



Ethnobotanical Approaches of Traditional Medicine Studies: Some Experiences From Asia

Pei Sheng-Ji

To cite this article: Pei Sheng-Ji (2001) Ethnobotanical Approaches of Traditional Medicine Studies: Some Experiences From Asia, *Pharmaceutical Biology*, 39:sup1, 74-79, DOI: [10.1076/phbi.39.s1.74.0005](https://doi.org/10.1076/phbi.39.s1.74.0005)

To link to this article: <https://doi.org/10.1076/phbi.39.s1.74.0005>



Published online: 10 May 2011.



Submit your article to this journal [↗](#)



Article views: 9602



View related articles [↗](#)



Citing articles: 17 View citing articles [↗](#)

Ethnobotanical Approaches of Traditional Medicine Studies: Some Experiences From Asia

Pei Sheng-Ji

Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, Yunnan, China

Abstract

Ethnobotany, as a research field of science, has been widely used for the documentation of indigenous knowledge on the use of plants and for providing an inventory of useful plants from local flora in Asian countries. Plants that are used for traditional herbal medicine in different countries are an important part of these studies. However, in some countries in recent years, ethnobotanical studies have been used for the discovery of new drugs and new drug development. In general, experiences gained from ethnobotanical approaches of traditional medicinal studies in China and Himalayan countries have helped drug production and new drug development. At the same time, in many cases, over-harvesting, degradation of medical plants, and loss of traditional medical knowledge in local communities are common problems in these resource areas. Issues of indigenous knowledge, intellectual property rights, and uncontrolled transboundary trade in medicinal plants occur frequently in the region. This paper discusses ethnobotanical approaches of traditional medicinal studies, in reference to experiences from China and Himalayan countries, with an emphasis on the conservation of traditional medical knowledge and medical plant resources.

Keywords: Ethnobotany, Asia, information bank, traditional medicine, drug development, conservation.

Introduction

Use of herbal medicine in Asia represents a long history of human interaction with the environment. Written accounts testify to the usefulness of Himalayan herbs for medicinal purposes. Perhaps the earliest use was documented in the Vedas in about 4500 to 600 B.C. This represents the oldest repository of human knowledge, and comprises 67 plant species. Ayurveda (a traditional medicine system practiced

widely in India and Nepal) provides further details for the therapeutic use of as many as 290 herbal drugs (Manabdhara, 1980). In China, Sheng-Nongs Herbal book is suggested to be one of the earliest sources of folk knowledge on the use of herbals; it comprises 365 plants, animals, and minerals useful as medication from the period of Sheng-Nong (3000 B.C.) (Pei, 1987). Recent studies on Tibetan medicine have shown that the earliest literature on Tibetan medicine was in the eighth century A.D. (Yang, 1988). The Unani Medicine in South and West Asia also has a very long tradition and is being practiced in many countries of the region.

From ancient literature to modern scientific records of traditional medicinal knowledge, there is evidence that plants supply the main medicinal source for peoples' health care in developing Asian countries. For instance, in China the updated inventory of medicinal plants used in Traditional Chinese Medicine (TCM) includes 11,146 species, of which 492 species are cultivated and the remaining 10,654 species are wild plants (SEPA, 1997). According to the World Health Organization (WHO), more than 80% of the world's population relies on traditional herbal medicine for their primary healthy care needs (Inglis, 1994). These valuable herbal traditions found in developing countries have always been considered an important component of the cultural heritage of the world.

However, over the last quarter century, environmental and cultural changes, and the transition of the economies from subsistence to market-based have created a serious impact on all aspects of traditional medical systems by affecting traditional medicine's resource base and environment. Over-harvesting of medicinal plants and animal species have resulted in resource degradation, loss of biodiversity, and the loss of indigenous medical knowledge and traditions. This has led to a breakdown of traditional medical systems. Moreover, the exploitation of traditional herbal medicine for

the creation and development of new drugs that supply modern markets with allopathic treatments will eventually lead to the replacement of traditional medicine.

