



Editorial

Building a bridge between ecology and Chinese herbal medicines

The modernization of traditional Chinese medicine (TCM) industry not only needs inheritance and development of the theory of TCM, but also requires application modern science and technology of related fields (Liu, 2016). Plant distribution is closely related to regional climate, because climate determines the type and quantity of vegetation. Taking advantage of the geographic and ecological information database and the latest data mining technology to investigate different medicinal resources is a good approach (e.g. Li et al., 2019). As it can help remote areas with unique TCM resources, such as Xinjiang in Northwest China, to achieve the sustainable development of TCM plants with regional characteristics, hence to rejuvenate industry of Chinese herbal medicines and largely support poverty alleviation of local community.

As the TCM industry continues to develop, people pay more attention to the quality of Chinese herbal medicines. The geographical relationship between the quality of medicinal materials and its origin has become one of the hot spots that needs to be investigated. Chinese medicinal materials, especially *Daodi* (genuine, i.e. geo-authentic and top medicinal quality) plants, are quite stable varieties with characteristic phenotypes formed during long-term evolution, such as *Fritillaria cirrhosa* in Sichuan, *Lycium chinense* in Ningxia, and *Panax ginseng* in Jilin. The variation of genotype in population and adaptation to the change of habitat (e.g. climate, soil, ecological community, geographical background of the fauna, and even anthropogenic activities) are the reasons for their formation (Chen et al., 2007). For example, *Citrus reticulata* Blanco (Ju in Chinese) was found on the south of Huai River whilst *Citrus trifoliata* L. (Zhi in Chinese) grows on the north of Huai River in China (Zhao Ren-long, 2011). Xinjiang is rich in Chinese medicine resources. According to a survey, 29% of TCM species were found in Xinjiang and more than 15 species were *Daodi* medicinal materials. The most well-known of them include *Glycyrrhiza inflata*, *Cistanche deserticola* and *Ferula sinkiangensis* etc. (Gulisitan, 2012).

Four natures (*qi*) and five flavours (*wei*) of Chinese medicinal plants are the basis of efficacy of TCM. Li Shizhen, a great pharmacist in China, has already proposed the important relationship between quality and habitats of medicinal materials in the Ming Dynasty. He believed that four *qi* of TCM were cold, hot, warm and cool, which are formed from the climate, and five *wei* of TCM were pungent, sweet, sour, bitter and salty, which are derived from soil. He clearly pointed out the relationship between the natures, flavours, quality of herbal medicines and the ecological factors such as climate and soil in the place of origin. He believed that the medicinal material is the product of mutual restrictions of various ecological factors (Tian, Chen, Zhou & Bai, 2000).

In recent years, the property of TCM was considered as the main trail to study the basis of the efficacy. Employing macroecology method based on a big dataset from Xinjiang, Li et al. (2019) investigated the correlations between the four natures (*qi*) and five flavours (*wei*) of TCM plants and the environmental determinants, e.g. temperature and precipitation. They demonstrated that species with bitter flavour were most commonly coupled with cold, whereas pungent and sweet species were more tended to be warm and neutral. Moreover, the percentages of *bitter* and *cold* species were higher in mountainous regions than those in basins. These findings successfully verified the TCM theory about the properties of medicinal plants.

It was an innovative study on the correlation between ecological factors and the formation of *qi* and *wei* in TCM plants, and the result was really encouraging. Using the modern data-minding algorithms, Li et al. (2019) established environmental and climate ecosystem models to show the natures and flavours of TCMs. As a result, the characteristics of the geographical distributions of TCMs in various regions of Xinjiang were quantified and visualized. It provides an important reference for the layout of key medicinal materials development in Xinjiang. This study also suggested a new research perspective and filled a gap in the knowledge of materia medica resources. We believe more work will be done to provide insights about correlations and interactions between ecological factors and the taxonomy, phytochemistry of indigenous plants, and hence to interpret the theory of Chinese herbal medicines with substantial evidence. Eventually, we will build a bridge between ecology and Chinese herbal medicines.

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References

- Chen, S., Suo, F., Han, J., Xie, C., Yao, H., Li, X., et al. (2007). Analysis on ecological suitability and regionalization of traditional Chinese medicinal materials. *Chinese Traditional and Herbal Drugs*, 38(4), 481–487.

- Gulisitan (2012). Medicinal resources in Xinjiang and some ideas about relevant to state general survey of Chinese medicinal material resources. *Chinese Journal of Experimental Traditional Medical Formulae*, 18(21), 348–350.
- Li, L., Zhang, B., Zhang, Z., Li, X., Wang, G., Song, H., et al. (2019). Towards a scientific rationale for the traditional properties of Chinese medicinal plants: 'Natures' and 'flavors'. *Chinese Herbal Medicines*, 11(3), 258–266.
- Liu, C. (2016). Reflections on TCM modernization and TCM international development. *China Pharmacy*, 27(11), 1441–1444.
- Tian, Y., Chen, J., Zhou, X., & Bai, Q. (2000). A survey and prospects on the research of the quality of traditional Chinese medicinal materials by means of plant ecology. *Chinese Journal of Ecology*, 19(6), 51–53.
- Zhao, R. (2011). Orange Mutate into Frutus: Yangtze River or Huai River – Inheritance and change of people's geographic concepts in the period of manuscripts. *Agricultural History of China*, 30(4), 130–134.