Malaria remains one of the most prevalent diseases in the tropical world. With 200 million to 450 million infections annually worldwide, it causes up to 2.7 million deaths. The disease remains endemic in more than 100 developing tropical countries, and its control is a major goal for improved worldwide health. In view of the widespread emergence of resistant strains of *Plasmodium* spp., the pathogen responsible for the disease, enormous efforts are being made to find alternatives to the usual treatments – quinine derivatives and synthetic antimalarials – which are still insufficient to meet the needs.

Control of malaria has been based on herbal drugs – and more specifically on forest products – for centuries. Wormwood (*Artemisia annua*) infusions have been used in China for 2 000 years; bark of Cinchona ledgeriana was used long before its active ingredient, quinine, was isolated in 1820. Many other plants such as *Warburgia ugandensis* and *Azadirachta indica* have been used either to treat the disease or as insecticides to control the vector (mosquitoes).

Herbal remedies have most often been used in traditional or natural medicine, although some have found their way into conventional pharmacies. Today, however, many medical authorities, including the World Health Organization (WHO), have come to recognize herbal medicine as a viable treatment for various ailments. WHO has recently devoted much attention, for example, to *Artemisia annua* and other new herbal antimalarials. The active ingredient of *Artemisia annua*, artemisinin, has recently been identified. Ethnobotanical research has reported over 1 200 species as having antimalarial effects, some of which might hold enormous potential to control this devastating disease if researched further.

Malaria may not be a neglected disease, given the WHO interest in its control, but since it mainly afflicts poor populations in the tropics it attracts scant rewards for bio-prospecting by big pharmaceutical companies for active molecules that could lead to new drugs – although developed-country interest could rise with speculation that global warming might extend the range of the disease. While traditional methods of treatment exist throughout the tropics, little effort has been devoted to testing them as cheaper alternatives to conventional pharmaceuticals.

To coordinate research and investment efforts with a view to creating a steady supply of safe, appropriate and cost-effective forms of treatment for those affected by malaria, the Centre for Development of Enterprise (an institution of the African, Caribbean and Pacific Group of States and the European Union) and the World Agroforestry Centre (ICRAF) organized the Africa Herbal Antimalaria Meeting from 20 to 22 March 2006. Botany and agronomy experts, farmers, pharmaceutical manufacturers and marketers, researchers, herbal medicine practitioners, quality assurance and regulatory specialists, public health administrators and government representatives discussed prospects for new solutions and progress made in the wake of commitments made by African governments to control the disease, particularly through the Roll Back Malaria initiative, which especially promotes the use of insecticide-treated mosquito nets as a preventive measure.

A research report by the Kenya Medical Research Institute (KEMRI) (Rukunga and Simons, 2006), launched as a working document for the meeting, shows that many chemicals with antimalarial potential can be derived by researching traditional antimalarial formulations. From more than 300 species screened in over a decade of research, 84 species in 34 families were found to have high antimalarial activity. A further 138 species in 50 families were found to have moderate activity. The Research Initiative on Traditional Antimalarial Methods (RITAM) has launched activities to test the potential of traditional methods for vector control and repellents, prevention and treatment. Candidate species for further research such as *Azadirachta indica* and *Phytolacca dodecandra* were presented in the meeting.

Forest trees and shrubs such as *Entandrophragma angolense*, *Picralima nitida*, *Schumannophyton magnificum* and *Them- andersia hensii* (Bickii et al., 2007), *Mammee afericana* (Okokon, Udokpoh and Essiet, 2006), *Annona senegalensis* (Ajayi and Bodeker, 2007), and *Okokon, Udokpoh and Essiet* (2006), *Annona senegalensis* (Ajayi, 2007), and others (see Wilcox, Bodeker...
and Rasoanaivo, 2004) have already shown potential, but obstacles remain in the product development path through to approval. Given the current death rate, participants at the meeting expressed dissatisfaction with the slowness of the process for conventional drug development based on isolating pure chemical compounds or derivatives of such compounds from medicinal plants. An alternative is to verify ethnobotanical information from traditional medical practitioners through scientific toxicity and clinical confirmatory tests. Many countries in Africa now have products formulated in this way. Examples presented at the meeting include Manalaria and Sansiphos (Democratic Republic of the Congo), Malarial (Mali) and Phyto-Laria (Ghana).

Concerns about the possible toxicity of drugs developed from herbal remedies and the potential that Plasmodium spp. could develop resistance to them were raised. Because of such concerns, only one of the many products derived from Artemisia annua had obtained WHO approval by March 2006. Initiatives addressing issues related to drug safety, efficacy, testing and approval include the Association for African Medicinal Plant Standards (AAMPS), formed in 2005 to set quality standards and compile profiles of major medicinal plants, and a centre to coordinate research into traditional medicine established by WHO and based in the Congo.

What does the enormous potential of antimalarial therapies from forests portend for their conservation? Interest in Artemisia annua has spurred cultivation efforts in China, India, Viet Nam and East Africa, creating opportunities for farmers to raise their income and for jobs in the extraction industry. There is great potential for cultivation of other medicinal plants in the tropics if appropriate germplasm and propagation technology is available. Estimates show that at least 60 percent of current medicinal plant products are from wild harvesting. Indigenous knowledge used in traditional therapies often incorporates conservation practices used by communities. If more commercial antimalarial products are developed, however, potential profits accruing to collecting groups may lead to the extinction of useful species. Research to prioritize antimalarial species should therefore be in tandem with efforts to spur their cultivation, while guaranteeing rights to forest-adjacent communities to gain benefits from sustainable collection of medicinal products.

The full proceedings of the meeting are available at: www.worldagroforestry.org/treesandmarkets/antimalariameeting/proceedings

Bibliography


