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Research Paper

Traditional uses of medicinal plants against malarial disease by the tribal communities of Lesser Himalayas–Pakistan

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ABSTRACT

Ethnopharmacological relevance: Malaria is among the most prevalent infectious diseases in the developing countries of world. Estimated number of annual malaria episodes in Pakistan is 1.5 million, but very little is known about medicinal plant species of Pakistan, which have great potential against malarial disease. Present study was aimed to document medicinal plant species used by the local inhabitants of Lesser Himalayas–Pakistan to treat malaria.

Materials and methods: Data were collected through interviews, questionnaires and contributor observation. A total of 55 informants aged between 25 and 80 years who were familiar with malarial disease participated in the survey.

Results: A total of 84 plant species belonging to 69 genera and 50 families were recorded to treat malaria. Asteraceae was found as most cited botanical family with (11.9%) representation, followed by Lamiaceae (5.9%), Solanaceae and Verbenaceae (4.7%) and Violaceae (3.5%) respectively. About 60% of the inhabitants prefer herbal treatment by local herbalists or self-treatment with locally available medicinal plant species. Of the plants identified during present investigation against malaria, *Azadirachta indica, Swertia chirayita* and *Swertia ciliata* exhibited uppermost frequency of encounter (36.3%) and corresponding PR value 5. About 67.2% of the botanical taxa are reported for the first time in the treatment of malaria. It was observed thatover harvesting is the foremost threat to medicinal plant species of the study area.

Conclusion: Present survey indicates that traditional knowledge about the use of plant species against various diseases and particularly to treat malaria is in decline. Similarly anthropogenic pressure, over exploitation and grazing of the botanical taxa are the major concerns regarding medicinal plant biodiversity loss. Frequently utilized plant species with significant malarial reduction should be authenticated by in vitro and in vivo standard tests

1. Introduction

Malaria is caused by *Plasmodium* species, transmitted from infected person to normal through female *Anopheles* mosquito. It is one of the fatal diseases in the world, which is responsible for major morbidity and mortality, especially among children and pregnant women in the tropical areas of the world (Smyth, 1994). At present malarial disease is found endemic in 104 countries of the world including about 97 countries and territories with ongoing malaria transmission and 7 countries in the prevention of reintroduction phase (World Malaria Report, 2013). Globally, it has been estimated that about 3.4 billion people are at the risk of malaria, and only in 2012 about 207 million cases (uncertainty range 135–287 million) of malaria have been recorded and 627,000 human deaths (uncertainty range 473,000–789,000) were occurred because of malarial disease (World Malaria Report, 2013).

Pakistan being a subtropical country has a rich diversity of pathogenic vectors including mosquitoes, sand flies, houseflies, biting midges, ticks, lice, mites, fleas, cockroaches, bed bugs which, account for number of vector born diseases like malaria, leishmaniasis, dengue

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fever, Crimean and Congo fever (Anonymous, 2010). Malaria has become a serious disease in Pakistan during recent years and is wide spread both in rural and urban areas. It is the second most prevalent and devastating disease and accounts 16% disease load of the country. Major malaria transmission period in Pakistan is post monsoon from July to November. Overall situation reveals that there is a concrete relationship between rains, vector densities and disease transmission in the country (Anonymous, 2010). World Health Organization has classified Pakistan as a country with modest malaria prevalence and relatively well developed control programs, but in spite of this, estimated number of annual malarial episodes in Pakistan is more than 1.5 million estimated cases (World Health Organization (WHO), 2004).

The use of medicinal plants against malaria extends over at least three continents; Africa, Americas and in Asia (Phillipson et al., 1987). Obviously, medicinal plants still have immense potential to be explored for the effective management of various malarial strains including those resistant to available therapies. Ethnobotanical survey is the most significant step in the identification, selection and development of the therapeutic agents from medicinal plants. Phytotherapy or phytomedicine based on medicinal herbs has been practiced since the beginning of recorded history, with specific remedies being handed over from generation to generation (Idowu et al., 2010). In Pakistan, use of traditional therapies based on medicinal plants to treat diseases is common practice particularly among rural communities. The Himalayan medicinal plants are of great significance as being used both in traditional medicine system and by modern pharmaceutical industries.

Over the decades medicinal plants and their active constituents have been used in the treatment and prevention of malaria in various parts of the world (Chiyaka et al., 2009). Quinine and artemisinin, are the drugs of choice for treatment of malaria (Basco et al., 1994; Kayser et al., 2003). In fact chloroquine is used to treat acute attacks of malaria, but less efficiency of this drug against resistant strains of malarial pathogen has led to further studies, which had produced a new and effective anti malarial drug, artemisinin (World Malarial Report, 2005). Globally malaria becoming a major source of mortality, as its control has been mainly affected by drug resistant pathogens like *Plasmodium falciparum* and *Plasmodium vivax* except artemisinin (Sharma, 1997). The strains of *Plasmodium falciparum* is showing resistant to many existing drugs, i.e. chloroquine (Nguta et al., 2010; Cui et al., 2012). According to (Howard et al., 2011; Shah et al., 1997) falciparum malaria has become resistant to chloroquine in Pakistani and Afghan refugee populations throughout the country.

