Should the Unpublished Name *Citrullus lanatus* subsp. *vulgaris* var. *megalospermus*, for the ZiGua Seed-Snack Variety from China, be Validated?

Susanne S. Renner
Washington University, Department of Biology, Saint Louis, MO 63130, U.S.A., Email: srenner@wustl.edu

Scientific names must be linked to permanently preserved and publicly accessible type material so that future generations will be able to link research results to unambiguously named organisms. In China, a variety of watermelon with large, red or black seeds is sold as a snack, called 'ZiGua' (Fig. 1). The variety appears to have been first mentioned in 1985 by De Pei Lin (1939 – present) and Rui Tang Chao (1939 – 2004), who had seen ZiGua watermelons being grown by local Uygur farmers in North Xinjiang. Unfortunately, their attempt to name ZiGua watermelons did not fulfil the rules of nomenclature that were in effect in 1985. Those rules required a Latin diagnosis (a few words pointing to some trait differentiating the variety, for example, its large seeds) and citation of a permanently-preserved specimen accessible in an herbarium. Lin and Chao failed to cite a herbarium specimen and provided no Latin diagnosis, and their name therefore is not validly published.

The ZiGua seed-snack watermelon differs from other Asian cultivars in its consistently large and numerous seeds. The seeds are eaten lightly salted, roasted, or sometimes coated in licorice extract. The fruit rind and pulp are discarded, but efforts are underway to use these by-products for making watermelon juice (Zhang et al., 2016; Wang et al., 2018). A video showing the preparation of ZiGua is here: https://www.youtube.com/watch?v=DV6y2pPv76I

Herbarium material does not permit distinguishing ZiGua watermelons from other subspecies of *Citrullus lanatus*, but this would not prevent naming the variety since the Code of Nomenclature for algae, fungi, and plants (https://www.iapt-taxon.org/nomen/main.php) does not require traits recognizable in dead (dried) material. Instead, traits obtainable from living material or from nuclear DNA can also be used. Since 1 January 2012, Latin is no longer required either. Instead, diagnoses can be given in English.

Several hundred Chinese watermelon cultivars as well as material from outside China and even from 6000-year-old seeds have been re-sequenced (Guo et al., 2019; Renner et al. 2021; Pérez-Escobar et al., 2022), including several ZiGua watermelons (WM151, WM196, WM197, WM199, WM201, WM202, WM205, WM206, and WM280 in Guo et al. 2019: Tables S5 & S6). So far, however, it has not been possible to detect mutations (alleles) that would characterize all ZiGua watermelons. This makes it difficult to write a diagnosis based on some genomic feature.

The watermelon seed-processing industry in China is developing rapidly because of an increasing market for this snack. By 2015, the area under cultivation had increased from140,000 ha in 1996 to 320,000 ha (Zhang et al., 1996; Chen et al., 2015). A single plant can bear about 2-3 mature fruits with an average weight of 2.3 kg (Wang et al., 2018) and 100-200 seeds per fruit (Liu et al., 2018). They are harvested using seed-melon harvesters and seed extracting machines (Zhao et al., 2017). Black-seeded ZiGua watermelons are grown mainly in northwest China (Gansu, Xinjiang, Inner Mongolia and Ningxia), while red-seeded ZiGua are more popular in southern China (Guangxi, Anhui, Jiangxi, Hunan). The seeds are rich in protein, crude fat, multiple vitamins, and minerals (Li et al., 2020). The variety is thought to have been cultivated for some 350 years (Chen et al., 2015).

Perhaps once a *de novo* high-quality genome for ZiGua watermelons has been produced, a unique genetic trait will be found that could serve to diagnose the taxon. However, under the current Code of Nomenclature, herbarium specimens are still required, and any *de novo* genome should thus be linked to one or more herbarium specimens deposited in Chinese herbaria as well as herbaria outside China.

Literature Cited

Chen Q., Xu Y., Zhang J., Chen N. 2015. Production and research of seed using watermelon in China. China Vegetables 12: 12-18. http://qikan.cqvip.com/Qikan/Article/Detail?id=666873314

Guo, S. *et al*., 2019. Resequencing of 414 cultivated and wild watermelon accessions identifies selection for fruit quality traits. *Nature Genetics* 51: 1616-1623. https://doi.org/10.1038/s41588-019-0518-4

Li ZH., Chu S., Wang P., Gao S., Li S., Yu XW. 2020. Effects of irradiation treatment on protein structure and digestion characteristics of seed-watermelon (*Citrullus lanatus* var.) kernel protein. Food Sci. Biotechnol. 29: 1201–1211. https://doi.org/10.1007/s10068-020-00777-9.

Liu H, Chen Y, Lin M, Bai X, Deng C, Pan J, Li C. 2018. Selection of superior varieties (lines) of seed-watermelon based on growth period and economic yield. Xinjiang Agricultural Sciences 55: 430-438.

Pérez-Escobar, O. A., et al. 2022. Genome sequencing of up to 6,000-yr-old *Citrullus* seeds reveals use of a bitter-fleshed species prior to watermelon domestication. Molecular Biology and Evolution 39(8), https://doi.org/10.1093/molbev/msac168

Renner, S. S., S. Wu, O. A. Pérez-Escobar, M. V. Silber, Z. Fei, and G. Chomicki. 2021. A chromosome-level Kordofan melon genome illuminates the origin of domesticated watermelons. *Proceedings of the Natl. Academy, USA*, 118(23):e2101486118; https://doi.org/10.1073/pnas.2101486118

Wang, J., Shi, Y., Zhang, H., Deng, X., Wang, Y, Ma, Y., Zhao, X., and Zhang, C. 2018. Characterization and comparison of unfermented and fermented seed-watermelon juice. Journal of Food Quality, Article ID 4083903, 9 pp., https://doi.org/10.1155/2018/4083903

Zhang, C., X. Deng, Y. Ma, X. Zhao, and W. Li. 2016. Effect of fermented strains on aroma of the seed-watermelon wine. *Food Industry and Technology* 37: 241–246 (in Chinese).

Zhang, J. 1996. Breeding and production of watermelon for edible seed in China. *Cucurbit Genetics Cooperative Report* 19: 66–67.

Zhao Z, Zhang Q, Huang C, Liu J, Li H, Wang S. 2017. Research status and prospect of seed-melon harvesting machinery in Xinjiang. Journal of Chinese Agricultural Mechanization 38(2): 139-144. (in Chinese), http://lib.cqvip.com/Qikan/Article/Detail?id=671484534

Figure 1. The only known permanent record of ZiGua watermelon material, deposited in the herbarium of Munich, Germany.