Participatory Approach for Rapid Assessment of Plant Diversity through a Folk Classification System in a Tropical Rainforest: Case Study in Xishuangbanna, China

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Abstract: Rural indigenous people are often very knowledgeable about plant and animal species, including their identification and ecology. The use of indigenous knowledge has increasingly attracted attention in scientific circles. The Dai people, a dominant nationality in southwestern Yunnan, China, have developed their own traditional plant classification system. In a case study in Xishuangbanna, we compared the differences in number of plant species identified between scientific and Dai folk classification. The Dai people identified more than 80% of the plant species, and the correspondence between folk and scientific plant species was 87.7%. Our results indicate that folk plant classification could be used in rapid assessment of plant species in certain regions. The use of folk systems of plant classification for rapid biodiversity assessment will contribute to conservation of both indigenous knowledge and regional biodiversity.

Key Words: Dai nationality, indigenous knowledge, rapid assessment, Xishuangbanna

Método Participativo para la Evaluación Rápida de Diversidad de Plantas con un Sistema de Clasificación Popular en un Bosque Tropical Lluvioso: Caso de Estudio en Xishuangbanna, China

Resumen: A menudo, los habitantes rurales indígenas son conocedores de las especies de plantas y animales, incluyendo su identificación y ecología. Cada vez más, el uso del conocimiento indígena ha llamado la atención en círculos científicos. La gente Dai, una nacionalidad dominante en el suroeste de Yunnan, China, ha desarrollado su propio sistema tradicional de clasificación de plantas. En un estudio de caso en Xishuangbanna, China, comparamos las diferencias entre el número de especies de plantas identificadas con la clasificación científica y la popular Dai. Los Dai identificaron a más de 80% de las especies de plantas, y la correspondencia entre las especies científicas y populares fue 87%. Nuestros resultados indican que la clasificación popular de plantas podría ser utilizada en la evaluación rápida de especies de plantas en ciertas regiones. El uso de sistemas populares de clasificación de plantas para la evaluación rápida de biodiversidad contribuirá a la conservación tanto del conocimiento indígena como de la biodiversidad regional.

Palabras Clave: conocimiento indígena, evaluación rápida, nacionalidad Dai, Xishuangbanna
Introduction

Biodiversity inventories at particular sites provide essential data for conservation and resource management. Disney (1986) and McNeely et al. (1990) calculated that if the use of traditional methods to describe new species continues at the current rate and with the same number of taxonomists, the cataloging of global biodiversity would take several thousand years to complete. Furthermore, this process is slowing down because funding for taxonomy continues to decline (McNeely et al. 1990; Stork & Gaston 1990; Gaston & May 1992). Rapid and effective methods of biodiversity assessment are urgently needed because of the enormity of the extinction crisis and the limited time and budget available for conservation. One such approach is to use selected indicator taxa (e.g., birds, butterflies, beetles, ants, termites, nematodes) as proxies for the biodiversity of a habitat (Rodrigues et al. 1998; Person 1994; Hodda et al. 1998; Lawton et al. 1998; Kerr et al. 2000). A second method is to use RTU, recognizable taxonomic units for rapid biodiversity assessment (Oliver & Beattie 1993).

Rural indigenous people are often very knowledgeable about plant and animal species, including their identification and ecology (Redford & Padoch 1992; Johnson-Gottesfeld 1998). In addition, many rural societies possess systems for classifying plant and animal species (Sheil et al. 2002). However, folk classification systems have rarely been applied in the assessment of biodiversity. The Dai, a dominant nationality in Xishuangbanna, southwestern China, have developed their own folk system of plant classification and nomenclature (Xu & Huang 1991) in which there are four hierarchies. They use a binomial method to name plants, which is similar to the scientific binomial system. The Dai people divide plants into cultivated and wild plants, classifying wild plants as tree, herb, vine, fern, or tuber and cultivated plants as fruit, vegetable, bean, flower, or cereal. Finally, they identify specific plants to a particular name. They do not identify to species in the way that scientists do.

How many plant species can be identified by the Dai system and what is the difference between scientific and folk identification? We addressed these questions to evaluate the potential of folk classification systems as a tool for rapid biodiversity assessment in specific regions. We compared the number of plant species accurately identified by local people and by field botanists.

Study Area and Methods

Xishuangbanna is in the south of Yunnan Province, in southwestern China (24°10′–22°40′N, 99°55′–101°50′E). It borders Laos in the south and southeast and Myanmar in the southwest (Fig. 1). The total area is 19,220 km², of which mountains and hill terrain cover approximately 94%. The climate is diverse, and the area is rich in plant diversity. There are about 5000 species of vascular plants (about 18% of China’s flora), although the area covers only 0.2% of the total land of China. This is a Dai autonomous region, but 13 nationalities inhabit the area, including Dai, Hani, Jinuo, and Yao. The population of the Dai people is 2.8 × 10⁸, some one-third of the total population of the area.

We selected three Dai villages in Xishuangbanna as research sites, with areas of 667, 500, and 430 ha. The vegetation distributed in the villages is tropical, seasonal rainforest and evergreen broadleaf forest. The distance between the villages is >100 km. We surveyed all the plants in areas of different land use, including community forests, sacred hill forests, economic plantations, and home gardens. We conducted the survey in October 2000 and again in October 2001. The surveys were carried out by both experienced field botanists from Xishuangbanna Tropical Botanical Garden, the Chinese Academy of Sciences, and by local villagers. In each village, two groups were involved in the survey: two field botanists as one group and two Dai villagers approximately 40 years old as another group. Each group had two graduate students as assistants. All specimens were collected and identified separately by local people and field botanists. Voucher specimens were kept in the herbarium of Xishuangbanna Tropical Botanical Garden, the Chinese Academy of Sciences.

