

The Biosystematic Situation in China's Mainland: Its Strength, Deficiency, and Need with Special Reference to Insects

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There exists a great need for biosystematics in China's mainland, especially because it is currently undergoing rapid changes. The present infrastructure for research and education was developed since the 1950s following the founding of the People's Republic of China in 1949. The total collection of insects in China's mainland now reaches over 13 million specimens, and about 190 specialists are engaged in biosystematic studies on insects. With these collections and expertise for research, China can offer biosystematic services on certain groups and function as the regional center both for referenced specimens and biosystematic information in East Asia.

China is a developing country with a huge population of 1,200 million, over one fifth of the world's total population, of which 80% still inhabit in rural areas. The arable lands and available energy resources are very limited, and the average cultivated land area is 1.1 ha. per capita. This has forced China to energetically find and adopt economical and ecologically efficient ways for its future development rather than following the western style of development. There is a long way to go to achieve the sustainable rural and urban development in China.

In China's mainland 796 nature reserves of various types have been established with a total area of 670,000 km², about 7% of the total territory of China. However, nearly all of the nature reserves were set up mainly for conserving particular species or representative habitats, with little consideration of the overall biodiversity richness. Management strategies and activities are mainly based on deficient biosystematic knowledge of the conservation targets. Government authorities at different levels rarely seek the advice of biosystematists in rural and city development planning and no regulations or laws exist to make this procedure a must.

China is also a multi-nationality country. Most minorities inhabit in S. W. China. Because of unbalanced development between the east coastal area and the west mountainous area, much of their traditional ways of living are still being carried on but will face change under the ever-increasing impact of exotic culture and life styles. It is rather urgent to record the traditional knowledge of the minorities with regard to local plants and animals.

China is among the twelve mega-biodiversity countries in the world, and estimated to own the highest species diversity and endemism in comparison with other Asian and South Pacific countries (Braatz, 1992). China became a party to the United Nations Convention on the Trade in Endangered Species (CITES) in the early eighties. China strongly endorsed Agenda 21 in the 1992 Rio Earth Summit and was one of the earliest states to approve the Convention on Biological Diversity (CBD). The Biodiversity Action Plan of China was passed and formally issued for enforcement in 1994, and the biodiversity state report of China is being edited. China became a state member of the World Conservation Union (IUCN) in 1996. For fully and efficiently enforcing these international agreements and the corresponding domestic laws, a better biosystematic service is required.

However, China's biodiversity has not even been moderately surveyed and recorded. A high proportion of species, especially invertebrates and microorganisms, has not been inventoried and described, some groups have not yet been studied, and much fauna and flora of remote areas in China's mainland are scarcely known. The result of an official survey with questionnaire on the human-resource needs in 1995-2000 to 11 universities and 12 research organizations in China in 1995 indicates that the most needed professionals are taxonomists, and especially taxonomists on animals.

All these constitute the general situation stressing a strong and urgent need for biosystematic studies in China. Biosystematics can and also should contribute much to the future of China's development, which in turn will bring about significant influence on the future of whole mankind. For achieving this, it is believed that China can benefit greatly through cooperation on biosystematic studies with other countries.

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Table 1. The Statistics of Main Collections and Expertise in Insects