It is of deep concern that this parasite will soon develop total resistance to such conventional treatments. Hence, the search for novel and more effectual malaria cures is a major challenge of worldwide investigation today. Such studies on medicinal flora will be useful for the synthesis of essential compounds. Globally over 1200 plant species from 160 families have been documented, which are used to treat malaria or fever (Willcox and Bodeker, 2004).

Though, several studies (Chaudhri, 1959; Zaman et al., 1971a and 1971b; 1972; Baquar, 1989; Haq and Hussain, 1993; Shinwari and Khan, 1999; Inam et al., 2000; Gilani et al., 2001; Matin et al., 2002; Ahmad et al., 2004; Qureshi et al., 2006, 2008, 2009; Shah and Khan, 2006; Ali and Qaiser, 2009; Jabeen et al., 2009; Sabeen and Ahmad, 2009; Shah et al., 2009; Abbasi et al., 2010a and 2010b; Zafar et al., 2011; Abbasi et al., 2012; 2013a and 2013b; Khan et al., 2013), have been carried out to identify medicinal plants traditionally used to treat various ailments in Himalayas and its surroundings. However, to our knowledge little is known about the medicinal plants used against malaria in Pakistan.

Lesser Himalayas in Pakistan is a potential source of medicinal plant biodiversity. Moreover, inhabitants of the area are well aware of surrounding flora and are using medicinal plants in the treatment of various diseases since long time. Although malaria is not widespread in the area under investigation, but it is a rich source of medicinal plant species used in malarial treatment. To our knowledge no survey was conducted with particular reference to use medicinal plants to treat malaria in the visited areas. Therefore present study was aimed to document ethnomedicinal potential of medicinal plants, particularly against malaria in the Lesser Himalayas of Pakistan, based on ethnobotanical survey.

2. Materials and methods

2.1. Study site

Present survey was carried out from March 2011 to April 2013 in 40 different sites of the three districts, Haripur, Abbottabad and Mansehra of Khyber Pakhtunkhwa (KPK) province in the Lesser Himalayas–Pakistan (Fig. 1). The study region in Pakistan lies between 33°–50′ and 34°–50′ north latitude and between 72°–30′ and 73°–40′ east longitude, comprising an area of approximately 8100 km^2, with an elevation ranges from 587 to 2860 m. The climate of the area is subtropical with average rainfall varies from 70 to 90 mm in south and 100–130 mm in the north. However, its vegetation falls within the subtropical, temperate, sub-alpine and alpine zones (Hussain and Ilahi, 1991; Khan et al., 2010). According to (Anonymous, 2008) the total population of the area is 1.05 million. The main tribal communities of the area are Abbasies, Syeds, Tanolis, Awans, Rajputs, Jadoons, Kashmiri, Maliar, Dhaynal, Gujer, Sarrara, Qureshis, Karals and Sheikhs. Almost 100% population of the area is Muslim. The primary language is Hindko (75–94%) in urban and rural areas, while Gojri, Pashto and Urdu are also spoken (Shah and Khan, 2006). Major part of the study areas is remote and isolated. It has high endemism, full of natural resources and indigenous life style. The inhabitants of the study areas have flexible and diverse livelihood and cultural activities including agriculture, timber wood cutting for selling, livestock keeping, selling of commercial wild fruits and other Non Wood Forest Products (NWFPs) and also go abroad for labor work.

2.2. Data collection and analysis

Ethical approval was taken from competent authority of Hazara University, Mansehra Pakistan and COMSATS Institute of Information Technology, Abbottabad-Pakistan before starting the field survey, while informed permission was obtained from all the participants prior to the administration of the questionnaire. A comprehensive ethnobotanical survey was conducted in 40 different localities of three districts, Abbottabad, Haripur and Mansehra during different seasons from March 2011 to April 2013 by a team of eight members belonging to three research groups; one from Hazara University, Mansehra (3 members), second from COMSATS Institute of Information Technology, Abbottabad (4 members) and third from Quaid-i-Azam University Islamabad (1 member).

Most of the traditional knowledge is owned by, the old age people and traditional hakims which live particularly in remote areas with less modern health facilities. Data on botanical taxa used to treat malarial disease were collected based on semi structured interviews and questionnaires. A total of 55 informants (30 males and 25 females), including tribal people having sufficient knowledge about ethnomedicinal uses of plants and 15 local traditional healers (hakims) live in these villages at higher altitudes were interviewed in local language (Hindko). During survey it was observed that Gujer tribe has more traditional knowledge as compare to the others tribal communities of the study area.

Questionnaires were divided into three sections: (a) Personal information including age, sex, religion, education, job, and ethnic

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