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# Anti-malarial herbal remedies of northeast India, Assam: An ethnobotanical survey

Nima D. Namsa[a,*], M. Mandal[a], S. Tangjang[b]

[a] Department of Molecular Biology and Biotechnology, Tezpur University, Tezpur 784 028, Assam, India
[b] Department of Botany, Rajiv Gandhi University, Rono Hills 784 028, Itanagar, Arunachal Pradesh, India

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ABSTRACT

*Ethnopharmacological relevance:* Malaria is a serious public health problem in the north-eastern region of India including Assam, in view of development of chloroquine resistant *Plasmodium falciparum*. There is need for alternative and affordable therapy.
*Aim of the study:* This study was conducted to document indigenous knowledge, usage customs and practices of medicinal plant species traditionally used by the residents of Sonitpur district of Tezpur, Assam to treat malaria and its associated symptoms.
*Materials and methods:* A total of 50 randomly selected sampling represented by male (38.76%) and female respondents (12.24%) were interviewed using a semi-structured questionnaire.
*Results:* The present ethno-botanical survey revealed 22 species of plants belonging to 17 botanical families were reported to be used exclusively in this region for the treatment of malaria. Verbenaceae (three species), Menispermaceae (two species), and Acanthaceae (two species) botanical families represented the species that are most commonly cited in this survey work and the detailed use of plants has been collected and described.
*Conclusions:* The most serious threat to the existing knowledge and practice on traditional medicinal plants included cultural change, particularly the influence of modernization and lack of interests shown by the next younger generations were the main problems reported by the informants during the field survey. Hence, the proper documentation of traditional medicinal plants being used as anti-malarial agents and related indigenous knowledge held by the tribal community is an important approach to control the spread of vector-borne diseases like malaria reported in this survey work.


## 1. Introduction

Malaria is a major public-health problem associated with high morbidity and mortality in the world with an estimated 350–500 million clinical cases every year with a corresponding mortality rate of 2–3 million deaths each year (WHO, 2005). Malaria is caused by *Plasmodium* parasites and transmitted by the female *Anopheles* mosquito acting as a host and a vector of the parasite. In Assam where malaria is highly endemic and causes high morbidity (Dev et al., 2001; Pardal Singh Pal et al., 2009; Baruah et al., 2007; WHO Malaria Report, 2009), the emergence of multiple drug resistant strains of *Plasmodium falciparum* have been found in many endemic areas of the world including Assam (Dua et al., 2003). Drug resistant strains of *Plasmodium falciparum* have been found in many endemic areas of the world including Assam and majority of the anti-malarial drugs has been associated with treatment failure (Olliaro and Bloland, 2001). These developments and the difficulty of developing efficient vaccine coupled with adverse side effects of the existing anti-malarial drugs underline the urgent need for novel and more efficient anti-malarial drugs (Bickii et al., 2000) affordable to poor people, living in malaria endemic tropical regions of India.

Historically, majority of anti-malarial drugs have been derived from medicinal plants or from structures modeled on plant derived compounds (Klayman, 1985). These include quinoline-based anti-malarial as well as artemisinin and its derivatives. Medicinal plants are commonly used in traditional healthcare in many indigenous communities of the world, and Assam with the presence of nearly rural population of ~92.7% and urban population ~7.3%, (Population Census, 1991), access to conventional drug treatments is reduced in rural areas and cultural practices of traditional herbal remedies for treating range of ailments, including malaria and its associated symptoms still remain important. Malaria is a serious public health problem in Assam, particularly Sonitpur district with

* Corresponding author. Current address: Department of Microbiology and Cell Biology, Indian Institute of Science, Bangalore 560 012, India. Tel.: +91 9900 806897; fax: +91 3712 267005.
*E-mail address:* ndnamsa@yahoo.co.in (N.D. Namsa).

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60–90% prevalence of seasonal *Plasmodium falciparum* infection and the remaining cases are due to *Plasmodium vivax* (Baruah et al., 2007; Dev et al., 2001). The state alone contributes >5% malaria cases and 20% of all the malaria attributable deaths reported in the country annually. During the years 2000–2007 malaria attributable mortality was documented between 43 and 300 with highest being 300 deaths in the year 2006 (Sharma and Dev, 2006). The present malaria situation has been found deterring the socio-cultural and economic progress of the state. Difficult terrain, hilly forests, rainfall patterns, zoophagic nature because of the presence of large number of domestic animals, inadequate infrastructure coupled with the development of chloroquine resistance in *P. falciparum* in Assam (Sehgal et al., 1975; Baruah et al., 2007) is aggravating the situation. Owing to the widespread suffering and death and the major problems associated with the treatment and management of malaria (failure of the safest and most affordable anti-malarial drugs to treat the disease), these underline the urgent need to develop new drugs or vaccines affordable to poor people, living in malaria endemic tropical regions of India. Information regarding the links between socio-economic factors, knowledge and usage custom of traditional anti-malarial plants among unprivileged section of the society in Assam is limited. The purpose of the present ethnopharmacological field survey conducted from March 2008 to November 2009 (i.e. high seasonal malarial prevalence) in the selected rural areas of Sonitpur district, Tezpur, was to utilize the common knowledge in order to document useful medicinal plants being used to treat and prevent malaria in a selected locality of Assam where malaria is highly endemic.

