dried damassissa appears to be as effective as the green plants themselves, and remains potent for several years. If establishing damassissa (which is, after all, a weed) along irrigation systems where it might possibly compete with food crops should prove undesirable, then it could be grown at a distance on separate lands, dried, stored, and applied as needed.

A preliminary field test involved submerging cloth bags containing 200 grams of dried damassissa every 10 metres along both banks of a 500-metre length of canal. One week later, the downstream snail population had been reduced by 60 percent, two weeks later by 97 percent, and by three weeks, virtually eliminated. The molluscicidal effect continued for about eight weeks, after which snails washed down from the untreated upstream portion of the canal began to repopulate the cleared section.

When compared to the other methods of control of bilharziasis, the use of damassissa seems very attractive. The Chinese have enjoyed considerable success in their compaign against the snail hosts, achieved largely through the mobilization of a massive workforce to dig out and clear waterway habitats and destroy the snails. Chemical means are expensive and often toxic, both to humans handling them and other — beneficial — lifeforms living in or using the water.

Establishing improved sanitation and water supply systems is a major development goal in itself: certainly the permanent elimination of transmission routes of the schistosome eggs will be one of the benefits such programs will eventually bring.

There are no effective means of providing mass treatment of bilharziasis. The available drugs are not efficient, they tend to have harmful side effects and are difficult to administer. The prevailing rate of cure is only 20-40 percent, while relapses and reinfection are common. Recent research in the UK has uncovered a promising lead in the development of a potential vaccine, involving a type of human blood cell known to increase in bilharziasis sufferers, but the possibility of any sort of mass immunization is still a very long way off.

Using damassissa to control the snail host of bilharziasis offers a more immediate, inexpensive, and elegantly practical method of attacking the disease. If Dr. El-Sawy and his colleagues establish that the plant can adequately fulfill this promise, then perhaps there is a very real chance that millions of people will be able to free themselves of a health burden that has already weighed too long on them. □