

China's Insect Diversity and Recommendations of Conservation

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ABSTRACT

China includes many different environments inhabited by insects, ranging from Palearctic to Oriental realms. More than 45 000 species of insects occur in China, but the status of knowledge varies widely among different groups. The status researches and conservation of insect diversity was introduced.

Insect studies as one of the project of biodiversity must synchronize with the research and protection of plants and animals. To coordinate the research of insect diversity in the Ecological Research Stations is necessary.

The priority sites and priority species of rare and endangered species are suggested. To strengthen biological and ecological studies of rare and endangered species and to edit the "Red List of Insect" are the urgent works in the coming years.

Key Words China, insect, diversity

China is a large country with complicated topography and natural environment. Zoogeographically, China possesses the Palearctic and Oriental Realms. She includes the world's highest Qinghai-Xizang Plateau, the southwest mountainous region, the most humid and warm tropical rain forest in Xishuangbanna, the most arid region in Xinjiang, the most humid and cold north-east region. These characteristics account for the tremendous species diversity and high level of endemism. China is among the twelve megadiversity countries in the world and one of the two countries with the highest biodiversity and endemism in Asia and South-Pacific Region.

1 *Status of China's insect diversity*

1.1 Rich species diversity

It was reported that the total number of the living things on earth is among 10 to 30 millions, of which insect is 8 millions. The described species is 1.7 million, among them 950 000 species for insects (Kim, 1993). In China there are still more species to be found and identified. But roughly the species from China accounts for over 1/10 of the world total. On the basis of the statistics of insect groups comparably well studied by Chinese scholars in recent years (Table 1), the number of insect species should be far beyond 1/10 of the world total.

The richness species is obvious from the several published regional faunal books, such as there were about 2500 species recorded in Tibet near 5000 species from south-west mountainous region and 5300 species in "Forest Insects of Hunan Province" and others. It is re-

cently estimated that more than 45 000 species have been described in China so far (Wu Yanru, 1992), but compared with some other countries there still remain to be discovered. For example, there are 90 968 species known in the North America (Kosztarab et al., 1990), 30 399 species in Japan (Hirashima, 1990) and 10 253 species from Korea (Lee, 1993).

TABLE 1
Statistics of selected insect groups in China and the World

Groups	Species number of China (SC)	Species number of the world (SW)	SC/SW (%)
Protura	144	546	26.4
Siphonaptera	575	3000	19.2
Megaloptera	70	200	35.0
Aphidoidea & Adelgidae	1000	4000	25.0
Drepanidae & Cyclidiidae	220	400	55.0

1.2 Abundance of endemic species

In China, there are many areas with high endemism of genera and species. For example, in book "Insects of Hengduan Mountains Region" (Chen Sicien, 1992, 1993) 4735 species are recorded, in which the endemic species of Diplura, Phasmatodea, Orthoptera (3 families), Homoptera (7 families), Trichoptera and Neuroptera represent more than 1/2, other groups more than 1/3 of the total species in Mt. Hengduan. The endemic genera of Acridinae (Orthoptera) account for 30.4% of the total, and the endemic genera of Galerucinae (Coleoptera)-11.6%. In Qinghai-Xizang Plateau some species gradually adapted and survived in the extremely environment or became diversification and endemic to the plateau, such as 200 species and subspecies of Acridinae, of which 102 species are endemic to this area. For adaptation to the special environments many changes had happened in body structures of all these endemic species: 87 species wing reduced, nearly no function of flying, 54 species sound organ absent, distribution of restrictive patch or island form, with the increase of elevation level the body sizes become smaller, most species are univoltine (Yin Xiangchu, 1984). In *Leptomias* Fanst (Coleoptera), of all 93 species of the world, 74 species endemic to Himalayan region, 55 species endemic to Xizang, equivalent to 59% of all known species of the world (Chao Yangchang et al., 1981). Among 11 genera of Panphagidae (Orthoptera) 10 genera are restrictively distributed in Mongol-xinjiang region, of which 5 genera are endemic to xinjiang (Liu Jupeng, 1990) the genus *Sphingonotus* of Acridinae is a typical group distributed in Mongol-Xinjiang region, of which 75 species are known from the world, 33 species are recorded in China, 21 species are distributed in Xinjiang 14 are endemic to Xinjiang (Huang Chunmei, 1990).

1.3 Insect resources has important economical significance

China is rich in insect natural enemies. Several hundreds species parasites and predators of pests play important role in integrated pest management and protection of ecosystem. About 10 millions hectare crop's pests have been controlled by insect natural enemies. Seven hundreds' colonies of honey bee and about 1,000 species of wild bees play obvious economical role in pollination of various crops and protection of ecosystem. China is famous in sericul-

ture and had a long history. The cocoon yield account for 65% of the world total, the silk exports account for 90% of the world silk trade, the silk fabric exports account for about 45% of the world total. The export amount of both honey and royal jelly are at the first place in the world. The production and international trade quantity of Chinese gall nut and white wax, Chinese caterpillar fungus and insect-tea are of the first place in world. The species number and populations of prize and favored insects with trade value are quite big in China, such as 54 species of Parnassidae in the world, but 36 species are distributed in China. There are only 2 species of *Teinopalpus* with high price in the world, both of which are found in China.

