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A quantitative ethnozoological assessment of traditionally used animal-based therapies in the tropical island of Mauritius

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ABSTRACT

Ethnopharmacological relevance: There is currently a dearth of documentation on the use of animal-based therapies (ABT) in Mauritius. This study was therefore designed to gather primary folk knowledge on the different ABT used by Mauritians. Failure to document such knowledge can results in losses in both the use of such remedies and in the scientific documentation of the cultural traditions of animals used in the treatment and/or management of human diseases. The aim of the study is to collect, analyze, document and disseminate ABT from the tropical island of Mauritius used against common human ailments.

Methods: Data was collected following interviews from key informants ($n=126$) and reported diseases and health complications were classified in 14 categories. Eight quantitative indexes such as informant consensus factor (FIC), fidelity level (FL), relative frequency of citation (RFC), relative importance (RI), cultural importance index (CII), index of agreement on remedies (IAR), cultural agreement index (CAI) and ethnofaunistic index (EFI) were used to analyze the reported animal species.

Results: A total of 31 animal species belonging to 12 taxonomic groups were documented to be used in traditional medicine by Mauritians. ABT were prepared from whole animals or their body parts or products extracted from them such as: butter, meat, milk, bones, horn, musk, skin, fin, honey, mucus, eggs and legs. The most encountered taxonomic group was Actinopterygii (7 species). According to EFI, 3.34% of the indigenous fauna in Mauritius were used in the treatment and/or management of different ailments. The highest FIC value (0.98) was cited for endocrine, nutritional and metabolic disorders which included diabetes and gangrene. *Rattus rattus* scored the highest FL (100%) for the ailment category injury and poisons of external cause; *Bos taurus* had the highest RI value (2.00) due to its versatility, had the highest frequency of citation (RFC=0.49), the highest cultural importance (CII=0.84) and the highest CAI value (0.77). According to IAR, *Salmo salar* (IAR=1.00) had the highest agreement among the informants for being used for the same medicinal purpose. Furthermore, no side effects have been reported from the use of ABT.

Conclusions: Our study revealed that Mauritians possesses valuable knowledge on a plethora of ABT. It is believed that the present documentation will serve to record this vanishing knowledge before it is eroded completely from the island and to the scientific community. It is also anticipated that the present documentation will be fundamental to protect traditional knowledge, for the conservation and sustainable use of the rich biodiversity of Mauritius for future generations and to ensure Mauritius's sovereign rights over its genetic resources and utilization by first documenting them. In addition, further experimental investigations are required to elucidate the pharmacological properties of the reported medicinal fauna of Mauritius

1. Introduction

Zootherapy is defined as the healing of human ailments with therapeutics based on medicines obtained from animals and their products (Costa-Neto, 2005). Since ancient time, traditional healers and indigenous people have been collecting natural remedies such as plants and animals for medicinal purposes. The medicinal use of animals and their products has been documented throughout history in ancient documents such as papyri, archives, and

Abbreviations: CEN, Common English name; VN, Vernacular name; SN, scientific name; RFC, Relative Frequency of Citation; RI, relative importance; CII, Cultural Importance Index; IAR, Index of Agreement on Remedies; CAI, Cultural Agreement Index.

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other early written historical sources dealing with medicine (Costa-Neto and Oliveira, 2000; Lohani, 2010; Quave et al., 2010). The practice of zootherapy can be dated back to the times of the ancient Egypt and several civilizations of ancient Mesopotamia, mainly the Assyrian and the Babylonian (Lev, 2003). Historically zootherapeutic practices have often been neglected in favor of ethnobotanical studies and surveys aim at the documentation of medicinal plants that have been much more prioritized by researchers. However, recently the phenomenon of zootherapy has aroused the interest of many researchers from different branches of science who have recorded folk medical systems and sought compounds with pharmacological action (Alves and Alves, 2011; Costa-Neto and Oliveira, 2000; Lohani, 2010; Quave et al., 2010). In modern societies, the use of animal-derived remedies constitutes a fundamental part of traditional medicine of many cultures worldwide. Traditional medicine is the most easily accessible and affordable form of therapy in low income countries and therapeutic compounds derived from plants and animals are not only used in traditional medicines, but are also valued as raw materials in the preparation of modern medicines and herbal formulations (Alves and Alves, 2011). Moreover, all human cultures which possess a developed medical system utilize animals as therapeutic agents (Costa-Neto and Oliveira, 2000). Undoubtedly, the most famous of these are the Chinese people, who use animals for panoply of ailments. More than 1500 animal species have been documented to be used for medicinal purposes in traditional Chinese medicine. Though just as varied and rich as the traditional Chinese medicine is the Latin America's long tradition of animal-remedies used for all kinds of ailments whereby in Brazil, over 180 medicinal animals have been recorded (Alves and Alves, 2011; Alves et al., 2011; Alves and Rosa, 2005).

