Long-lasting insecticidal nets for malaria control

A decade ago, we reported a success story related to insecticide-treated nets (ITNs) for malaria control as an alternative strategy to DDT spraying against disease vectors in Assam[1]. Based on the demonstrated success of this community-based approach, the ITNs-based intervention was subject to field evaluation as pilot project study in other northeastern states under primary health care services. The outcome of the study that was assessed by the Technical Advisory Committee of the National Vector Borne Disease Control Programme was encouraging, reporting appreciable disease transmission reduction[2]. The communities clearly preferred ITNs against DDT spraying and reported collateral benefits for decreased nuisance due to biting mosquitoes and other household insect pests. However, re-treatment exercises that were necessary every six months made it a difficult proposition to meet the target population coverage that fell short of <5% (source, State Health Directorate of Assam) – similar to experiences reported in African countries[3].

In search for sustainable intervention, the advent of pre-treated mosquito nets with insecticide, popularly known as long-lasting insecticidal nets (LLINs) that would obviate the hassles of treatment and re-treatment, is viewed as a breakthrough in malaria prevention[4]. These are ready-to-use factory treated nets which do not require re-treatment for 4–5 years (the expected life span of net). In these LLINs, insecticide is either bound around netting fibre (Type 1) or is incorporated into polymers before fibre extrusion (Type 2). These nets can be washed many times and still remain effective against target disease vector species. The efficacy of these LLINs is expressed in terms of wash-resistance for maintaining sufficient insecticide concentration for ≥95% knockdown of target mosquito vector species and/or ≥80% mortality for at least 20 serial washings in laboratory and 3 years of continuous use in field conditions without re-treatment.

Among a variety of LLINs that are currently available, Olyset net® and PermaNet®2.0 have been given full recommendation under WHO Pesticide Evaluation Scheme (www.who.int/whopes) for which WHO regularly provides technical information and updating on the subject as well as more specific advice on procurement and quality control (Table 1). Among other products that are under consideration are: Interceptor®, Duranet® , Netprotect® , PermaNet®2.5 and PermaNet®3.0, which have been granted interim recommendation, and more are in the offing. Of these, Olyset net, Interceptor net and PermaNet 2.0 that were subject to evaluation have been promising, reporting sustained wash-resistance and residual efficacy against malaria-transmitting mosquito species of *An. culicifacies*, *An. fluviatilis*, *An. minimus* and *An. stephensi* that are prevalent in India[5–7]. The public responses were overwhelming and forthcoming for making it a community-based intervention. On the basis of these technical inputs, LLINs are currently being considered for large-scale provision in the national control programme for population groups most at risk under centrally sponsored scheme supported by Global Fund against AIDS, Tuberculosis and Malaria (Source: National Vector Borne Disease Control Programme, Delhi).

The technology is being further upgraded for new generation LLINs that have improved bio-efficacy against resistant mosquito vector species, longer durability and effective protection in resource-poor settings[8]. LLINs are now accepted worldwide, and it is the need of the hour to upscale their availability at affordable prices for wider population coverage supported by information, education and communication activities for behaviour change communication/greater community compliance[9]. These LLINs combined with other approaches including on-the-spot diagnosis by rapid test kits, effective treatment with artemisinin-based combination therapy and increased awareness for disease prevention are all strongly advocated in reducing disease transmission and parasite load in the communities. With the available tools and increased allocation of resources, the roll back malaria partnership initiative that started in 1998 has much to offer over the next 10 years in achieving substantial reduction in morbidity and mortality if not elimination/eradication of the age old scourge[10]. The disease trends are clearly declining in areas once considered intractable[11]. WHO estimates substantial decrease in the number of cases and deaths globally compared to previous years[12]. A major challenge is now to develop human capacity and health systems to reach the outreach population groups. It is critical to seize the opportunity for making sound investment for strengthening interventions for prevention of malaria and other vector-borne diseases, forging partnership and confidence building by greater political commitment for equity in healthcare services in communities at any risk of malaria.

