CHINESE GOVERNMENT IN PUSH FOR SUSTAINABLE TRADITIONAL MEDICINE RESOURCES

A conversation with **LUQI HUANG**, President, China Academy of Chinese Medical Sciences

Chinese medicinal materials are fundamental to the development of the Traditional Chinese Medicine (TCM) industry, and its sustainable utilization is central to government policies. From 2011 to 2020, China implemented its Fourth National Survey of Chinese Materia Medica (CMM) Resources in a bid to establish a comprehensive database on CMM resources to improve their management, protection, development and utilization. The survey results will bolster large-scale planting of medicinal plants, TCM industry growth and regional economic development. Molecular pharmacognosist, Luqi Huang, President of the China Academy of Chinese Medical Sciences (CACMS), shares his insights on the survey and its implications for the investigation, conservation, and dissemination of CMM knowledge.

What is the background of the survey?

TCM and related industries are booming in China due to growing demands by the healthcare system and a medical paradigm shift.

Thanks to the increased demand and technical know-how surrounding CMM resources, the status quo is drastically different from that of the last survey conducted almost 30 years ago. A new survey was urgently required to update our perception on CMM resources, provide scientific evidence to facilitate policy-making on CMM resources protection and the development of TCM related industries.

Pilot work on the Fourth National Survey of Chinese Materia Medica Resources started in 2011. Given the complexity, breadth and volume of the work, the survey was implemented by multiple government sectors while the technical aspects were primarily led by National Resource Center for Chinese Materia Medica of CACMS, and carried out by TCM-related universities, research institutions and hospitals.

What are the survey's goals?

We intend to build a database based on the survey results to foster information sharing; deliver suggestions for CMM resources management, protection, development and utilization; and construct a CMM resources monitoring and service system.

We have implemented a bottom-up approach to enrich local knowledge and provide data to empower indigenous resource protection and utilization. We have developed a long-term monitoring system capable of trend forecasts of herbal medicine output volume, price and quality, to promote healthy development of TCM industry. We have built multiple Chinese herbal medicine seed and seedling nurseries and germplasm resource databases to maintain quality and protect rare, endangered and indigenous regional CMM resources.

What is your approach for talent training?

To charter the survey team, professionals including students and senior experts were recruited from more than 10 fields ranging from medicine, health to forestry. The survey involved more than 400 academic institutions, 100-plus enterprises, and most of the country's TCM hospitals.

We are keen on building a talent pool through the survey, and have organized a series of seminars to educate survey team members on plant science, resource protection, and survey methods. Through the survey, some of the team members have grown to become local experts on CMM resources.

How do you encourage interdisciplinary collaboration in the survey?

We are keen to promote an interdisciplinary collaboration and have tried to get the most out of available technologies. We have adopted spatial information technology and other advanced technologies for data collection, and with the aid of artificial intelligence and big data technologies, we have developed survey information management systems, digitalizing the entire process from data input to display and management. In the survey on CMM resources, new technologies and approaches were also widely adopted.

An example is the use of remote sensing (RS) and geographic information systems (GIS) to carry out the distribution and growth zoning, the quality and production division of *Artemisia annua L*. It can be used to guide the artificial acquisition of artemisinin for fighting malaria. Using such methods as molecular pharmacognosy, 79 new species were discovered with more than 60% of the species having potential medicinal value.

How do you picture the transformation and application of the collected CMM data?

We are compiling a volume on CMM resources in China based on the survey, as well as building a CMM resources archive to preserve all the original specimens collected from the survey with the aim of supporting effective and sustainable uses of these CMM resources.

In terms of applications, we believe that our data could provide the essential puzzle pieces for making policy and supervising plans to develop CMM resources, formulating programmes to alleviate poverty by standardizing production chains for CMM products, and developing and promoting TCM industry.

What is the global significance of this survey?

Our survey provided much valuable data for TCM and natural medicine research, enriching the field with new insights and directions. For instance, a Gouqizi (*Lycii Fructus*) berry variety with a bitter taste was discovered on the Tibetan Plateau, which is different from the common strains. The finding brings evidence for the CMM theory of cultivar selection. Moreover, our survey form of organization and methodology could be served as valuable reference for similar surveys and studies in other countries. We have recently initiated collaboration with the International Regulatory Cooperation for Herbal Medicines (IRCH) on IHP, and several countries, including Laos, on herbal medicine surveys, which has already led to the compilation of *Herbal Pharmacopoeia of Laos* by collaborating with experts in the country.

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FOURTH CHINESE MATERIA MEDICA (CMM) RESOURCES SURVEY
A decade of data (2011—2020)

34	**2,800**	**50,000**	**20**	**13,000**	**3,150**	**79**
PROVINCES	COUNTIES	PARTICIPANTS	MILLION RECORDS	SPECIES AND THEIR NATURAL DISTRIBUTION	ENDEMIC SPECIES	NEWLY-FOUND SPECIES AND 60% WITH MEDICINAL VALUE

THREE previous surveys between **1960-1962**, **1969-1973** and **1983-1987** made notable contributions on CMM resources and paved the way for the sustainable development of TCM

PROMOTING BIODIVERSITY:
• Based on the survey data of more than 1 million samples, National Resource Center for Chinese Materia Medica of the China Academy of Chinese Medical Sciences estimated the available amount of 563 medicinal species listed in the Pharmacopoeia of the People's Republic of China.
• More than 1,000,000 CMM specimens, wax specimens, and germplasm resources will contribute to the largest archive of CMM resources.

BUILDING INFRASTRUCTURE:
• A multi-layered national network combining 28 technical centres and 66 monitoring stations, at provincial and county levels, provides valuable information on CMM resources and related services on a centralised platform.
• In total, 28 CMM bases and 180 sub-bases spread across 20 provinces, currently targeting more than 120 key species to maximize economic values.

REVAMPING CMM INDUSTRY:
• First-hand data on 6 key parameters including price, market circulation and plantation field for 190 cultivars of CMM are meticulously collected and measured, illustrating trends and projections of the yield and quality of CMM.
• 10 technical services from field to quality management were also set up. Localized CMM resources, in particular, have been nurtured for years with promising, standardized quality. These parameters are ideal for respective government departments to develop targeted policies, including anti-poverty programmes and CMM manufacturing bases.

GIVING BACK TO THE LOCAL COMMUNITIES:
• National Resource Center for Chinese Materia Medica of CACMS shares the diverse technical know-hows from site selection, breeding and cultivation, to pest control.
• Comprehensive sampling helped evaluate the total volume and geographic breakdown of CMM resources, along with detailed comparison against space, time and other primary data. Digitization and synchronization of CMM big data increase efficiency of data management, collection and knowledge transfer.
• Dedicated geographical data points refine CMM resources distribution accuracy right down to specific location. The combination of GPS and GIS technologies connects each node into meaningful paths for further consolidation on CMM resources representative of individual region.

DELIVERING UNIFORM STANDARDS AND INDUSTRY PUBLICATIONS:
• Defining statistical methods for national CMM resources survey: pilot effort to fill the gap in TCM industry by setting up related technical specifications and industry standards.
• Software copyright: Information management system for survey on CMM resources (No. 0660877), Dynamic monitoring system for CMM resources (No. 1363876), Space information and grid data collection platform for CMM resources (No. 2995044).
• Producing a Dictionary of Chinese Materia Medica Resources: 85 volumes by province and county are compiled and enriched.
• Publicizing TCM knowledge through specialist volumes on CMM geographic distribution, TCM functions and technologies, and TCM knowledge of ethnic groups, such as the Dai and Naxi people.