The role of ethnobotany and the approaches of ethnobotanic studies in traditional medicine and drug development will be discussed in this paper, with specific references to experiences from China and other Himalayan countries.

An overview of traditional use and management of medicinal plants in Asian countries

Medicinal Plants are an important resource to traditional societies' health care systems. It is estimated that 70–80% of the rural population in developing Asian nations depends on traditional medicine for primary health care today, even through allopathic medicine is available in many places of the region. In rural societies of the region, food, health care and wood-derived energy meet the basic needs, but there are no alternative resource options to ensure the survival of these traditional rural communities.

Medicinal plants are also an important source of income. Their sale and barter contribute to the economic development of rural communities and support modern industrial development. For instance, the total number of medicinal plants in the Hindu Kush-Himalayan countries is approximately 7500 to 10,000 species (Pei, 1998). These plants play an important role in the biodiversity of the region and have great conservation value for global biodiversity. The Hindu Kush-Himalayas (Afghanistan, Bangladesh, Bhutan, China, India, Nepal and Pakistan) host the four largest traditional medicinal systems in the world: Ayurvedic medicine, Chinese medicine, Tibetan medicine, and Unani medicine. This region is the only geographic area among the world's large mountain systems (the Himalayan, Andean, African and European mountain systems) that possesses both rich medicinal plant diversity and great traditional medical knowledge documented in ancient literature.

Traditional management of medicinal plants and practices of herbal medicine are built on the basis of indigenous knowledge. There is a long tradition, in rural societies, of using medicinal plants for both preventive and curative health care; local people have developed reliable knowledge and effective methods to identify, harvest, utilize, maintain, and preserve medicinal plants and their habitats for sustainable use.

The transition from centuries of isolation to intense interaction with the outside world since 1950 has been rapid and abrupt. Traditional systems of knowledge, including traditional medicine, have disintegrated in many areas of Asia. Modern life, including access to modern allopathic medicine and improved health care facilities, has resulted in population growth. This has caused changes in consumption patterns of medicinal plants among local societies, from home and local use in small quantities to massive harvesting for marketing in large quantities. Population growth has also caused changes in resource maintenance systems, resulting

in uncontrolled over-harvesting of wild medicinal plants and loss of traditional knowledge, medicinal plants, and conservation traditions.

Field-based research and community participation in the documentation, application, and proliferation of indigenous knowledge of medicinal plant resources (and their management) can be a part of the process of coping with such changes without losing valuable local tradition and biodiversity. Hence, ethnobotany is important to conservation and community development. Understanding the indigenous knowledge of rural people in relation to biodiversity resource management and cultural traditions is important for the development of the region. Identifying changes in resource management, culture, decision-making and maintenance systems, as well as overall changes in social and economic relationships to resources is required to effectively face the changing reality that confronts rural societies in the region.

Application of ethnobotany to community conservation and medicinal plant resource management

There is a growing recognition that sustainable resource management needs participation from local communities. Hence, participatory approaches have been developed through community-based research and development programs in agriculture, forestry, watersheds, and resource management. Medicinal plants use is an important subject of these community development programs in rural Asian societies.

Ethnobotany is the science that studies the relationship of a given society with its environment and, in particular, with the plant world. These relations may be social, economic, ecological, symbolic, religious, commercial, or artistic (among others). Ethnobotany is derived from both the social and biological sciences, and is based on a multidisciplinary approach combining a diversity of knowledge bases and methods (Ford, 1978; Davis, 1991; Jain, 1987; Martin, 1995). Originally, ethnobotany was based mostly on qualitative and descriptive methods, i.e., inventory of plants and their uses. In the work of Conklin (1980) and Ford (1978), ethnobotany developed further and began to include an understanding of knowledge systems through the use of anthropological methods. Another turn was taken by researchers who developed quantifying methods in order to estimate amounts of products or distributions of useful species (Caballero, 1992). Today, ethnobiology addresses a larger scope than ethnobotanical studies, as it pertains to people's perceptions of plant-animal-human-soil-climate relationships and the practices that originate from these perceptions.

