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Medicinal plants from Mali: Chemistry and biology

Helle Wangensteen^a, Drissa Diallo^b, Berit Smestad Paulsen^{a,*}^a School of Pharmacy, Department of Pharmaceutical Chemistry, division Pharmacognosy, University of Oslo, Oslo, Norway^b Department of Traditional Medicine, Bamako, Mali

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ABSTRACT

Ethnopharmacological relevance: Mali is one of the countries in West Africa where the health system rely the most on traditional medicine. The healers are mainly using medicinal plants for their treatments. The studies performed being the basis for this review is of importance as they will contribute to sustaining the traditional knowledge. They contribute to evaluate and improve locally produced herbal remedies, and the review gives also an overview of the plant preparations that will have the most potential to be evaluated for new Improved Traditional Medicines.

Aim of the review: The aim of this review is to give an overview of the studies performed related to medicinal plants from Mali in the period 1995–2015. These studies include ethnopharmacology, chemistry and biological studies of the plants that were chosen based on our interviews with the healers in different regions of Mali, and contribute to sustainable knowledge on the medicinal plants. The Department of Traditional Medicine, Bamako, Mali, is responsible for registering the knowledge of the traditional healers on their use of medicinal plants and also identifying compounds in the plants responsible for the bioactivities claimed. The studies reported aimed at getting information from the healers on the use of medicinal plants, and study the biology and chemistry of selected plants for the purpose of verifying the traditional use of the plants. These studies should form the basis for necessary knowledge for the development of registered Improved Traditional Medicines in Mali.

Materials and methods: The healers were the ethnopharmacological informants. Questions asked initially were related to wound healing. This was because the immune system is involved when wounds are healed, and additionally the immune system is involved in the majority of the illnesses common in Mali. Based on the results of the interviews the plant material for studies was selected. Studies were performed on the plant parts the healers were using when treating their patients. Conventional chromatographic and spectroscopic methods were used for the isolation and structural elucidation of compounds. The compounds to study were selected based on the bioassays performed concomitant with the fractionation.

Results: Our results show that plants traditionally used as wound healing agents contain polysaccharides basically of pectin nature with immunomodulating activities. These pectins all have different and new structures. Several of the plants also contain compounds with effects related to antioxidant properties. These compounds are mainly of polyphenolic nature. Three of these are new compounds from Nature, while 32 was for the first time described from the plant they were isolated from. This review gives an overview of the most important results obtained during the 20 year long collaboration between Department of Traditional Medicine, Bamako, Mali, and Department of Pharmacognosy, School of Pharmacy, University of Oslo, Norway.

Conclusion: Our studies showed that ethnopharmacological information is important for the determination of screening and chemical methods to be used for studies of plants used in traditional medicine.

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1. Introduction

Mali is a landlocked country located in the centre of West Africa. Traditional medicine is still a very important factor in the

health system, and more than 80% of the population relies on the practice of traditional medicine for the treatment of most diseases that are frequent in the country. The Department of Traditional Medicine (DMT), within Institute National de Recherche en Santé

* Correspondence to: School of Pharmacy, P.O. Box 1068 Blindern, 0316 Oslo, Norway.

E-mail addresses: helle.wangensteen@farmasi.uio.no (H. Wangensteen), dri.diallo@yahoo.fr (D. Diallo), b.s.paulsen@farmasi.uio.no (B.S. Paulsen).

Publique (INRSP), Bamako, Mali, has been made responsible for the registration of the traditional use of medicinal plants in Mali. This collaboration is based on trust and DMT has established an effective collaboration with the healers. DMT has also been involved in creating local organisations amongst the traditional healers throughout the country, thus creating meeting points for the healers in the different regions of the country. DMT is also responsible for keeping the national herbarium on medicinal plants used, and they perform ethnopharmacological studies all over the country in order to make sure that the traditional knowledge is kept for future generations. Their goal is also to study the bioactivity of the plants, to identify the compounds in the plants responsible for the observed activity, and they also produce monographs for the national pharmacopoeia.

During the period 1995–2015 there has been a close cooperation between DMT and School of Pharmacy, division Pharmacognosy, at the University of Oslo, Norway. This cooperation has led to the development of DMT into a modern laboratory; the project has produced 4 Malian PhD candidates, more than 100 Malian master degrees, as well as several PhD and master degrees in Oslo.

