Science Bulletin 62 (2017) 1626–1627

Contents lists available at ScienceDirect

Science Bulletin

journal homepage: www.elsevier.com/locate/scib

Editorial

In memory of Prof. Yang Zhong

Arabidopsis thaliana serves as a model organism for the study of genetics, and is the first flowering plant to get its genome completely sequenced. It also has greatly advanced our understanding of intraspecific genome variations. The extreme and unforgiving environments in Xizang (Tibet), mainly due to the high altitude, have prompted scientists to ask how wild populations of plants adapt to biotic and abiotic environments.

For the past 15 years, Professor Yang Zhong's research team has focused on the biodiversity and adaptive mechanisms of plants in the Qinghai-Tibet Plateau, over 4,000 m above sea level. Definitely, as he believed, such plants are precious natural materials that are models to enable investigators to peer into the processes of evolution and adaptation in extreme environments.

With the support of the research program "Genetic mutation and adaption mechanisms of plants under extreme environments in the Tibet-Qinghai plateau" funded by the National Natural Science Foundation of China, Yang Zhong and colleagues studied the microevolution traits in *Hippophae tibetan* and *Ephedra sinica.* His group completed whole genome sequencing and transcriptome analysis of *Trichormus cyanobacterium*, isolated from Namucuo Lake, which is the largest (1920 km^2) and highest (4741 m.a.s.l.) saltwater lake in the world, and found hereditary evidence underlying its adaptations to such extreme environmental conditions. Their research findings on *Rhodiola crenulate*, *Gymnadenia conopsea*, *Lamiophlomis rotate*, all important medical herbs specific to Tibet, published in *Genetica* and *Biochemical Systematics and Ecology*, have attracted not only academic attentions but also interests from herb growers keen to improve production of these precious herbs.

Finally, after more than 10 years of continuous effort Prof. Zhong's team discovered a high altitude (4000 m.a.s.l.) ecotype of *Arabidopsis thaliana*, and performed whole genome sequencing (SRP Serial No: SRP052218) on the plant in 2013. His international collaborative team has shown that the Tibetan *A. thaliana* is evolutionarily at the root of all wild *A. thaliana*, and had diverged from other species around the time of the third Qinghai-Tibet Plateau movement. Their hypothesis is that Tibetan *A. thaliana* has grown in isolation, and adapted to the extreme environment, developed unique hereditary traits. Hence, *A. thaliana* from such a high altitude can provide an important reference in studies of the physiology and development of high altitude plants and animals. Part of the research is published in this issue entitled "Discovery of a high-altitude ecotype and ancient lineage of *Arabidopsis thaliana* from Tibet" [1]. As a model plant, *A. thaliana* Tibet-0 genome updates our understanding of *A. thaliana* history. Moreover, with the discovery of Tibet-0 in the Qinghai-Tibet Plateau, this ecotype can be used to unravel the long-term physical and genetic adaptation of plants to high-altitude and extreme environments.

Prof. Zhong's publications related to Tibet are listed below:

Effects of VA mycorrhizae and *Frankia* dual inoculation on growth and nitrogen fixation of *Hippophae Tibetan*. *Forest Ecology and Management*, 2002

Chemical composition of the essential oils of two *Rhodiola* species from Tibet. *Zeitschrift fur Naturforschung*, 2003

Interpopulation variability of rhizome essential oils in *Rhodiola crenulate* from Tibet and Yunnan, China. *Biochemical Systematics and Ecology*, 2004

Volatile constituents of the leaves and flowers of *Salvia przewalskii* Maxim. from Tibet. *Flavour and Fragrance Journal*, 2006

Genetic diversity and population structure of *Lamiophlomis rotate* (Lamiaceae), an endemic species of Qinghai-Tibet Plateau. *Genetica*, 2006

Chemical variation in lipophilic composition of *Lamiophlomis rotate* from the Qinghai-Tibetan Plateau. *Chemistry of Natural Compounds*, 2006

Chemical composition of the essential oils of three *Rhodiola* species from Tibet. *Chemistry of Natural Compounds*, 2007

Tibet's seeds must be stored as climate changes, *Nature*, 2008

Fine- and landscape-scale spatial genetic structure of cushion rock-jasmine, *Androsace tapete* (Primulaceae), across southern Qinghai-Tibetan Plateau. *Genetica*, 2009

High genetic differentiation and low genetic diversity in *Incarvillea younghusbandii*, an endemic plant of Qinghai-Tibetan Plateau, revealed by AFLP markers. *Biochemical Systematics and Ecology*, 2009

Effect of sampling strategy on estimation of fine-scale spatial genetic structure in *Androsace tapete* (Primulaceae), an alpine plant endemic to Qinghai-Tibetan Plateau. *Journal of Systematics and Evolution*, 2010

Microsatellite markerd for the cushion rock Jasmine, *Androsace tapete* (Primulaceae), a species endemic to the Qinghai-Tibetan Plateau. *American Journal of Botany*, 2010

Intense uplift of the Qinghai-Tibetan Plateau triggered rapid diversification of *Phyllolobium* (Leguminosae) in the Late Cenozoic. *Plant Ecology & Diversity*, 2012

Microrefugia and shifts of *Hippophae tibetana* (Elaeagnaceae) on the north side of Mt. Qomolangma (Mt. Everest) during the last 25,000 years. *PLoS ONE*, 2014

Phylogeography of *Gymnadenia conopsea* from the Qinghai-Tibet Plateau. *Biotechnology Bulletin*.

Transcriptome sequencing of *Crucihimalaya himalaica* (Brassicaceae) reveals how *Arabidopsis* close relative adapt to the Qinghai-Tibet Plateau. *Scientific Reports*, 2016

The genome and transcriptome of *Trichormus* sp NMC-1: insights into adaptation to extreme environments on the Qinghai-Tibet Plateau. *Scientific Reports*, 2016

https://doi.org/10.1016/j.scib.2017.12.008

Essential oil composition and bioactivities of *Waldheimia glabra* (Asteraceae) from Qinghai-Tibet Plateau. *Molecules*, 2017
Testing the effect of the Himalayan Mountains as a physical barrier to gene flow in *Hippophae tibetana* Schlect. (Elaeagnaceae). *PLoS ONE*, 2017

Reference

[1] Zeng L, Gu Z, Xu M, et al. Discovery of a high-altitude ecotype and ancient lineage of *Arabidopsis thaliana* from Tibet. Sci Bull 2017;62:1628–30.

Xiao-Ya Chen
Institute of Plant Physiology and Ecology, Chinese Academy of Sciences, Shanghai 200032, China
E-mail address: xychen@sibs.ac.cn

Available online 13 December 2017