Traditional management systems have been the subject of numerous studies using ethnobiological methods (Johnson, 1980; Brush, 1980; Alcorn, 1984; Altieri et al., 1987; Balee & Gely, 1989; Aumeeruddy & Pimglo, 1989; Pei & Sajise, 1995). Since 1992, an international umbrella program called the People and Plants Initiative, operated by WWF-

UNESCO-Kew Garden, has been launching a number of field-based projects which aim at using ethnobotany as a tool to work with local communities to achieve sustainable management systems of plant resources. Recent development of ethnobotany in China, India, Nepal, Pakistan and Bangladesh of the Hindu Kush-Himalayan region are strongly oriented toward traditional herbal medicine, indigenously managed plant resources, home gardens and traditional agrarian ecosystems, cultural interpretations of the plant world in connection with conservation, and the ethnobotany of a particular ethnic group. Ethnobotany of economically important plant groups (bamboo, rattan, edible plants, etc.) and ethnobotany of rural development and biodiversity conservation have been conducted with a strong emphasis on applied approaches in the field (Jain, 1986; Banik, et al., 1998; Shrestha, et al., 1998; Rastogy, et al. 1998; Pei, 1991, 1998).

Ethnobotany as an interdisciplinary science is therefore in a position to preserve the wealth of traditional knowledge that indigenous people possess concerning their natural systems and environment in which medicinal plants are included. This includes their knowledge on the utilization and maintenance of different types of plant resources on a long-term basis without damaging or destroying their habitats. Hence, maximum efforts should be made to document and integrate indigenous knowledge on land-use, vegetation and forest management, non-timber forest products, medicinal plants, agro-forestry, home-gardens, swidden agriculture, and biodiversity. Meanwhile, the planning for natural resources development should continue by establishing close dialogue and communication with indigenous peoples using ethnobotanical approaches. This will also ensure local people's participation in future management, and avoid the adverse impact on the local people and the environment that might be caused otherwise (Pei, 1998).

More specifically, the goals of ethnobotany with regard to the sustainable development of plant resources are highlighted by the following points:

- To assess historical and contemporary changes, and their impact on management by ethnobotanical methods both qualitatively and quantitatively.
- A better understanding of the direct interactions between people and biotic elements in an environment, achieved through ethnobotanical studies and helping resource management at the local level.
- To transfer replicable indigenous techniques, practices and knowledge into other areas of the same bioregion for resource management through farmer-to-farmer exchange, based on the biocultural "niche-transfer" concept of indigenous environmental management.
- To facilitate local people's participation in the collection, documentation, analysis, and assessment of indigenous knowledge through field studies.
- To contribute to participatory resource management planning for rural development and conservation projects by

application of Participatory Rural Appraisal (PRA), Rapid Rural Appraisal (RRA), and Participatory Biodiversity Assessment (PBA).

- To inventory species of plants used by humans for medicinal purposes, food, fodder, non-timber forest products, swidden crops, home gardens, religious motives and other reasons. This usually involves a large number of local people and a certain number of informants identified from the local community. Inventories of this type document information (and store voucher specimens) based on indigenous knowledge from local communities on both natural and human-use aspects of the surveyed species including scientific names, vernacular names, habitat, utilization, preparation, properties, and maintenance.

Ethnobotanical inventory and documentation as an information bank on traditional medicine

Ethnobotany as a research field of science has been widely used for the documentation of indigenous knowledge on the use of plants and for the inventory of useful plants from local flora in Asian countries (Jain, 1987; Pei, 1988; Martin, 1995). Similarly, ethnopharmacology is defined as, "a research field to study the medicinal use of plants by indigenous cultures and to validate scientifically their effects and side effects". Since they are culturally acceptable and allow developing nations to reduce health, ethnopharmacological methods can be recommended for use in such countries (Farnsworth, 1993). However, in Asian countries like China, India, Nepal, and Bangladesh, ethnobotany has been employed widely in the documentation of traditional knowledge and inventory of herbal medicines (Shah, 1990; Manandhar, 1980; Pei, 1988; Alam, 1996).