To understand the knowledge possessed by local people of different ages, we selected 80 plant species of different life forms (including lianas, herbs, shrubs, and trees) to be identified by local people aged 16 to 75 from the three villages. To determine the accuracy of identification, we adopted three terms to refer to different types of correspondence between folk species and scientific species: one-to-one correspondence, overdifferentiation, and underdifferentiation (Berlin et al. 1966). One-to-one correspondence meant that one folk species referred to one scientific species, overdifferentiation meant that two or more folk species referred to a single scientific species, and underdifferentiation meant that a single folk species referred to two or more scientific species.
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Table 1. Comparison of the number of plant species identified by local people and by field botanists.

<table>
<thead>
<tr>
<th>Survey</th>
<th>Folk species</th>
<th></th>
<th>Scientific species</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>identified</td>
<td>unknown</td>
<td>total</td>
<td>identified</td>
</tr>
<tr>
<td>First</td>
<td>1016</td>
<td>157</td>
<td>1183</td>
<td>951</td>
</tr>
<tr>
<td>Second</td>
<td>1062</td>
<td>235</td>
<td>1297</td>
<td>1007</td>
</tr>
<tr>
<td>Average</td>
<td>1039</td>
<td>196</td>
<td>1240</td>
<td>979</td>
</tr>
</tbody>
</table>

\(\text{a}\)Time used for field collection and plant identification by local people to produce a full list of plants.

\(\text{b}\)Time used for field collection and plant identification in the herbarium by field botanists to produce a full list of plants.

Results

The local people identified 1016 and 1062 species of plants during the two surveys, whereas field botanists identified 951 and 1007 species (Table 1). The difference between the number of plant species identified by local people between the first and the second survey was <10%, although different local people participated in the surveys. The identification rate of plant species by local people was 83.79%, which was lower than that by field botanists (89.73%), but it took local people less time to identify species than it did the field botanists.

The number of folk plant species was 13.65% more than the number of scientific species. The correspondence between different types of folk species and scientific species showed 87.7% of the identifications were one-to-one correspondence, 8.8% of the identifications were overdifferentiated, and 3.5% of the identifications were underdifferentiated (Fig. 2). The number of plant species identified by local people had a significant relationship with their ages (Fig. 3); older people were more knowledgeable about plants than younger people.

Discussion

Like the Dai people of Xishuangbanna, many indigenous people in the world also have folk plant classification systems (Berlin et al. 1966, 1973; Diamond 1966; Atran 1985, 1990; Balee 1989, 1994; Berlin 1992; Pearson 1994). The Dai classification system corresponds closely with the scientific classification system. The one-to-one correspondence we found was higher than that found in studies in Chiapas, Mexico (34% one-to-one correspondence; Berlin et al. 1966), and in central Kalimantan, Indonesia (77% one-to-one correspondence; Wilkie 2000). Most of the species overdifferentiated by Dai people were cultivated or intensively used plants. For example, *Allium fistulosum* was identified by local people as two species according to its leaf size. *Alstonia scholaris* is used for traditional medicine and as timber, and it was identified as two species according to its uses. *Raphanus sativus* was identified by local people as two species according to the color of the flowers.

Generally, scientific identification of plant species depends on morphological characteristics, and folk systems of plant classification include morphological and ecological characteristics as well as cultural aspects. Thus, the Dai name for *Alstonia scholaris* is “maidingbie,” meaning a tree (“mai”) with leaves resembling the foot (“ding”) of a duck (“bie”); and the Dai name for *Ficus religiosa* is “guomaixini,” meaning straight (“guo”) tree (“mai”) symbolizing good luck (“xini”). The latter is worshiped as a sacred tree by the Dai.

In certain regions of the world, especially in the tropics, the number of plant species is still unknown. It usually takes a long time to make a plant inventory even in a small area with numerous botanists. For example, many...
botanists have worked in Xishuangbanna since the 1950s and have produced an estimate of only about 5000 vascular plant species. To make conservation decisions in specific areas, managers need rapid assessment of biodiversity, but there are not enough taxonomists. To make up for the dearth of taxonomists, folk botanical classification systems could be used in regional assessments of plant diversity with lower cost and timely output. The results of this study indicate that the Dai classification system can be used in rapid assessment of biodiversity in this area. With proper technical arrangements, experienced Dai people over 45 years old can work as excellent folk taxonomists, because they know the plants and environment of the region so well. Their contribution to plant diversity assessment can be at least supplementary to the scientific study of regional plant resources.

Most existing biodiversity on Earth is found in areas inhabited by indigenous people (Maffi 2001), and the level of local people’s participation is considered a key measurement of performance in conservation efforts (Pimbert & Pretty 1995; Tuxill & Nabhan 1998). The use of indigenous knowledge will encourage local people to participate in the conservation of biodiversity. It will also contribute toward the preservation of indigenous knowledge. The folk classification systems of plants and animals are unwritten and passed down from generation to generation orally and through practical use. Unfortunately, the world is facing a rapid loss of linguistic diversity. It is expected that at least half and perhaps up to 90% of the 6000–7000 languages in the world may vanish during the twenty-first century (Wuethrich 2000; Maffi 2001). The local terms for plants and plant classification will also disappear. Therefore, the use of systems of folk plant classification for rapid biodiversity assessment will contribute to the conservation of both indigenous knowledge and regional biodiversity.

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Literature Cited