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ScienceDirect
Journal of Ethnopharmacology 115 (2008) 302–312
Journal of ETHNO-PHARMACOLOGY
www.elsevier.com/locate/jethpharm

Ethnobotanical survey of folk plants for the treatment of snakebites in Southern part of Tamilnadu, India

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Received 10 April 2007; received in revised form 27 September 2007; accepted 4 October 2007
Available online 10 October 2007

Abstract

Ethnobotanical surveys were conducted in four different indigenous groups in Southern parts of Tamilnadu, India, using a questionnaire. The herbal practitioners in the study area were interviewed, and information on medicinal plants was collected from the traditional healers called "Vaidyars". This survey covers 72 medicinal plants belonging to 53 families that are used for the treatment of snakebite in a traditional way. Traditional approach was evaluated scientifically with some selected plant extracts (7.2 mg/kg bw) and partially purified fractions (2.4 mg/kg bw) were orally administered to mice experimentally envenomed with rattlesnake venom s.c. injection (2.5–15 μg/kg bw). Tested fractions (*Aristolochia indica*, *Hemidesmus indicus*, *Gloriosa superba*, *Strychnos nux-vomica*, *Eclipta prostrata*, and *Andrographis paniculata*) showed potent neutralizing effect against the venom. Compared to the extracts, administration of purified fractions was more effective in increasing the body weight. Control mice injected with the venom alone showed weight loss and severe toxicity at 15 μg/kg bw. The purified fractions (2.4 mg/kg bw) produced significant protection against venom induced changes in serum SOD and LPx levels. The isolated fractions effectively inhibited the toxic effect of snake venoms in vitro than in vivo. The above observations confirmed the protective activity of plants—*Aristolochia indica*, *Hemidesmus indicus*, *Gloriosa superba*, *Strychnos nux-vomica*, *Eclipta prostrata*, and *Andrographis paniculata* against the lethal action of snake venom and need further investigation.

Keywords: Snakebite; Neutralizing effect; Medicinal plants; Ethnic groups; Traditional uses

1. Introduction

From time immemorial, man has been dependent on nature for survival. This dependency led the aboriginal people living in harmony with nature to evolve a unique system of knowledge about plant wealth by trial and error methods. Traditionally, this treasure of knowledge has been passed on orally from generation to generation without any written document (Perumal Samy and Ignacimuthu, 1998, 2000), and is still retained by various indigenous groups around the world. In India, there are about 54 million indigenous people of different ethnic groups inhabiting various terrains. These indigenous groups possess their own distinct culture, religious rites, food habit and a rich knowledge of traditional medicine (John, 1984; Pushpangadan and Atal, 1984; Anuradha et al., 1986; Harsha et al., 2002; Parinitha et al., 2005). Even today, indigenous and certain local communities practise herbal medicine to cure a variety of diseases, with plants particularly used as folk medicine to treat snakebites (Siddiqui and Husain, 1990; Martz, 1992; Houghton and Osibogun, 1993). Snakebite is a serious medical, social and economic problem in many parts of the world, especially in the tropical and subtropical countries. Envenomations due to snakebites are commonly treated by parenteral administration of horse or sheep-derived polyclonal antivenoms aimed at neutralization of toxins. However, despite the widespread success of this therapy, it is still important to search for different venom inhibitors, either synthetic or natural, that could complement or substitute for the action of antivenoms.

Traditional herbal medicine is readily available in rural areas for the treatment of snakebite. Application of the plant or its

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0378-8741/$ – see front matter © 2007 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.jep.2007.10.006

