

Status and Prospects of *Lagenaria siceraria* (Bottle Gourd) Landraces in Tunisia: A Neglected and Underutilized Resource

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The genus *Lagenaria*, a member of the *Cucurbitaceae* family, contains five wild dioecious species including *L. breviflora* (Benth) Roberty, *L. abyssinica* (Hook F.) Jeffrey, *L. rufa* (Gilg) Jeffrey, *L. sphaerica* (Sonder) Naudin and *L. guineensis* (G. Don) Jeffrey. The genus also contains a single cultivated monoecious species *L. siceraria* (Molina) Standl. (Morimoto et al., 2005). No previous research has been done regarding this species in Tunisia. The lack of information about the diversity of *L. siceraria* in Tunisia, and the absence of an adequate conservation strategy, can easily result in genetic erosion and the loss of local ecotypes. In this report, we emphasize the need to characterize and valorize Tunisian landraces of *L. siceraria*.

Lagenaria siceraria ($2n = 22$), commonly known as the white-flowered gourd, bottle gourd, or calabash, is a vigorous annual climber that has been exploited for its nutritional and medicinal properties by local peoples in many tropical and temperate countries (Mashilo et al., 2022; Yetisir and Aydin, 2019). Great diversity of bottle gourd varieties exists in India (Sunil et al., 2014) and West Africa (Stephens and Suresh, 2015). Tropical Africa is considered the primary gene pool for *L. siceraria* (Singh, 1996).

The immature fruits of bottle gourd are generally consumed as a vegetable in Africa and Asia. They are typically boiled, fried or stuffed like the fruit of *Cucurbita pepo*. Cultivars of bottle gourd differ markedly in their sweetness and bitterness (Mashilo et al., 2017). Selected varieties are comparable in consumer favor to the popular summer squash varieties of temperate regions. Young shoots, tendrils and flower buds of less bitter types are sometimes eaten as a green vegetable. Leaves can also be eaten as a vegetable (Stephens and Suresh, 2015).

The flesh of the mature fruits of bottle gourd is often removed by scraping and the shells are then used as containers, bowls, musical instruments, for various decorative purposes or, in some cases, fishing floats. The

seeds are harvested for oil extraction and also used in cooking. Use of cooking oil extracted from harvested seeds is common in Africa. The seeds of *L. siceraria* contain an oil that is comparable in content to sunflower and grape seed oil (Axtell and Fairman, 1992). Loukou et al. (2011) reported that seeds of bottle gourd are rich in protein, oil, and energy.

Seeds, tendrils, and young leaves of bottle gourd are also used for medicinal purposes (Manandhar, 2002; Moerman, 1998) in various countries. Uses include as a pectoral medicine, an anthelmintic, a purgative and even as a headache remedy (PROSEA, 2018; PROTA, 2018). Syrup made from the green fruit is used to treat bronchial disorders including cough and asthma (Shah et al., 2010; Sivarajan and Balchandran, 1996).

In addition to its nutritional and medicinal uses, bottle gourd has been used for decades in Asia as a rootstock for watermelon. Its use promotes root system development under conditions of water, salinity and heat stress. It also minimizes the deleterious effects of soil-borne pathogens (Yetisir et al., 2007, 2003; Colla et al., 2006; Oda, 2002; Lee, 1994) and increases plant growth by increasing water and nutrient mineral uptake (Yetişir et al., 2007). These characteristics make bottle gourd a crop to be utilized in climate change adaptation strategies. Yetişir et al. (2007) reported that bottle gourd was a preferred rootstock for watermelon because it confers resistance to *Fusarium* wilt in addition to enhancing female flower formation. Bottle gourd also improves the yield and vigor of the watermelon scion when compared to other rootstocks because of its high graft compatibility and stability (Davis and Perkins-Veazie, 2007; Yetişir et al., 2003). Positive effects of bottle gourd rootstocks on watermelon fruit quality have also been reported (Davis and Perkins-Veazie, 2007).

In Tunisia, bottle gourd is a neglected and underutilized crop. Bottle gourd is a minor crop, locally cultivated only in small regions of the country. Various landraces are favored

for cultivation in regions of south Tunisia and used for food, a musical instrument (known as Darbouka), decorative purposes and containers. Bottle gourd does not require complex or sophisticated field management practices. It grows well with only small amounts of nitrogen fertilizer and in low-input farming systems. There is a need for well-established pre-breeding and breeding programs in Tunisia aimed to utilize bottle gourd genetic resources and identify and design consumer-preferred varieties to serve the diverse value chain.

Collection of Tunisian bottle gourd landraces was initiated in 2017 at the Regional Research Centre on Horticulture and Organic Agriculture (CRRHAB, Tunisia). Examples of the fruit of these landraces are depicted in Figure 1. There is wide diversity in seed yield and size, fruit trait qualities, including size and shape (Chikh-Rouhou et al., 2021). In addition, characterization of these landraces for root system morphology and resistance to the soil-borne fungal pathogens *Fusarium oxysporum f.sp melonis* race 1.2 (Fom), *Fusarium oxysporum f.sp niveum* (Fon), *Neocosmospora falciformis*, and *Monosporascus cannonballus* has been initiated. Preliminary results indicate that some accessions could have an apparent high-level of resistance to Fom race 1.2 and Fon race 0 (unpublished data). In case we confirm the resistance, these landraces could be useful as rootstocks for melon or watermelon production in soils infested with Fusarium wilt.

Research to evaluate these landraces as rootstocks for melon and watermelon production is ongoing. Use of local landraces as rootstocks provides an opportunity to limit the need to import rootstock seeds. Promoting the use of Tunisian bottle gourd landraces as rootstocks also serves to support crop diversification efforts and contributes to improving the income of smallholders and rural women in our country.

Acknowledgements

We acknowledge the assistance and support of the Research Laboratory LR21AGR03-Production and Protection for a Sustainable Horticulture funded by the Ministry of Higher Education and Scientific Research of Tunisia. Project PID2020-116055RB-C22 I+D+I was funded by MCIN/AEI/10.13039/501100011003. The A11-20R project was funded by the Aragon Government.

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Figure 1. Diversity in size and shapes of dried mature fruits of some bottle gourd (*Lagenaria siceraria*) landraces collected from local farmers in Tunisia.