## 2. Materials and methods

### 2.1. Description of ethno-botanical study area: Sonitpur district

Sonitpur district region (5324 sq. km.) is located approximately between 26°30′ and 27°01′ North latitudes and 92°16′ and 93°43′ East longitudes with an estimated total population of 16,77,874 as per 2001 census. Tezpur is the headquarter of Sonitpur District, situated on north bank of Brahmaputra river, adorned by lush green hills and hillocks and it is a city steeped in mythology and folklore. The different ethnic groups in the study sites are Assamese, Nepalis, Bengalis, Adivasis-tea garden tribes, Muslims, Mishing, Bodos, and others. The majority of the people inhabiting the districts are Assamese and they follow Hindu religion. The Adivasis people were originally brought by the British from Chotanagpur area and Orissa, India to serve as laborers in the tea gardens. They follow Hindu and Christian religions and have adopted Assamese as their mother tongue.

Sonitpur district falls in the sub-tropical climatic region and enjoys monsoon type of climate. Summers are hot and humid with an average temperature of 29–34 °C in the month of June–July every year and winters are cold and are generally dry with an average temperature of 16 °C. The altitude of reserve forest is at 1800 ft. above sea level. The present study was conducted among the Assamese and Adivasis tribal villages located in Forest Reserves with rich source of bio-diversity (i.e. Nameri National Park, Balipara reserve forest and the adjoining areas of Bhalukpong of Arunachal Pradesh, which marks the starting of the Himalayan foothills). The people living in the study sites include mostly tea garden workers, laborers, farmers, and small traders. Multi crop cultivation (jute, sugarcane, wheat, maize, and green vegetables) is adopted in a few places while paddy rice and jute cultivation represents the predominant crop grown round the year. Cattle are an additional source of income and are also employed in agriculture for ploughing and threshing food grains. Drainage and ponds nearby the dwelling area are used for duck rearing and jute seasoning. The economic status of the people is low and solely dependent on agriculture (paddy rice and jute) and part time labor in tea gardens. Malaria is endemic in the study sites and in many parts of the Assam but there are modern health facilities in the Tezpur town for the treatment of malaria. However, the rural people appears to still continue their traditional phytotherapy for treating malaria once upon diagnosed as malaria positive or due to the onset of physical symptoms like headache, fever, general body pains and gastro-intestinal upset.

### 2.2. Interview and ethical considerations

The objectives of the study were clearly explained and verbal consent was obtained from each study participant. The present study was conducted from March 2008 to November 2009 to document an indigenous anti-malarial plant traditional knowledge. A total of 50 randomly selected knowledgeable male and female respondents from all age-groups were included during interview. Of which, the elderly people (age group 40–70 years) had traditional knowledge on use of anti-malarial plants and have a tradition of healing in their families and locality (Table 1). All collections were made by the first author (M. Mandal) who could speak the local language and was also familiar with some of the traditional plants used by the local tribal people of the region. Study participants were interviewed using a semi-structured questionnaire (Nima et al., 2009), with some modifications were re-designed for collection of information on plants used for treating malaria by the people living in rural areas of Assam (Appendix A). The questionnaire was mainly focused to collect socio-economic status of the participants, local names of the anti-malarial plants, plant parts used, traditional usage custom procedures and associations with other plants, and how such knowledge is preserved and transmitted to next generation. With the help of local informants, the plant material was collected and dried following the standard herbarium procedures (Jain and Rao, 1997). The plant voucher specimen numbers provided in Table 2 were taxonomically identified with the help of herbarium materials, experts and taxonomic keys at Botanical Survey of India, Arunachal Pradesh.

## 3. Results

### 3.1. Socio-economic characteristics of participants and malaria prevention

Socio-economic features of respondents are shown in Table 1. In this study, male respondents constituted 76% and female were 24%. Age of the respondents was ranging from ≤20 to ≥60 years. The majority of the informants (62.0%) were illiterate and their average monthly income between 400, 601–800, and >1000 (INR). Overall, 86% respondents had adequate knowledge and traditional usage custom for the treatment of malaria prevailing in rural areas (Table 1). Another malaria control method was the use of mosquito nets and on average, 26.0% of the respondents indicated the use of mosquito nets during sleep at night. Domestic animals such as cattle, sheep, pig, and goats were reared by the tribal community (76.0%) and livestock sheds are located adjacent to human residential area. Hence, the domestic animal sheds might create aquatic habitats for mosquito breeding. Agriculture rice farming (93.6%) through irrigation method is a common practice by the farmers, hence, may provide the habitat for mosquito breeding. A significantly larger respondent (60.0%) suggests the availability of treatment in health services at high cost and lack of poor services or lack of affordability in rural areas was mentioned by 40.0% of the respondents and cultural practices of herbal remedies still remain important traditional approach to control mosquito-borne diseases. Majority of surveyed houses (96.0%) had doors equipped with