Table 1. WHO recommended long-lasting insecticidal mosquito nets*

Product name	Product type	Status of WHO recommendation
Duranet®	Alpha-cypermethrin incorporated into polyethylene	Interim
Interceptor®	Alpha-cypermethrin coated on polyester	Interim
Netprotect®	Deltamethrin incorporated into polyethylene	Interim
Olyset®	Permethrin incorporated into polyethylene	Full
PermaNet® 2.0	Deltamethrin coated on polyester	Full
PermaNet® 2.5	Deltamethrin coated on polyester with strengthened border	Interim
PermaNet® 3.0	Combination of deltamethrin coated on polyester with strengthened border (side panels) and deltamethrin and synergist (PBO) incorporated into polyethylene (roof)	Interim

*Source: Report of the WHO Pesticide Evaluation Scheme (WHOPES) update of January 2009.

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Nonpathogenic theileria of Indian cattle and buffalo

I have pointed out[1] that the usually nonpathogenic theileria of Indian cattle was commonly, but mistakenly named as *Theileria mutans* because this parasite did not occur outside Africa. This paper was followed by a critical review of mostly nonpathogenic theilerias of cattle described in the literature[2]. I assigned the parasite of Indian cattle and buffalo, provisionally, to 'buffeli/orientalis' group. This paper has been commented upon by Uilenberg[3]. The comments, being relevant and apt, are reproduced below.

(GU: Unless it can be convincingly demonstrated that there are also specific parasites which only infect buffalo, and that differences in virulence and those found with molecular methods are species-specific and not strain-specific, the name *T. buffeli* Neveu-Lemaire, 112 appears to have priority.)

The view of Uilenberg that the proper taxon for mostly nonpathogenic thieleria of Indian cattle and buffalo is *Therleria buffeli* is correct.

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A need for online herbaria in India

Herbaria represent fundamental documentation of the diversity of plants. The process of documentation through herbarium involves drying and preservation of plant specimens on paper sheets of a standard dimension bearing information. Collection of herbarium specimens results in voluminous repository, 'Herbarium' which is accessible to a wide spectrum of naturalists. Floristic workers, taxonomists, ecologists, etc. consult herbaria from time to time in order to study the diversity and distribution of species. Recently, herbaria are also being consulted by the biochemists, pharmacological workers, molecular biologists, etc. for authentication of species.

India harbours a rich diversity of plants. The enormous wealth of our plant resource can be judged from the recent estimates of flowering plants alone, which are about 17,000 species[1]. Specimens representing the diversity of plants are stored in our National, State and District level herbaria spread across the country. These include several type specimens, specimens of RET species. There are about 48 recognized herbaria in India, which store more than 3.5 million specimens[2]. These include herbaria maintained by various circles of Botanical Survey of India (BSI), research institutes, several universities and colleges.

Considering the dimension of the nation, it becomes practically very difficult for researchers to visit each and every herbarium in each part of our country. Technological advances, in the recent years, have potential to circumvent this problem through digitization of herbaria, which involves the process of gathering data and images of specimens and storing them in a digital format. By computerization, these vast collections can be accessed and analysed at a glance in various ways which was not possible previously. The 'image herbaria', however, are not intended to replace the actual collection and in-depth study of specimens.

In many developed countries, herbaria are now available online. Virtual Herbarium of Chicago University[3] and Australia's Virtual Herbarium[4] are examples. Such efforts are lacking in the Indian context. Internet facilities have succeeded in reaching even remote places, and information technologies have emerged as viable media to disseminate and share knowledge. Having a knowledge base of herbaria in India with a catalogue of the species made available online would bring convenience to researchers in our country.

One of the pioneering works in this direction has been the digitization effort called *Sampada* initiated by the Indian Biodiversity Information Network (IBIN) of the National Chemical Laboratory, Pune. IBIN has provided a freely downloadable package known as *Sampada* to all the natural history collection curators[5] in order to form an online repository of herbarium and other natural history collections. The online databases like Medicinal Plant Board Database[6], Foundation for Revitalization of Local Health Traditions (FRLHT) database[7], Indian Biodiversity Information Database[8] are a few more such efforts.

The Agharkar herbarium (AHMA) of Agharkar Research Institute, an internationally recognized herbarium, has been the first herbarium in India to have a dedicated website[9], allowing anyone to access the herbarium database. The website was launched during the Symposium