

Citrullus naudinianus Genome Assembly

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The genome assembly of the watermelon-related *Citrullus naudinianus*, aka gembok cucumber, has been completed. This unusual *Citrullus* (formerly *Acanthosicyos*) species is native to southern Africa including Botswana, Namibia, Mozambique, Zambia, Zimbabwe, and South Africa. Like all *Citrullus* species, *C. naudinianus* possesses an array of unique physiological and morphological characteristics that enable it to survive, and thrive, in an extremely hostile environment. In its native habitat, the fruit of this 'cucumber' are eaten by gembok, mole-rats, jackals, honey badgers and likely other fauna as well.

Among the 7 species of *Citrullus* currently recognized, *C. naudinianus* represents the basal branch in the taxonomic tree of *Citrullus* and the species most distantly related to the common watermelon. *Citrullus naudinianus* is, unlike other members of the genus *Citrullus*, dioecious having separate male and female plants. The genetic mechanism accounting for the change from dioecy (*C. naudinianus*) to monoecy (other *Citrullus* species) in this genus currently awaits determination. In addition to its rather small but numerous fruits, this species produces multiple storage roots that are both large and dense.

Although distantly related to *C. lanatus*, successful hybridizations, producing viable progeny, between *C. naudinianus* and several other *Citrullus* species (i.e., *C. rehmi*, *C. eirrhosus* and *C. colocynthis*) have been made. Information on the ability to hybridize *C. naudinianus* with other *Citrullus* spp. does not appear to be available. The crossability of various *Citrullus* species (with *C. lanatus*) exhibits a substantial genotypic effect when *C. lanatus* is used as the maternal parent. However, obtaining flowers of *C. naudinianus* (grown in the greenhouse) has proven to be a challenge, limiting attempts to obtain additional hybridization/crossability data. The full extent of the potential of this taxon to contribute to the improvement of cultivated forms remains undetermined.

Not surprisingly, the fruit of *C. naudinianus* are bitter due to the presence of terpenes common in the fruit of many *Citrullus* species. However, the cooked fruit are apparently edible. The bushmen of the Kalahari have been reported to eat the fruit after the fruit have been roasted in a fire or boiled (the

cooking renders the terpenes harmless). The fleshy fruits are also known to serve as a source of water for man and animal and have been used to make pickles. This species is also a locally important source of edible oil and protein. The plant yields a crop quickly, the fruit are easily harvested, the plant is ecologically adapted to a wide range of environments, and it is readily propagated by seed or storage roots. Hence, it has been suggested as a candidate for development and domestication - although studies on the extent of genetic and phenotypic diversity within this species are yet to be conducted.

The genome sequence of the gembok cucumber serves to provide an evolutionary anchor point for a pan-genus study on genome evolution in the genus *Citrullus*. It also facilitates an examination of the evolution of the gembok cucumber's unique reproductive traits and its many adaptive traits that allow it to survive in a true desert environment. Links to the assembly can be found at:

https://www.dnazoo.org/assemblies/Citrullus_naudinianus.

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Figure 1. Photo of the interior of fruit of mature *C. naudinianus*.



Figure 2. Photo of storage roots of *Citrullus naudinianus*.

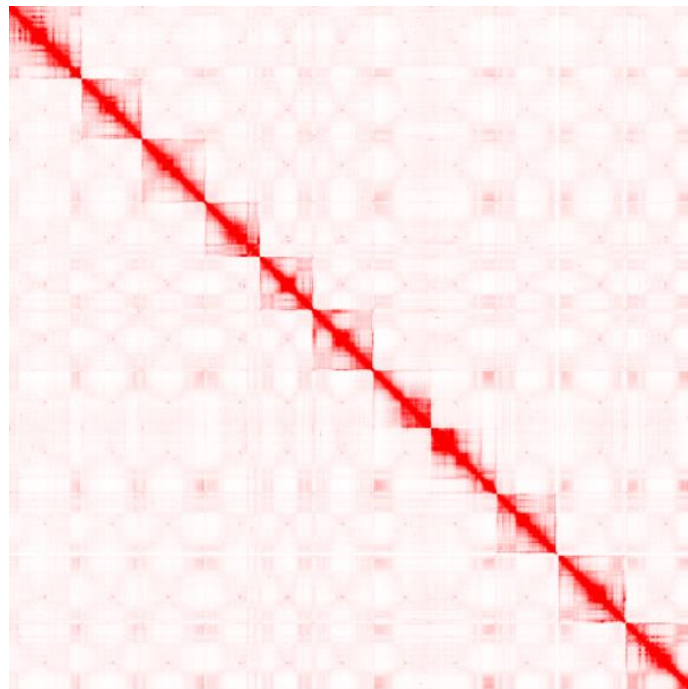


Figure 3. Hi-C contact map of the assembled (n=11) chromosomes of *C. naudinianus* (with permission of DNAZoo.org).