Ethnobotanical information on medicinal plants and their uses by indigenous cultures is not only useful for conservation of cultural traditions and biodiversity, but also for community health care and drug development. This information is utilized as a guide for drug development under the assumption that a plant that has been used by indigenous cultures over a long period of time may have an allopathic application (Farnsworth, 1993).

Ethnobotanical documentation and inventories are scientifically organized with local and scientific names, medical uses, cultural interpretations, and information on the ecology, botany, phenology, harvesting, distribution, management, and conservation of medicinal plants. The information derives from local herbal doctors, community healers, and herbal traders at various local markets as well as community members who hold the knowledge. The indigenous knowledge documented and described involves rich, diverse, and often reliable local experiences in prevention, curing, and maintaining the health of people in the local environment. The inventory and documentation can be usefully incorporated into community resource management programs and biodiversity conservation at the local level. It can also be used as information to guide the selection of plants and

collection of samples for laboratory identification and pharmacological testing in drug development. Thus, the documentation and inventory can be considered the information bank of traditional medicine.

The updated documentation and inventory of Traditional Chinese Medicine (TCM) consists of 11,146 plant species, 1581 animal species, and 80 minerals. Of these, 500 to 600 species are commonly used medicines in TCM. The detailed, well documented information of TCM has been recently been compiled into six volumes in a series of Chinese Medicinal Resources, by the Chinese National Corporation of Traditional & Herbal Medicine, published by Science Press, Beijing in 1994–1995. The series includes the following six volumes:

- (1) Chinese Medicinal Resources (287 pp.).
- (2) Outline of Chinese Medicinal Resources (2069 pp.).
- (3) Regionalization of Chinese Medicine (634 pp.).
- (4) Commonly used Chinese Medicinal Materials (1138 pp.).
- (5) Chinese Folk Prescriptions (1817 pp.).
- (6) The Resource Atlas of Chinese Herbal Medicine (in Chinese and English, contains 81 color maps).

The Atlas is a pharmaceutical document with scientific value and practical significance. The series is a set of documents on TCM covering an inventory of 12,807 medicinal plants, animals, and minerals, and 20,000 Folk Prescriptions. It includes resource distribution, environmental conditions, harvesting, history of utilization, and conservation information about each entry.

China is inhabited by 55 ethnic minority groups with a population of 100 million, distributed over 18 provinces that make up 64% of the total territory of China. Their traditional medicine systems and knowledge of herbal medicines are called the “Ethno-Medicine” of China (EMC). It comprises over 8000 plant and animal species, according to various inventories and documentation works carried out in the last two decades (Zheng, 1997; Pei, 1999). For example, catalogued Tibetan Medicine consists of 1106 plants, 448 animals, and 840 natural minerals. Ethnobotanical information on Ethno-Medicine has been considered a great treasure for regional economic development and for new drug development (Zheng, 1997; Xiao, 1999).

In India, it is reported that 2500 plant species are used by traditional healers (WWF, 1990) and 100 species of plants serve as regular sources of medicine (Shah, 1990). In Nepal, about 800 medicinal plants were reported by ethnobotanists (Mamamdhar, 1995), while in Bangladesh, about 700 medicinal plants were reported (Banik, 1998). In Pakistan, it is reported that nearly 50% of the drugs currently used in modern medicine are prepared synthetically from petrol-chemical based raw materials (Hussain, 1987). In recent years, there has been an increased interest in documenting and inventorying traditional herbal medicine in Himalayan countries using ethnobotanical approaches. International organizations such as UNESCO, WWF-

International, ICIMOD, IDRC, and European funding agencies have played an important role in the promotion and support of different ethnobotanical programs in the Himalayan countries.

Use of ethnobotanical information in drug development

Rapid development and advances in science, technology, and the world economy have drastically changed the world and environment. With remarkable improvements in human health care on one hand and environmental deterioration on the other, a growing demand for natural products and phytomedicine has shifted research and development works into new drug discovery. Many research institutions and companies in this field have turned to traditional medicine, mainly the use of plants as a source for new drugs. Researchers use ethnobotanical information as the, “clue to which plants are prime candidates for further screening and chemical analysis” (Farnsworth, 1993). This development trend is not limited to Western countries but also includes developing countries in Asia.

