Nimis P. L., Vignes Lebbe R. (eds.)
Tools for Identifying Biodiversity: Progress and Problems – pp. 207-211.
ISBN 978-88-8303-295-0. EUT, 2010.

Indochinese bamboos: biodiversity informatics to assist the identification of “vernacular taxa”

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Abstract — Bamboo (Bambusoides – Gramineae) is one of the most important natural resource in Southeast Asia. However, bamboo identification has many difficulties. In the area of SEP programme «Indochina Bamboos» (2008-2010), the final objective is to update the bamboo flora of Indochine (Vietnam, Laos, Cambodege) and to publish an e-flora including free access keys, digital images and information about the traditional and economic use of bamboos. During field trips in Vietnam, Laos and Cambodgia, samples, pictures and morphological description sheets were collected in various locations and previously assigned to the local vernacular names. We use an informatic program, Xper^2, to assist the comparison and identification of “vernacular bamboo taxa” based on morphological characteristics.

Index Terms — bamboo, Indochinese, taxonomy, common name, computing, XPER^2.

1 Introduction

Bamboo is extensively used in traditional handicrafts in Southeast Asia. Nowadays, bamboo is also used in others fields: construction, medicine, etc. With a better understanding of this group of plants, we could propose recommendations on conservation measures and find species to be developed for industrial exploitation and economic benefits [4].

Bamboo is in the family Gramineae (Poaceae), subfamily Bambusoideae, tribe Bambuseae. Since Linné time, its taxonomy is based on flower characteristics. However, bamboo is characterized by infrequent flowering. The taxonomy

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of Indochinese Bamboo has not been completed; it is basically based on E. G. Camus and A. Camus, «Flore Générale d'Indochine, Vol 7 Gramineae» [9] describing 14 genera and 73 species [6]. In the 1970s, Professor Pham Hoang Ho mentioned more than 120 bamboo species in «Vietnamese Plants» [8]; almost 200 species with illustrative pictures are recorded in Nguyen Hoang Nghia, «Vietnamese Bamboos» [7].

Facing the ongoing disappearance of many traditional uses of bamboo, and its shrinking natural environment, Dr. Diep Thi My Hanh has decided to establish the Bamboo Ecology Museum and the Plant Conservation Centre in Phu An, to collect a variety of bamboo species and other endangered precious plants in the Southeast. The project is jointly undertaken by Rhône-Alpes (France), the Binh Duong Province (Vietnam), the Pilat Natural Garden, and the Natural Science University of HCMC. In 2003-2007, the project has gathered a large amount of information on Vietnamese bamboos in the North, Central Part, Highlands, Mekong Delta, and the Southeast, with 301 dry specimens in a botany collection and 157 samples of bamboos growing in the Conservation Centre [2].

Since 2007, a project to achieve the revision of Indochine Bamboos is in progress, in collaboration with Laotian, Cambodgian and Vietnamian biologists. During many field trips, morphological description sheets with pictures and information on the bamboo applications in various locations have been made. With a few exceptions, most samples have their common names in each location. A crucial task is then to assign a scientific name to all gathered data. This paper describes the methodology and the results of the project.

2. Methodology

2.1 Data collection

Data were gathered from literature, collections and field trips. Field trips were conducted for the most part in Vietnam (all the regions) and in Laos and Cambodia as well. The exploration needs to be completed in some locations. The literature was consulted and analysed to collect all characters proposed by botanists to define and identify bamboo species. This task was completed by the observation of specimens (including type material) in the main reference collections, such as the Royal Botanic Gardens Kew (UK), the Laboratoire de Phanérogamie de Paris (France), and other botany collections in Asia.

2.2 Proposal of a standardised description form to describe specimens and Bamboo species

A list of 90 morphological characters, divided into 11 groups, has been established and documented by texts and images (Fig. 1). The botanic terminology was controlled by the botanist Soejatmi Dransfield. The database is now translated into five languages (Vietnamese, English, French, Laotian, and Cambodian).

