

Fruits that Develop Underground in the Genus *Cucumis* and other Cucurbitaceae

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In most Cucurbitaceae, the pedicels of pollinated female flowers elongate and the fruits then mature dangling in the air or laying on the ground. In at least four cucurbit species, however –the Mexican *Echinopepon arachioideus* (Dieterle, 1974), the Australian *Cucumis umbellatus* (Telford et al., 2011), the South African *Cucumis humifructus* (Meeuse, 1962; Hollmann et al., 1995; Johnson et al., 2025), and *Kedrostis psammophila* (Bruyns, 1993)– the pedicels of pollinated flowers grow into the ground and the fruits then develop entirely below ground. Such underground fruit development, geocarpy, evolved in an estimated 30 species of flowering plants, with new cases still being discovered (Kuhnhäuser et al. 2023). Here we report the first successful *ex situ* cultivation of any geocarpic Cucurbitaceae.

The first author has twice grown *Cucumis humifructus* outdoors in his garden in western France (1994 – 1995 one generation only; 2025 – 2026: successful seed production), using seeds received from Pretoria and Namibia. Seeds were planted in mid-April in 50-cm-wide mounds of soil as commonly used for squash or melon plantings. The soil used was a sandy clay with a little compost added. A drip irrigation system was installed but used for only 5 min/week. Later in the summer, plants were watered during exceptionally hot days. The mounds were covered with black plastic mulch to reduce temperature fluctuations. Seeds germinated in about a week, at which point the mulch was removed. The plants appeared resistant to spider mite attacks but were susceptible to white powdery mildew in early autumn.

Cucumis humifructus is a monoecious perennial with hispid shoots that reach 2.5 m in length when flowering and over 4 m when fruiting (Fig. 1). Male flowers are borne solitary or in fascicles, female flowers are borne solitary. Cross pollination in France occurred in June and July and involved native species of halictid bees as well as bumble bees. The pedicels of fertilized flowers undergo negatively phototropic and positively gravitropic growth to push the fertilized ovary into

the loose ground. Further pedicel elongation by at least 30 cm (Fig. 1), and fruit maturation seems to be triggered by the darkness and humidity conditions underground and perhaps mechanical stimuli. Fruits do not develop above ground.

Fully mature fruits were soft and contained ca. 30 seeds, each surrounded by a gelatinous bag. They were dug up in late January 2026.

Cucumis humifructus is native in semi-deserts of southern sub-Saharan Africa, where it has been documented in Angola, the Central African Republic, Ethiopia, Kenya, Senegal, Namibia, South Africa, and Zimbabwe (www.gbif.org). Very few of those populations have been confirmed more recently (https://www.inaturalist.org/observations?taxon_id=1525671) but the species is easily overlooked and probably still widespread throughout its former range, which likely overlaps that of its specialized seed disperser, the aardvark (*Orycteropus afer*). The aardvark is a nocturnal ant- and termite-specialist that digs up the fruits of *C. humifructus*, thereby swallowing and spreading the plant's seeds through its feces (Hollmann et al., 1995; Johnson et al., 2025: video!).

The adaptive value of geocarpy is thought to lie in the protection of the developing seeds from herbivores, combined with the benefit of the seeds being dispersed inside piles of dung of relatively large mammals.

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Figure 1. Left: Mature fruit of *Cucumis humifructus* in the hand of Jean-Luc Gatard. Western France, January 2026. Fruit diameter: around 7 cm. Right: Fertile seeds of *Cucumis humifructus*. Seed size: 2 x 0.8 cm.