Since the founding of the People’s Republic of China fifty years ago, great changes have taken place within Traditional Chinese Medicine. The legal status and scientific position of TCM has been officially confirmed. The constitutional law clearly stipulates, “to develop modern medicine and traditional medicine”; the guiding policy of “integrating Chinese Traditional Medicine with Western Medicine” has been fully implemented for the countrywide health care system. The creation of the TCM medical care system using TCM hospitals has further brought the characteristics and advantages of TCM into full play. As the TCM education system and research institutions developed and the standardization and legal framework of TCM improved, the TCM industry has established an advanced productive system to meet the needs of domestic and international demands.

Over the past fifty years, through policy instruction and TCM development on a countrywide basis, great attention has been paid to traditional medicine (including TCM and ethno-medicine) for drug development and production. The use of ethnobotanical information for drug development through various approaches constitutes an essential part of the methodology.

Study of lead compounds of medicinal plants for structure, activity, and formulation of new medicines

Ethnobotanical information on medicinal plants is often used to guide chemical screening of new drug development. Traditional herbs which had proven clinical efficacy and safety were the first chosen for screening. Then plant materials collected and identified with reference to ethnobotanical information and phytochemical analysis were screened in consultation with local users of the herbal medicine. The identified lead compounds of herbal medicines are tested through phytochemistry, pharmacy animal experiments, and

clinical trials. It is then possible to use them in the formulation of new medicines according to government regulations concerning new medicinal developments.

According to 400 papers published in China on chemical studies of medicinal plants used in ethno-medicine from October 1987 to October 1988, about 150 new compounds were discovered and reported (Xia, 1998). During the 1980s, at least 20 new medicines were developed and established based on traditional ethno-medicine. Many of these new medicines were formulated from identified and tested lead compounds from one or two plants, while the others were chemical extracts (or parts of extracts) of active compounds from one or more herbal plants. Purified and active compounds from herbal medicine are also used for the development of new TCM medicines, but not as often as the concentrated extracts from medicinal plants.

During the 1980s, a few collaborative projects were established between Chinese research institutions and foreign pharmaceutical companies for research purposes in herbal medicines. For example, the former Yunnan Institute of Tropical Botany (YITB) at the Chinese Academy of Sciences, collaborated with Yamanouchi Pharmaceutical Ltd., of Japan. From 1986 to 1991 they studied and searched for active compounds from herbal medicines. The joint project was carried out using an ethnobotanical approach. Candidate plants of 155 species were screened based on ethnobotanical information from the resource areas. Plant materials were then collected in accordance with ethnobotanical information, and the YITB scientists prepared samples. Further chemical studies and pharmacological testing were conducted in Japan. This joint research project resulted in seven patents being established from 1988 to 1991 by the two parties of the project.

Search for substitute plants for TCM and ethno-medicine to reduce costs and resource pressures

Traditionally, China imported more than 70 species of TCM medicines from South/Southeast Asia and Africa. Since the 1970s, research on substitute plants was carried out for TCM medicines and Tibetan medicines. After the 1990s, the number of imported TCM medicines and Tibetan medicines had been reduced to about 30 species. This dramatic drop in imported traditional medicine was due to the discovery of domestic resources from botanically rich areas such as the Yunnan Province and Hainan Island, and due to the identification of substitute species distributed in China, such as *Cardamon*, *Catechu*, "Dragon's blood", *Strychnus*, *Terminalia*, *Phyllanthus*, *Picrorhiza*, and *Rauwolfia*. Ethnobotanical works have played an important role in discovering indigenous medicinal uses of substitute plants from local flora.

With the development of the health industry and the increase of market demands on botanical medicines, the fact that the resources of these species are endangered or in short supply may affect the clinical uses of traditional medicine.

