

Arachis duranensis, *Arachis ipaensis*, and the Origins of Cultivated Peanut (*Arachis hypogaea*)

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Cultivated peanut (*Arachis hypogaea*) origins have been debated vigorously. The genus *Arachis* evolved in the southwest of Brazil's Mato Grosso do Sul or northeastern Paraguay (Simpson et al., 2001). This region, the Brazilian Shield, was uplifted during the Cenozoic and subjected to erosion and fragmentation by river action (Simpson et al., 2001). Cultivated peanut appears to have double the number of chromosomes of most other species in the genus *Arachis*, with half of the chromosomes resembling the form of some diploid wild species ("AA genome") and the other half resembling that of another species cluster ("BB genome"). It is believed that a single hybridization event involving two wild diploid species, *Arachis duranensis* (AA genome) and *Arachis ipaensis* (BB genome), followed by chromosome duplication, gave rise to a wild allotetraploid (plausibly the still extant *Arachis monticola*) that was fertile and capable of reproducing itself (Seijo et al. 2007). The domestication of the wild allotetraploid and improvement for use as human food then resulted in the present day cultivated peanut (Seijo et al. 2007).

There is substantial laboratory evidence supporting this vision of the dawn of the peanut. Seijo et al. (2007) performed tests using double GISH (genomic in situ hybridization) and found that *A. duranensis* and *A. ipaensis* appeared to provide the most likely source genomes for cultivated peanut based on the strong hybridization of these species' chromosomes with peanut. They argued that all of the various cultigens of cultivated peanut arose either from a single hybrid and tetraploid population, or from several populations produced in different places and times by these same two diploid species (Seijo et al., 2007). Cultivated peanut was also shown to be very similar to *A. monticola* and that the latter was most likely the immediate predecessor of the peanut (Seijo et al., 2007). In addition, Fávero et al. (2006) successfully mated *A. ipaensis* and *A. duranensis* and doubled the chromosome count of the resulting cross-species hybrid, to produce a "synthetic amphidiploid". Fertile crosses were then made between the synthetic amphidiploid and various types of cultivated peanut (Fávero et al., 2006). This series of successful hybridizations further supported the concept that *A. ipaensis* and *A. duranensis* are forerunners of cultivated peanut (Fávero et al., 2006). Finally, Burow et al. (2009) found that *A. ipaensis* was the most plausible donor for all 10 chromosomes of the BB-genome, whereas *A. duranensis* was shown to be the most likely donor for 8 of the 10 AA-genome chromosomes.

Archaeological excavations on the coast of Peru in the gardens of ancient humans have suggested a genesis of peanut consistent with the molecular evidence. Shells similar to *A. ipaensis*, *Arachis magna*, and the tetraploid *A. monticola* were discovered in a layer dating from 1800 to 1500 BC (Simpson et al., 2001). Shells of cultivated peanut were found in a more recent layer immediately above it; these shells resembled those of the local peanut landraces (Simpson et al., 2001). Shells resembling *A. duranensis* were found at a nearby site from the same historical period (Simpson et al., 2001). Therefore,

cultivated peanut may have first occurred in human gardens where the progenitor species were in close proximity, at which point it would have been recognized as desirable and propagated (Simpson et al., 2001). Other species of diploid *Arachis* are still cultivated in South America for food, including *A. villosulicarpa* and *A. stenosperma* (Simpson et al., 2001).

What can be said of these two kindred species? *Arachis ipaensis* and *Arachis duranensis* are annual non-climbing herbs that are well adapted to regular drought conditions (“*Arachis duranensis*”, n.d.; “*Arachis ipaensis*”, n.d.; Krapovickas and Gregory, 2006). Perennials of the genus *Arachis* are usually found in stable and productive habitats, while annuals seem to occur under environments prone to drought or flooding (Krapovickas and Gregory, 2006). The ranges of the two species overlap slightly; *A. duranensis* is found in South America in the nations of Argentina, Bolivia, and Paraguay, whereas *A. ipaensis* has only been reported from Bolivia (“*Arachis duranensis*”, n.d.; “*Arachis ipaensis*”, n.d.). *A. duranensis* grows in dry environments in the Chaco plain and the foothills of the Andes from 250 to 1250 meters of elevation, an area that is the watershed of the Rio de la Plata (Krapovickas and Gregory, 2006). *A. duranensis* prefers to grow in sandy and deep soil near to flowing waterways (Krapovickas and Gregory, 2006). *A. ipaensis* thrives in the upper portions of stream ravines and grows readily in close company to bromeliads such as *Bromelia serra* (Krapovickas and Gregory, 2006).

Members of *A. duranensis*, although similar in outward appearance, exhibit great genetic variability that is not related in any simple way to geographical origin (Krapovickas and Gregory, 2006). Thus it is quite possible that *A. duranensis* actually represents a species complex rather than a unitary species. *A. duranensis* was previously referred to in older literature as *Arachis argentinensis* and *Arachis spegazzinii* (“*Arachis duranensis*”, n.d.). *A. duranensis* is noted for long hairs on the undersides of leaves, stipules without bristles, and smooth pericarps on the fruits (Krapovickas and Gregory, 2006). The fruit of *A. ipaensis* has a reticulate pericarp and the stipules lack bristles (Krapovickas and Gregory, 2006). Both *A. duranensis* and *A. ipaensis* are easy to confuse in the field with other species of the genus *Arachis* such as *A. pusilla* and *A. magna*, respectively (Krapovickas and Gregory, 2006).

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