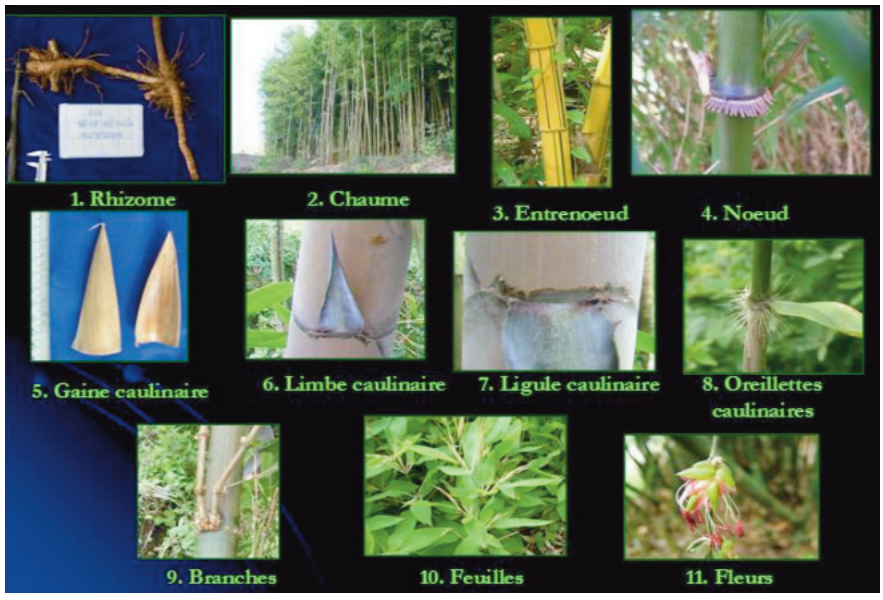

Fig. 1 – The 11 groups of characters describing Bamboos.

2.2 Digitalization of the Bamboo descriptions

Xper^2 appears well adapted to manage our structured descriptions, texts and images. Following the standardized list of characters, we edit the descriptions of the species and also the descriptions of specimens with their common names.

2.3 Assigning scientific names to vernacular names

The scientific identification of each specimen is time-consuming and requires highly skilled and adequately trained scientific personnel. To facilitate this task, we use the facilities offered by Xper^2 to compare descriptions (see Fig. 2). We also use the free access key of Xper^2 to associate the specimens of the references collections to “vernacular taxa”. Similarity measurements between descriptions are used to group vernacular and scientific descriptions. All these results are compared, to propose one or few scientific names for each vernacular name. This work is already in progress.

2.4 DNA analyses

To complete and to verify some identifications, DNA analyses are conducted iin collaboration with the MNHN and the laboratory of Créteil University. This early approach enables us to conduct more intensive studies on the Indochinese Bamboo evolution based on analyzing the molecular evolution.

Legend
Discrimination
Partial discrimination
No discrimination

	Dendrocalamus giganteus Munro	Tre mỡ gai (Hà Tĩnh)-C	UNION	INTERSECTION
Type de rhizome (Dạng căn hành) (Type of rhizome)	sympodial (cespiteux) (cộng trụ) (sympodial)	sympodial (cespiteux) (cộng trụ) (sympodial)	sympodial (cespiteux) (cộng trụ) (sympodial)	sympodial (cespiteux) (cộng trụ) (sympodial)
Taille du chaume (Chiều cao thân) (Size of culm)	géant: supérieure à 20 m (rất lớn: lớn hơn 20 m) (giant : greater than 20 m)	grand: 7 à 20 m (lớn: 7đến 20 m) (large : 7 to 20 m)	géant: supérieure à 20 m (rất lớn: lớn hơn 20 m) (giant : greater than 20 m), grand: 7 à 20 m (lớn: 7đến 20 m) (large : 7 to 20 m)	
Diamètre du chaume (Đường kính thân) (Culm diameter)	10 à 20 cm (10đến 20 cm) (10 to 20 cm); supérieur à 20 cm (lớn hơn 20 cm) (greater than 20 cm)	5 à 10 cm (5đến 10 cm) (5 to 10 cm)	10 à 20 cm (10đến 20 cm) (10 to 20 cm), supérieur à 20 cm (lớn hơn 20 cm) (greater than 20 cm), 5 à 10 cm (5đến 10 cm) (5 to 10 cm)	
Coloration du chaume (Màu sắc thân) (Colouration of the culm)	unie (đồng nhất) (uniform)	unie (đồng nhất) (uniform)	unie (đồng nhất) (uniform)	unie (đồng nhất) (uniform)

Fig. 2 – The automatic comparison of descriptions displays in a visual table the characters which are common or different between two or more descriptions. Here the comparison of a “vernacular” entity and the species *Dendrocalamus giganteus*.

2.5 Computer-aided identification for Indochine bamboos

All the information collected in the project is already digitalized in a structured format. The automatic HTML export of Xper^2 and Xper^2 online free access keys will be combined to offer a e-bamboo-flora.

3. Conclusion

The project “Indochine Bamboos” is still progressing. Three new species have been detected and will be published.

Presently, the Centre’s collection has about 350 specimens from Vietnam, Laos and Cambodia. Few additional field trips are planned to complete the live collection in the Plant Conservation Centre in Phu An with typical bamboo species in Indochina.

The validation of the approach to identify vernacular names to scientific names could be proposed for other taxa, and made more automated.

Two master students and a PHD student are working on the subject. The project also offers the opportunity of organising training courses on the identification tools for students and young researchers coming from the participant institutions. Two workshop trainings for using the software Xper^2 were organized in 2008 and 2010. The participants were from Vietnam, Laos and Cambodia. This type of tools is attracting students interested in botany, enhancing their capabilities to analyse characters and taxonomic data.

Acknowledgement

The authors wish to thank Mrs Dransfield, Florian Causse and all participants of the "Bambous d'Indochine" project. This work is supported by the French initiatives Sud-Expert Plantes granted by the French. Ministry of Foreign Affairs.

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