With government protection, about 300 species of TCM medicines are under cultivation on a large scale in China. At the same time, research and development of new substitutes, animal experiments, and clinical trials are being examined and verified by scientists. If these new substitutes satisfy the scientists in all aspects, then they can be successfully considered new medicinal materials (Yang, 1999). Efforts made so far on searching for new medicinal materials from plants have contributed to the reduction of pressures on TCM plant resources, and ethnobotanical information has played an important role in this course.

Conclusions

Traditional medical knowledge is important not only for its potential contribution to drug development and market values, but also for people's health care in the past, present and future. Information banks on traditional medicine and ethnobotanical knowledge have played different roles in drug development in China and in many other countries, and will continue to contribute to this field in the years ahead. In many cases today, over-harvesting of medicinal plants, degradation of medicinal resources, and loss of traditional medical knowledge in local communities where these resources are found are common problems. Indigenous knowledge, intellectual property rights of new drug development based on bioprospecting and herbal plants, as well as uncontrolled transboundary trade on medicinal plants in some border areas are issues that have been brought onto the international agenda.

There is an urgent need, in this new millennium, for the conservation of traditional medical knowledge and medicinal plant resources in developing countries – particularly in Asia.

The future of ancient traditional medicine in the new millennium is uncertain, and depends on the innovations of science and technology, the interests of large industry groups, and the policies that govern cultural traditions in developing countries. There is also the undeniable truth that, at present, no single medical system is perfect and complete in its ability to treat all forms of illness and disease – whether it is Western, Eastern, allopathic, or homeopathic. Therefore, it is important for health care providers worldwide to understand and examine the medical traditions that are being practiced in all countries. In this regard, traditional medicines in Asia have a very important role to play.

Acknowledgements

I wish to thank the Directorate for International Programs of the American Association for the Advancement of Science, and Symposium organizer, Marina S. Ratchford for inviting me to participate in the Symposium on "Ethnobotany/Bioprospecting Effects on Drug Discovering in the Next Millenium" held February 19th, 2000 in Washington DC. I

wish to also thank Dr. Gordon Cragg, Chief, National Products Branch, National Cancer Institute (NCI), Frederick, Maryland, U.S.A. for sponsoring my participation in the symposium and my visit to NCI prior to the symposium.