The objective of this collaboration was to perform ethnopharmacological surveys on plants used against the most frequent ailments in Mali. These include wounds, both external and internal, as well as various types of infections and infestations such as malaria, jaundice and bilharzia. Toxic plants used by the healers have also been evaluated. The plants that became the objectives for further chemical and biological studies were chosen based on the frequency of use mentioned by the healers related to illnesses where the immune system might play an important role. Thus the bioactivities tested for were relevant for the diseases that plants are used against traditionally.

In Mali, the Ministry of Health has a system for registration what is called “Improved Traditional Medicines”, ITMs. These products are based on plants with a long tradition of use that has been proven by clinical trials. DMT has developed the products and the production is quality controlled with respect to content and bioactivity. One of the objectives for DMT is to provide

information on plants which could be potentially valuable candidates for new ITMs. These have been well described by Willcox et al. (2012) and an overview of the 7 registered is given in Table 1.

Additionally, the Department of Traditional Medicine has also developed 12 other products, Medicaments Traditionnels Améliorés (MTAs), which can be found in Table 2. These MTAs are not yet registered, thus details on formulation and route of administration cannot be given.

2. Choice, background and methods selected for the research covered in this review

2.1. Ethnopharmacology

The collaboration programme contains ethnopharmacological studies as the important starting point for the determination of the medicinal plants to be studied in more detail regarding the chemical, biological and toxicological aspects as a background for the development of possible new ITMs and MTAs. The focus for these studies was in the beginning to identify plants that were used for healing wounds of different kinds. Later the ethnopharmacological studies were further developed to obtain information on what illnesses specific plants were used against. During the surveys, information from various areas of Mali were covered, e.g. Dogonland, the Bamako region, Kolokani, Siby, Dioila and Sikasso. The results of these studies can be found in Tables 3 and 4 and in the following publications: (Bah et al., 2006; Diallo et al., 2002; Gronhaug et al., 2008; Inngjerdingen et al., 2004; Maiga et al., 2005; Nergard et al., 2005a; Pham et al., 2011a; Rusten, 2006; Sanogo, 2011; Togola et al., 2008a, 2005). During these surveys, the identity of the plants for which the healers gave information was verified in collaboration between the healers and the scientists from Department of Traditional Medicine being specialists in plant systematics. All plants studied and presented in this paper can be found in the herbarium of DMT. The reference numbers are given in the relevant tables.

Table 1
“Improved Traditional Medicines” (ITMs) registered in Mali.

Name of ITM	Constituent; plant names	Plant family	Voucher no.	English name ^a	Malian name, Bambara ^b	Plant part; formulation	Indication; administration route
Balembo Dysenteral	<i>Crossopteryx febrifuga</i> (Afzel. ex G.Don) Benth. <i>Euphorbia hirta</i> L.	Rubiaceae	0052 DMT	Ordeal tree	Balembo	Fruit; syrup	Dry cough; oral
		Euphorbiaceae	00952 DMT	Pill-bearing spurge, asthma plant, hairy spurge, garden spurge, pillpod sandman	Débasijji/Bojara	Aerial part; powder	Amoebic dysentery; oral as tea
Gastrocedal	<i>Vernonia kotschyana</i> Sch.Bip. ex Walp., synonym of <i>Baccharoides adoensis</i> var. <i>kotschyana</i> (Sch.Bip. ex Walp.) “Isawumi, El-Ghazaly & B. Nord.”	Compositae	0787 DMT	Shire Vernonia	Bouayé	Root; powder	Gastritis, peptic ulcer; oral as tea
Hepatisane	<i>Combretum micranthum</i> G.Don	Combretaceae	0031 DMT	Kinkeliba	Ngolobè	Leaves; powder	Indigestion, nausea, poor appetite; oral as tea
Laxa cassia	<i>Senna italica</i> Mill.	Leguminosae	0963 DMT	Italian senna	Bali bali	Leaves; powder	Constipation; oral as tea
Malarial	<i>Senna occidentalis</i> (L.) Link, <i>Lippia chevalieri</i> Moldenke, <i>Acmella oleracea</i> (L.) R.K.Jansen,	Leguminosae,	2980 DMT,	Coffee senna, tea bush,	Mpalan mpalan nkasogo; N'ganiba; farimani	Leaves; leaves; flowerheads; syrup	Malaria, fever; oral
		Verbenaceae, Compositae	0001 DMT, 2670 DMT,	tooth ache plant			
Psorospermine	<i>Psorospermum guineense</i> (L.) Hochr. synonym of <i>Vismia guineensis</i> (L.) Choisy,	Hypericaceae	2495 DMT		Karijakuma	Root; pomade	Eczema; external application

^a When English name is missing, they are not available.

^b Bambara names as given by healers in the interviews.

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