| Institutions | Collection Size (No. of Specimens) | Specimens Database | No. of Curators and Taxonomists |
|--|---------------------------------------|--------------------|------------------------------------|
| Chinese Academy of Sciences (CAS) | | | |
| Institute of Zoology, Beijing | 3,800,000 | 30,000 records | 30 |
| Shanghai Institute of Entomology, Shanghai | 700,000 | 3,000 records | 10 |
| Kunming Institute of Zoology, Kunming | 450,000 | none | 8 |
| Northwest Plateau Institute of Biology, Xining | 110,000 | none | 3 |
| Chinese Academy of Agricultural Sciences | | | |
| Institute of Plant Protection, Beijing | 100,000* | none | 2 |
| Chinese Academy of Forestry Sciences | | | |
| Research Institute of Forestry, Beijing | 134,000* | none | 5 |
| Research Institute of Tropical Forestry, Guangzhou | 50,000* | none | 2 |
| Academy of Military Medical Sciences | | | |
| Institute of Microbiology and Epidemiology | 3,000,000 | none | 8 |
| Universities | | | |
| Department of Entomology, Beijing Agricultural University, Beijing | 560,000* | none | 5 |
| Beijing Forestry University, Beijing | 250,000* | - | 8 |
| Department of Biology, Nankai University, Tianjin | 220,000 | none | 10 |
| Shanxi Agricultural University, Taigu | 120,000* | none | 3 |
| Department of Plant Protection, Nanjing Agricultural University, Nanjing | 226,000* | none | 3 |
| Department of Plant Protection, Zhejiang Agricultural University, Hangzhou | 350,000 | none | 5 |
| Department of Plant Protection, Anhui Agricultural College, Hefei | 45,000* | none | 2 |
| Department of Plant Protection, Jiangxi, Agricultural University, Nanchang | 100,000* | - | 2 |
| Department of Plant Protection and Institute of Biological Control, Fujian Agricultural University, Fuzhou | 600,000* | none | 10 |
| Institute of Entomology, Zhongshan University, Guangzhou | 400,000 | none | 8 |
| Department of Plant Protection, Southwest Agricultural University, Chongqing | 150,000* | none | 3 |
| Sichuan Normal College, Sichuan | 30,000* | none | 2 |
| Department of Plant Protection, Northwest Agricultural University, Shaanxi | 500,000 | none | 8 |
| Department of Biology, Shaanxi Normal University, Xi'an | 60,000* | none | 5 |
| Ningxia Agricultural College, Yongning | 120,000* | none | 2 |
| Local Museums and Institutions of Provincial and City Levels | | | |
| Beijing Natural History Museum, Beijing | 150,000* | | 2 |
| Tianjin Museum of Natural History, Tianjin | 200,000* | none | 2 |
| Shanghai Natural History Museum, Shanghai | 20,000 | 2161 records | 2 |
| Butterfly Museum, Nanjing | 100,000 | none | 2 |
| Institute of Plant Protection, Ningxia Academy of Agricultural and Forestry Sciences, Yinchuan | 150,000* | none | 4 |
| Institute of Plant Protection, Hubei Academy of Agricultural Sciences, Wuhan | 26,000* | none | 2 |
| Hunan Institute of Forestry Sciences, Changsha | 70,000* | none | 2 |
| Other institutions in Fujian except Fujian Agricultural University | 400,000* | none | 4 |
| Xigaze Station of Plant Protection, Xigaze, Xizang | 50,000* | none | 2 |
| Guangdong Institute of Entomology, Guangzhou | 160,000* | - | 5 |
| Institute of Biology, Guangxi Academy of Sciences, Nanning | 110,000* | - | 3 |
| Total | 13,511,000 | initial stage | 174 |

- information not available

* figures cited from Wang et al. (1993)

Status of biosystematics of insects in China's mainland

Compared with European countries, the introduction and adoption of modern taxonomy (characterized by the Linnean system) in China were rather late. They began in the 1910s. The present infrastructure for research and education was developed since the 1950s following the founding of the People's Republic of China in 1949. It was devised according to the former Soviet Mode, i.e. research was concentrated in academies and education universities. Until now there is still no central biosystematic facility in China's mainland, such as a national natural history museum. Pragmatism prevailed during the first 30 years since

1949 as most of taxonomic work was concentrated on insects of economic or medical importance (Chu, 1979). China's mainland has witnessed the most rapid progress in insect systematics in the last two decades (Wu, 1992; Wang et al., 1993).