References

- Alam MK, Choudhury J, Hassan MA (1996): Some folk formularies from Bangladesh. *Bangladesh Life Sci*, 8(1).
- Alcorn JB (1984): Development policy, forest, and peasant farms: reflections on Huastec-managed forests' contributions to commercial production and resource conservation. *Econ Bot* 38: 389–406.
- Altieri MA, et al. (1987): In situ conservation of crop genetic resources through maintenance of traditional farming systems. *Econ Bot* 41: 86–96.
- Aumeeruddy W, Pinglo F (1989): Phytopractices in tropical regions. A preliminary survey of traditional crop improvement techniques. UNESCO, Paris. 71 P.
- Balee W, Gely A (1989): Management of forest succession in Amazonia: the Ka'apor case. In: Posey DA, Balee W, eds., *Resource Management in Amazonia: Indigenous and Folk Strategies*, pp. 129–158. Advances in Economic Botany 7, New York, New York Botanical Garden.
- Banik R, Alam MK, Pei SJ, Rastogi (1998): Applied ethnobotany, Proceedings on Applied Ethnobotany, January, Bangladesh.
- Brush SB (1980): Potato taxonomies in Andean agriculture. In: Brokensha D, Warren DM, Werner O, eds., *Indigenous Knowledge Systems and Development*, pp. 37–47. Lanham, Maryland, University Press of America.
- Caballero J (1992): Maya homegardens: past, present and future. *Ethnoecologica* 1: 35–54.
- Conklin HC (1980): With the special assistance of Pugguwon Lupaih and Miklos Pinter. *Ethnographica Atlas of Ifugao: A Study of Environment, Culture and Society in Northern Luzon*. New Haven, Conn. 39 p.
- Davis W (1991): Towards a new synthesis in ethnobotany. In: Rios M, et Pedersen HB, eds., *Las plantas y el hombre-Memorias del Primer Simposio Ecuatoriano de etnobotanica y Botanica Economica*, pp. 339–357. Ediciones Abya-Yala, Quito, Ecuador.
- Farnsworth NR (1993): Ethnopharmacology and future drug development: the North American experience, *J Ethnopharmacol* 38: 145–152.
- Ford RL (1978): The nature and status of ethnobotany. In: Ford RI, ed., *Anthropological Papers*. Museum of Anthropology, University of Michigan, No. 67.
- Hussain SF (1987): *Plant Resources for Economic Sustenance of Mountain People in Review of Medicinal and Aromatic Plants*. PCSIR, Peshawa.
- Inglis J (1994): Introduction. *Nature & Resources* 30: 3–4.
- Jain SK (1986): *Ethnobotany in Human Welfare*, India.
- Jain SK (1987): *A Manual of Ethnobotany*. Scientific Publishers, Jodhapur, India.
- Johnson A (1980): Ethnoecology and planting practices in a swidden agricultural system. In: Brokensha D, Warren DM, Werner O, eds., *Indigenous Knowledge Systems and Development*, pp. 49–66. Lanham/Maryland/USA, University Press of America.
- Manandhar NP (1980): *Medicinal Plants of Nepal Himalaya*. Ratna Pustak Bhandar Bhotahity, Kathmandu, Nepal.
- Martin G (1995): *Ethnobotany. A Methods Manual*. Chapman & Hall.
- Pei SJ, Sajise P (1995): *Regional Study on Biodiversity: Concepts, Frameworks, and Methods*. Yunnan University Press, China.
- Pei SJ (1991): Conservation of biological diversity in temple-yards and holy hills by the Dai ethnic minorities of China. *Ethnobotany* 3: 27–35.
- Pei SJ (1998): Biodiversity conservation in the mountain development of Hindu Kushi-Himalayas. *Frontiers in Biology. The Challenge of Biodiversity, Biotechnology and Sustainable Agriculture* (Chou CH, Shao KY, eds.), Academic Sinica, Taipei.
- Pei, Sheng-Ji (1987): Medicinal plants in tropical areas of China, Proceedings of Symposium 5–35, the 14th International Botanic Congress, Berlin. ISBN90-220-0921-1, Wageningen, Netherlands, PUDOC.
- Pei, Sheng-Ji (1988a): Ethnobotany and the exploitation of plant resources, *Acta. Bot. Yunnanica* Adit. China.
- Pei, Sheng-Ji (1999): *Modernize Traditional Medicine and Inheritance of Ethno-medicine in China*, December.
- Rastogi A, et al. (1998): *Applied Ethnobotany in Natural Resource Management*. Traditional Home Gardens, ICIMOD.
- SEPA (1997): National status report on biodiversity of China, States Environment Protection Agency (SEPA), China Environment Press. Beijing.
- Shah NC (1990): Endangered medicinal and aromatic herbs of Indian Himalayas, October.
- Shrestha KK, Jha PK, Pei SJ, Rastogi A, Rajbhandary S, Joshi M (1998): Ethnobotany for conservation and community development. Proceedings of the National Training Workshop in Nepal. Publisher: Ethnobotany Society of Nepal (ESON).
- Xia Q, Kong J (1998): Methods used in ethnomedicine studies in applied ethnobotany. Proceedings of the National Training Workshop on Applied Ethnobotany in China. (eds) Pei SJ, Long CL, Yunnan.
- Xiao, Pei-Gen (1999): Century review and perspective on TCM in *Research & Information on Traditional Chinese Medicine*, Vol. 7.
- Yang, Jing-Sheng (1988): A review on the derivation of Xizang (Tibetan) drugs and the Advance of its Research, *Acta Bot. Yunnanica* Adit. China.
- Zheng, Yu-Lin (1997): Greet the Spring of Exploitation and Utilization Ethnodrugs in *Chinese Journal of Ethnomedicine and Ethnopharmacy* 24: 1–5.