



# Ethnobotanical Leaflets

A Publication of the Southern Illinois University Herbarium  
Carbondale, IL 62901, U.S.A.



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## New World Domesticates of the Genus *Chenopodium*

By David Gordon De Fant

The genus *Chenopodium* includes a variety of weedy herbs native to much of Europe, Asia, India, China and both North and South America. This genus belongs to the Chenopodiaceae or goosefoot family which also includes spinach (*Spinacia oleracea*) and beets (*Beta vulgaris*). The name *Chenopodium* means goosefoot in Greek, and refers to the resemblance many leaves of *Chenopodium* have to the webbed feet of geese.

There are both wild and domesticated species of the Genus *Chenopodium* indigenous to the New World. Often regarded as a common weed (Dept. of Agriculture 1955), many different species of *Chenopodium* can be found growing wild today throughout North and South America. The most significant of these in terms of cultivar progeny and economic utilization are the species *Chenopodium berlandieri* from Mexico and the Southwestern United States, and *Chenopodium bushianum* of the Eastern United States. Common names often applied to members of this genus include goosefoot, lamb's quarter, and occasionally pigweed. Reaching a height of 3-4 feet (the Andean cultivar *C. quinoa* reaches 6 feet) these annual species propagate via seeds produced between August and November. Well known as a campfollower, *Chenopodium* is most often found in disturbed soil with in close proximity of human settlements or constructions.

### Domesticated Chenopods

Domesticated species of *Chenopodium* known today include *Chenopodium nuttalliae* from central Mexico, and two varieties of *Chenopodium quinoa* from the Andes of South America. *C. quinoa* has been dated from archaeological contexts as ancient as 7000 B.P. (Bender 1975:197). From the prehistoric eastern woodlands of North America, it is hypothesized that there once existed a now extinct domesticated chenopod named *Chenopodium bushianum* ssp. *jonesianum* (Smith 1987).

Among these cultivated species of *Chenopodium*, the wild mechanisms for seed dispersal and germination dormancy have been lost, seed size has increased dramatically and the seed is light colored because of an extreme reduction of the testa (Wilson and Heiser 1979). Economic Uses

Chenopods have long been recognized as a valuable resource for exploitation as food. Cultivation requires a minimum of energy and labor investment. Furthermore, the leaves and fruit (i.e. seeds) of these plants are extremely nutritious. For example, the leaves of *Chenopodium albidum* L. contain more vitamin A and Ascorbic Acid than the most common garden fruits and vegetables (Zennie and Ogzewalla 1977).

The prodigious yields derived from chenopods are also an important factor in terms of its value as an economic resource. Indeed, Asch and Asch (1977) reported that a single specimen of *C. bushianum* can yield 100,000 seeds.

Although widely cultivated as a pot-herb in Europe (*C. bonus-henricus*), it was the modern and pre-Columbian native cultures of North and South America that exploited *Chenopodium* to its greatest extent. In the Andes of Chile, Peru, Colombia, and Bolivia the seeds of the cultivar *C. quinoa* (commonly referred to as "little rice") are regarded as a staple food crop by many people. These seeds are ground for bread making, added to soups and gruel, and fermented with millet seed into alcoholic beverages such as chicha. *C. quinoa* is also highly prized by local Indians as a pot-herb, both cooked and raw. Employed as a medicine, quinoa seeds are eaten as an internal medication (anthelmintic) and applied to sores and bruises. From the stems of this species an alkaline substance is derived which is chewed with the leaves of coca as a stimulant (Asch and Asch 1977). The entire plant was utilized as cattle food and the seeds as poultry feed (Strange 1977).

### Origins and Evolutionary Relationships

There remains a great deal of uncertainty concerning the origin and evolutionary relationships of *Chenopodium*. A study of the history of New World *Chenopodium* domesticates conducted by Wilson and Heiser (1979) has shown that the Mexican (*berlandieri* ssp. *nuttalliae*) and Andean (*C. quinoa*) cultivars are indeed distinct species. Furthermore, Wilson and Heiser concluded that the Mexican domesticate is not the result of diffusion of quinoa from South America. Instead they suggest that the Mexican cultivars originated with an ancestral *berlandieri* form under artificial selection in Mexico.

The origins of *C. quinoa* remain problematic, Wilson and Heiser (1979) suggest either independent evolution from a as of yet unidentified ancestor or possibly migration of a northern tetraploid. This latter explanation is reinforced by the remarkable affinities of the Andean weed-cultigen complex to *C. berlandieri* var. *zschackei*, which is native to the western United States.

Perhaps the most interesting and certainly the most controversial circumstance surrounding the historical context of *Chenopodium*, regards the question of prehistoric domestication in the eastern woodlands of the United States. The controversy surrounding the native North American domesticate *C. berlandieri* ssp. *jonesianum*, arises out of the fact that this cultivar was not well documented among historically known natives of the Eastern United States, it is only known from prehistoric contexts. Consequently this extinct cultivar is only known from those fragmentary remains recovered from archaeological sites, which yield little data upon which to measure those morphological changes resulting from domestication.

Carbonized seeds assignable to the Genus *Chenopodium* have been recovered from North American archaeological sites dating back at least 5,000 years. These wild seeds were evidently gathered as one facet of a diverse resource procurement strategy. This strategy included a group of starchy seed native domesticates, often referred to as the "Eastern Agricultural Complex". The other components of this complex are Pigweed (*Amaranthus* sp.), Giant Ragweed (*Ambrosia trifida* L.), Sunflower (*Helianthus annuus* L.), and Marshelder (*Iva* sp.) (Smith 1987).

By 2,000 B.P. significant morphological changes, appear in the archaeologically recovered chenopod fruit. These changes include a thinning of seed testa and increase in seed size.

A recently calculated Carbon 14 date has documented that by 3400 B.P., a chenopod variety appears with a testa thickness ranging from 11 to 15 microns (Smith and Cowan 1987). This compares to a thickness of between 39 to 78 microns for modern wild populations of *C. berlandieri* from the Eastern Woodlands. This thinning of the seed coat represents a strong selective pressure for reduced germination dormancy. Seed dormancy is essential in wild cereals because it insures germination only under the right circumstances. Whereas, dormancy is selectively disadvantageous under cultivation. Because farmers need the consistency of uniform germination and maturity (harvest) (Smith 1987).

The increase in seed size noticed among prehistoric chenopods is another piece of evidence suggesting domestication. Alone, this variable is too susceptible to wild variation or human selectivity to be conclusive evidence of domestication. However, it is relevant when coupled with the evidence of a prehistoric thin testa variety. Indeed, King (1987) suggested that the increased germination rates achieved by the thin testa chenopod favored the production of larger seeds via Increased plant density and competition.

Whether the prehistoric domesticated chenopod of the Eastern United States is indigenous or imported is still unclear. A comparative examination (Wilson 1981) of extremely well preserved infructescence and fruit structure remains recovered from prehistoric rock-shelter contexts in Arkansas and Missouri, suggests that these samples belong to the Mexican cultivar *C. berlandieri* ssp. *nuttalliae*. Nevertheless, there has never been recovered any prehistoric thin-testa chenopods from Mexico.

Although chenopods are not economically important today, it is obvious that species belonging to this Genus formed an integral aspect of the prehistoric subsistence economies of North, Central, and South America. Hopefully, future research into the origins and history of domesticated chenopods might elucidate previously unknown processes of domestication and diffusion.

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Last updated: 09-December-97 / du