2 Status of insect diversity researches and conservation in China

2.1 Status of researches

14 comprehensive scientific expeditions have been organized. More than 1 million of insect specimens were collected. This laid the basis for the research of insect species diversity. Until 1991 the following works were published. Studies on the regional fauna appeared in following books: "Insects of Xizang" (2 volumes), "Insects of Hengduan Mountain Region" (2 volumes), "Biota of Mountain Tuomuer Region", "Grasshoppers and Locusts from Qinghai-Xizang Plateau of China" etc., 3 volumes of "Fauna sinica-Insecta", 39 volumes of "Economic Insect Fauna of China" and other 30 books. Iconographies have been published.

In Forest Ecological Research Station of Mt. Changbai and Steppe Ecosystem Research Station of Inner Mongolia, researches of insect community structures and successions have been surveyed systematically.

2.2 Status of threats and conservation

Most of the reserves are set mainly for protecting plants in priority, secondarily rare and endangered animals, but no enough attentions are given to protect insects. Over exploitation lead to rapid decreases of some bioresources, such as the productions of Chinese caterpillar fungus and the populations of *Bhutanitis thaidina* are quickly decreasing, pollution and improper uses of chemicals have put a lot of natural enemy and pollinators into endangered conditions. Some resources flew out blindly and transported them away stealthily are other causes of decreasing of resources.

Two reserves are established on the purpose of protection insect resources for sustainable exploitation and production Area of Japanese silk moth *Antheraea yamai* in Ningan, Heilongjiang and a Protection Area of a variety of *Apis mellifera* in Yili, Xinjiang. A patch of forest land is delimited in the suburb of Nanjing for protecting the butterfly *Luehdorfia chinensis*, which set the first example for protecting rare and endangered insects. Successful programs of ex-situ protection have been done, including mass-breeding of *Papilio bionor takasagi* in Liaozhong, Liaoning for trade purpose, artificial breeding of prize butterflies *Troides aeacus*, *Agehana elwisi*, *Luehdorfia chinensis* and *L. longicaudata*; breeding *L. chinensis* with artificial forages.

3 Recommendations

The focal points of research and protection of insect diversity are protecting species, maintaining the ecosystem balance and sustainable use of insect resources. Insect studies as

one of the project of biodiversity should synchronize and coordinate with the protection of plants and wildlife.

3.1 Species survey and inventory

Only 45 000 species are described in China, so the comprehensive surveys of insect species in priority area selected in terms of faunal representatives is the urgent work. Following sites are the suggested priority areas: Changbai Mt., Qinling Mt., Shennongjia, South-west mountainous region, Xishuangbanna, Hainan and south part of Gansu. The Ecological Research Station belonging to the Chinese Academy of Sciences should synchronize the research of insect diversity with other biodiversity researches. It is urgent to revise the catalogues to edit and publish the China's Insect List and Red Data Book.

3.2 Biological and ecological studies of rare and endangered insects

Systematically studying the distribution, population size, biotope, biology and ecology of rare and endangered insects, finding the influence of the environment on the population, identifying threats and endangered level, providing scientific basis for the *in-situ* protection and mass-breeding. Following species should be taken as priority species for studies: *Teinopalpus* spp., *Troides* spp., and *Agehana* spp., Pamassiidae, *Sasakia* spp. of Nymphalidae and other rare butterflies, *Galloisiana sinensis* Wang *Amphizoa sinica* Yu et Stork, *Zorotypus* spp. and others.

3.3 To strengthen the protection of insect diversity

The *in-situ* protection of rare species is the most effective method to prevent the extinction of species, so the construction of the natural reserves is the key link. Except for strengthening the management efforts of the two above mentioned insect reserves, the protected area of *Luehdorfia chinensis* in Nanjing should be enlarged. The further studies of the following rare and endangered species such as *Galloidiana sinensis*, *Amphizoa sinica* and *Luehdorfia puziloi* in Changbaishan Natural Reserve, *Luehdorfia chinensis* and *L. longicaudata* in Taibaishan Natural Reserve, *Hexalus* spp. and high mountainous species of *Parnassius* in Qinghai-Xizang Plateau; two species of *Bhutanitis* of Gonggashan, Sichuan, *Troides* spp. in Xishuangbanna, Yunnan, *Teinopalpus aureus* in Hainan; *T. aureus*, *Agehana* spp. and *Sasakia chionda* in Wuyishan, Fujian, *Sasakia funebris* in Wulingshan, Hunan, should be carried out in the national or provincial reserves.

The ex-situ protection of rare and endangered species also must be paid more attention, such as to establish artificial breeding areas, to construct butterfly garden or galleries in parks; to preserve the zygote in low temperature.

3.4 Comprehensive use of insect resources

The insect's larvae, pupae, adults and their productions have been used as food, medicine or materials of light industry. Extracting the nutritionally and medically active substances, such as amino acid, protein, antibiotic peptide, lysozyme, toxin, immune agent and antiseptic, from insects by using biotechnical method is medically important. To produce bioengineering vaccine or active polypeptide by introducing extra gene expression of insect silk-worm is most safe and cheap method. With batch process of the massbreeding of insect and the insect manufacture, so called "insect industry" will gradually being shaped.

3.5 Legislation and enforcement of laws

It is urgent to public awareness of the importance of protecting insect diversity, to implement the laws of protecting wild animals, to prevent over-exploitation and blind flew out of bioresources.

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