The total collection of insect specimens in China's mainland is over 13 million, much of which (11.8 million) are deposited in the institutes of both Chinese Academy of Sciences (CAS) and Academy of Military Medical Sciences, and plant protection or biology departments of universities (Table 1). The biggest insect collections is the Insect Collections of the Institute of Zoology, CAS, whose collection represents over 40,000 species of the total 51,000 insect species ever recorded in China including type specimens of

6,500 species. Private collections are usually very small and mainly consist of butterfly specimens.

Collection databasing has begun only in a few institutions. A big proportion of insect collections is not even properly sorted, let alone scientifically identified and named. The work on specimen database of insect collections only began in recent years at several institutions with only a small number of specimens being recorded. In total there are about 190 professional specialists in insect biosystematics in China's mainland.

Generally speaking, the foundation of and expertise in biosystematics in China's mainland are quite strong compared with other developing countries, and a lot of progress has been made in inventorying and describing China's rich biodiversity (Han and Wang, 1993; Wang et al., 1993; Wu, 1992). MSc and PhD programs of biosystematics are offered by some of the institutes and universities listed in Table 1. Computers and other non-traditional technologies (e.g. electronic scanning microscope, chromosomal analysis, and PCR) are being adopted more widely in biosystematic studies and collections management.

However, the following deficiencies exist, which hinder the progress of biosystematic research in China's mainland and may result in the degradation of both institution infrastructures and expertise in the immediate future if not properly addressed:

1. *The shortage of expertise in biosystematics with regard to the huge task of inventorying and studying insects in China*

The recorded species number of insects in China accounts for 5.4% of the world total recorded insect species, and even a conservative estimate indicates the percentage should be higher than 10%. It means that about a half of insects in China still remain to be recorded. In the last forty years, 8620 new species of insects have been described from China, and on average, over 500 new species had been described each year from 1980 to 1990 (Wu, 1992).

2. *Communication problems caused by technical incapacity and language differences*

Only in 1995 were institutes of CAS connected with Internet, but many biosystematists are still not joining and using it because of the lack of necessary financial support or hardware. Most scientific papers in biosystematics in China's mainland are published in Chinese, which impedes the academic exchanges with Western scholars.

3. *Lack of finance to sustain collections and related research*

In a survey held in 1995, nearly all collections managers of CAS institutes complained about inadequate financial support and degradation of collection infrastructure.

From 1989, five to six new projects of insect systematics have been funded by National Science Foundation (NSF) of China each year, with an average funding of US \$5,000-10,000 for each project. Usually, it is impossible for biosystematists in China's mainland to undertake field trips overseas or visit major collections elsewhere in the world.

4. *Rigid policies*

Strict policies governing field surveys by foreigners and specimen exportation sometimes discourages cooperation from overseas. To some degree poor international cooperation was also the result of China's own poor collection and knowledge with insect diversity of various parts, especially in some remote areas.

Capacity and Needs

In terms of biosystematic expertise and collections, China can offer:

1. Biosystematic services on certain groups, especially those from Asia. These groups include Protura, Siphonaptera, Odonata, Hemiptera, Trichoptera, and some families of Coleoptera, Lepidoptera, Hymenoptera, and Diptera.
2. Services as a regional collection center for referenced specimens from around Asia.
3. Services as a regional information center on various biodiversity networks in East Asia. In CAS, there are programs underway for constructing the Chinese Biodiversity Information System (CBIS), which includes collections databases and taxonomic databases as necessary constituents.
4. Education programs for MSc and PhD degrees and other training courses in biosystematics.

Meanwhile, China needs from elsewhere:

1. Biosystematic services on certain groups, which have not been systematically studied by Chinese scholars.
2. Information and material exchange, including a return of certain type or named materials originated from China.
3. Joint survey and research on various insect groups in China.
4. Technical assistance on collections management.
5. Cooperation on education and training of young specialists.
6. Financial supports from international organizations or other donors for biosystematic studies.

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