The fauna and flora of Mauritius has a relatively high level of diversity and endemism as a result of the island's location, age, isolation and varied topography (Ministry of Environment and Sustainable Development (MESD), 2010). Mauritius possesses a rich biological and cultural diversity which translates into a wealth of traditional knowledge and practices including the use of faunistic resources for medicinal purposes by various ethnic groups. Indeed, traditional medicine is omnipresent in the Mauritian community whereby Mauritians still use traditional medicine for the treatment and/or management of various ailments. Nonetheless, with globalization and access to conventional medicines, Mauritians, particularly the younger people, tend to remember their use in the past as such knowledge has not been documented. Therefore, there is a pressing need to record updated primary scientific information on the different animal-based therapies used by Mauritians. Interestingly, for the first time, a quantitative ethnozoological survey has been designed to collect primary data in Mauritius. It is believed that the present documentation will serve to record this vanishing knowledge before it is eroded completely from the island and to the scientific community. It is also anticipated that the present documentation will be fundamental to protect traditional knowledge, for the conservation and sustainable use of the rich biodiversity of Mauritius for future generations and to ensure Mauritius's sovereign rights over its genetic resources and utilization by first documenting them.

The present study therefore aims to provide an overview of the use of medicinal animals in Mauritius and to identify those species used as traditional folk remedies using quantitative ethnozoological indexes.

2. Methods and materials

2.1. Study site

The island of Mauritius lies in the southern hemisphere in the middle of the Indian Ocean with coordinates 57°30' east and 20°20' south (Map 1). The autochthonous language of the Mauritian population is 'Creole'. The population of the island of Mauritius is around 1,253,000 and comprises of Indo-Mauritians, people of mixed European and African origin and Sino-Mauritians. Mauritius has an area of 1865 km² and about 43% of the area is allocated to agriculture. Main crops are sugarcane, tea, potatoes, tomatoes, bananas, peanuts, tobacco and coconuts while the main animals used for livestock are chickens, beefs and porks. Mauritius enjoys a mild tropical climate, characterized by a warm humid summer between November and April and a cool dry winter between June and September whereby October and May are the transition months. Mean mid-day temperature ranges from 26 °C to 30 °C during summer days and from 22 °C to 27 °C during winter days (Ministry of Finance and Economic Development (MOFED), 2011). Mauritius is a multiethnic nation which has experienced rapid economic growth since the 1980s, with amplification in disposable income followed by changes in food consumption and lifestyle patterns similar to the globally observed trend. Mauritius is known to have maintained one of the developing world's most successful democracies. Previously the economy of the country was based on agriculture. However, the economy has successfully been diversified into textiles, tourism, banking and business outsourcing. It is classified by the World Bank as an upper middle income country.

2.2. Data collection

A total of 126 key informants (44 men and 82 women above 45 years old) were interviewed from year 2012 to 2013. The age of the key informants ranged from 45 to 86 years. In terms of education, 49.2% of the participants studied up to primary level and 1.6% were illiterate. Most of the interviewees (76.2%) lived in rural areas and were retired (40.5%). Proper data was partly collected using the participatory rural appraisal method, as the key informants also became investigators themselves, participating in interviews, informal meetings, open and group discussions, and overt observations with semi-structured questionnaires. The interviews were held in both urban and rural settings spread over 9 districts (Map 1). The interview was performed in vernacular and native languages ('Bhojpuri' and 'Creole'). The questionnaire developed was strictly confidential and non-compulsory and each participant was interviewed alone where appropriate to maintain confidentiality. Participants were given information on the purpose of the survey and a prior informed consent form was dully signed by the participants before the interview was conducted.

Vernacular names of species were recorded as quoted during the interviews. Animal based remedies were identified with the aid of experts, through examination of voucher specimens donated by the interviewees, or purchased at trading markets. During field visits, when a remedy was mentioned by the participant, where possible, the participant was encouraged to show a sample of the remedy which was collected and/or photographed. Larger animals were identified according to traditional description of each remedy. Whenever necessary, these procedures were complemented by checking vernacular names provided by informants against the scientific names, with the aid of specialists familiar with the study areas as described previously (Lohani, 2010; Oliveira et al., 2010).

The semi-structured questionnaire encompassed the following key questions: the local vernacular name of the animal used as remedy, part(s) used, conditions treated with the remedy, the method of preparation, the dosage, the route of administration, the reasons behind the preference of animal-based remedy, the efficacy of the animal-based remedy and any side effect(s).

This documentation will fully recognize the contribution of the local people who have been using the indigenous knowledge, protection of community biodiversity and intellectual property