sap onto the bite area, chewing leaves and bark or drinking plant extracts or decoctions are some procedures intended to counteract snake venom activity. Plants are used either single or in combination, as antidotes for snake envenomation by rural populations in India and in many parts of the world. Plants are reputed to neutralize the action of snake venom, with a plethora of plants claimed to be antidotes for snakebites in folk medicine (Kirtikar and Basu, 1975). In another report, the aqueous ethanolic extract of the aerial part of *Eclipta prostrata* Linn. (Compositae), known as an antidote to snakebite in Brazil and China, has been tested against South American rattlesnake (*Crotalus durissus terrificus*) venom (Mors et al., 1989). *Gymnema sylvester* R.Br. (Asclepiadaceae) root and the whole plant of *Andrographis paniculata* Nees (Acanthaceae) are used against snakebites in folk medicine (Russell, 1980). The leaves of *Perilla frutescens* have been found useful as an antidote against snake venom (Honda et al., 1986) because of its sedative effect. Phytochemical agents such as flavonoids inhibit snake venom phospholipase A_2 activity (Alcaraz and Hoult, 1985). Flavonoid glycoside rutin is also effective in increasing survival time of rats injected with cobra venom (Gujral and Dhawan, 1956). Hence, several substances have been isolated from plants and tested against the lethal action of the venoms (Mors et al., 1989; Pereira et al., 1994). As a result, a large number of plants have been found to be effective as antidotes against snake venoms in India (Chopra et al., 1956; Usher, 1974; Kirtikar and Basu, 1975; Nadkarni, 1976; Lewis and Elvin-Lewis, 1977; Alam and Gomes, 2003). However, in most cases the efficacy of this traditional treatment regimen is unproven. Thus, the study of herbal antidotes against snake venom is of great importance in the management of snakebite. There are few survey reports that reveal the practice of herbal medicine by either folk or indigenous communities (Bhandary et al., 1996; Harsha et al., 2002, 2003; Parinitha et al., 2005). To date, only a few species have been scientifically investigated with their active components isolated and characterized both structurally and functionally. Hence, the present study is focused on the preliminary survey of medicinal plants for therapeutic application of snakebite and extensive traditional use in four different indigenous groups in Southern parts of Tamilnadu, India. Their traditional (approach) plants which were responsible for snake venom (*Crotalus adamanteus*) neutralization and antioxidant property of the extracts/fractions were scientifically evaluated in experimental animals.

2. Materials and methods

2.1. Collection of medicinal plants and survey area

The present investigation was carried out between "1995 and 1998" and the surveys were conducted using questionnaire in Kolli hills, the area situated on Eastern Ghats at an altitude of 1200 m in the Namakkal district of Tamilnadu (TN). It is located between 11°00′ and 11°36′ in the North latitude, and between 77°28′ and 78°30′ in the East longitude. Kalrayan hills (680 ± 760 m altitude) are located in the semi-evergreen forest in the Eastern Ghats, Attur taluk of Salem district in TN. Pachamalai, a green hill range about 80 km North of Thiruchirappalli district in TN, is located in Sengattupatti reserved forest at an altitude of 1015 m a.s.l. It lies between 10°10′ and 11°20′ of the Northern latitude and 78°10′ and 79°0′ of the Eastern latitude. Javadi hills are located in Vellore district (TN) at an altitude of 300–1000 m above sea level (longitude 78°49.6′E; latitude 12°34.6′N), and Mundandurai (white) is situated in evergreen forest of Western Ghats at an altitude of 500 m in the Tirunelveli district (TN). It is located between 80°10′ and 90°40′ North latitude and 770°21′ and 770°99′ East longitude. The study area is situated in the Southern parts of Tamilnadu (Fig. 1), which is one of the places with a rich biodiversity in India. Traditional healers, called "Vaidyars" from four different indigenous groups were targeted for documentation of the uses of medicinal plants. The population of the study area is about 1500–2500; comprising various communities whose main occupation is agriculture, while some of them are laborers. Our main focus was to collect the oral information about the medicinal plants used by natives (different indigenous groups) for treatment of snakebite; we did not use any "statistical survey" in this study.

2.2. Identification of plants

The information recorded was further ascertained or cross-checked by consulting the beneficiaries, villagers and other traditional physicians. The collected plants were identified by S.P. Subiramanian, ERI, Loyola College, Chennai, India. The plant specimens were also identified according to different references concerning the medicinal plants of South India (Dhar et al., 1968; Nadkarni, 1976; Matthew, 1981–1983) and voucher specimens were deposited in the Institute herbarium. The medicinal information given in this paper includes botanical term, family, local name, parts used and their therapeutic use. No monetary compensation has been given to the traditional healers for providing the medicinal information.

2.3. Extraction of plants

Two hundred grams of each of the powdered shade dried plant materials was dissolved in 800 ml (w/v) double distilled water at room temperature. The majority of the extracts were filtered by "Whatman filter paper", although some plants like *Gloriosa superba*, *Hemidesmus indicus*, *Moringa oleifera* and *Vitex negundo* were filtered by sterile muslin cloth and concentrated by using lyophilization to obtain gummy aqueous residues (Buchi, Labortechnik AG, Switzerland). The extracts were kept in tightly stoppered bottle and stored at 4 °C for the in vivo testing of antidote study in animal model (Brantner and Grein, 1994).

2.4. Purification of active plant fractions

A portion of the aqueous extract that was subjected to phytochemical screening was used for identification of the major secondary metabolites (Harborne, 1976). The different chemical constituents tested include alkaloids, flavonoids, glycosides, polyphenolics, saponin, sterols, triterpenes, tannins, reducing sugars, gallic acid, catechol, aglycones, etc.