Chenopodium ambrosioides L., (Chenopodiaceae) Mexican-tea, Wanted Weed?[1]

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INTRODUCTION: Those of us who have large gardens or have been around cultivated fields have seen *Chenopodium ambrosioides* L. (Mexican-tea), *C. album* L. (lamb's-quarters, pigweed, or fat-hen), and numerous other weeds characteristic of cultivated or disturbed areas (Radford *et al.* 1964; Wunderlin 1982; Elmore undated, Murphy *et al.* 1996). These weeds are among the first pioneering species in a denuded landscape (*i.e.,* cultivated area) (Keever 1950; Odum 1953). Are these weeds useless invaders which are important only in the scheme of plant succession or are they overlooked useful plants? We will examine one of those weeds: Mexican-tea.

SYSTEMATICS: Family Chenopodiaceae, Order Caryophyllales (= Centrospermae), is temperate and subtropical, with a large proportion of halophytes (growing in saline habitats), is mostly herbaceous, and has small wind-pollinated flowers (Heywood 1978; Cronquist 1981; Takhtajan 1980; Zomlefer 1994). Caryophyllales members share many unusual characters, including presence of red betalain pigments rather than the anthocyanin (red of apples and wines; blues of larkspurs, etc.) pigments that most plants possess. Most Caryophyllales are C_4 plants with a specialized type of photosynthesis allowing competition in stressful conditions such as saline, dry, and hot environments (Smith 1976). This unusual photosynthetic pathway is mostly confined to some of the grasses and other monocotyledons, and it is peculiar that this group of dicotyledons should also possess the condition. Chenopodiaceae and Amaranthaceae are considered closely related by most taxonomists (Cronquist 1981; Rodman *et al.* 1984; Zomlefer 1994) and even included within the same family (Chenopodiaceae) by Takhtajan (1980). Wunderlin (1982) and Radford *et al.* (1964) distinguish Amaranthaceae by the presence of bracts and scarious (thin, dry, non-green) sepals while Chenopodiaceae flowers lack bracts and the sepals are not scarious. Both families lack petals; both usually have five stamens; both have 3-5 sepals.

Figure 1. Plant of *Chenopodium ambrosioides* growing as a nursery plant (Photography credit: Jeffery W. Lotz).

Mabberley (1989) relates there are *ca.* 150 species of *Chenopodium*. Wahl (1952) lists 48 species of *Chenopodium* for North America, with some of these nonnative (*i.e., C. multifidum* L. from South America; *C. pumilio* R. Br. from Australia; *C. bonus-henricus* L. from Europe; *C. vulvaria* L. from Eurasia; and *C. strictum* Roth from Asia).

The generic name *Chenopodium* (Greek, "goosefoot") refers to the leaf shape of some species (such as *C. album*). The specific epithet "ambrosioides" refers to its resemblance to *Ambrosia*, the ragweeds (family Compositae). *Chenopodium ambrosioides* (Fig. 1) is native to tropical America but has naturalized throughout much of the United States including Florida (Gleason 1952; Gleason and Cronquist 1991; Clewell 1985). *Chenopodium ambrosioides* is a herb with alternate, lanceolate to lance-elliptical leaves to 4 cm long. The leaf margins may be almost entire, wavy, toothed to lobed. The most striking feature of the plant is the presence on the leaves of strongly scented, tiny, golden-colored, glandular,

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resinous dots which can be seen when viewed with a 10X hand lens (Fig. 2). The terminal (or axillary) paniculate spikes are often very leafy and contain the insignificant flowers (Radford *et al.* 1964).

Aellen and Just (1943) distinguish several subspecies and forms of *C. ambrosioides*. Currently, there are two varieties listed by Kartesz (1994) in his synonymized checklist and in USDA's Plants National Database (http://plants.usda.gov/plants; updated 25 September 1997): *ambrosioides* and *obovatum* Speg. The variety *obovatum* seems to be restricted to Pennsylvania; Gleason and Cronquist (1991) do not list such a variety even in synonymy. *Chenopodium berlandieri* Moq. is often listed as a synonym of *C. album*, or as a variety.

Hill and Horn (1997) provide the first South Carolina report of *C. pumilio* R. Br. as a farm weed and quote Hugh Wilson that the species is spreading throughout the southeastern United States. The Florida collection of *C. glaucum* L was from a potato field in Dade County (Popenoe and Ward 1978). The presence of eight Florida *Chenopdium* species are based on the distribution maps from Wunderlin *et al.* 1997. Gleason (1952) provides good line drawings for all the species in Florida; *C. multifidum* is listed therein as *Roubieva multifida* (L.) Moq.

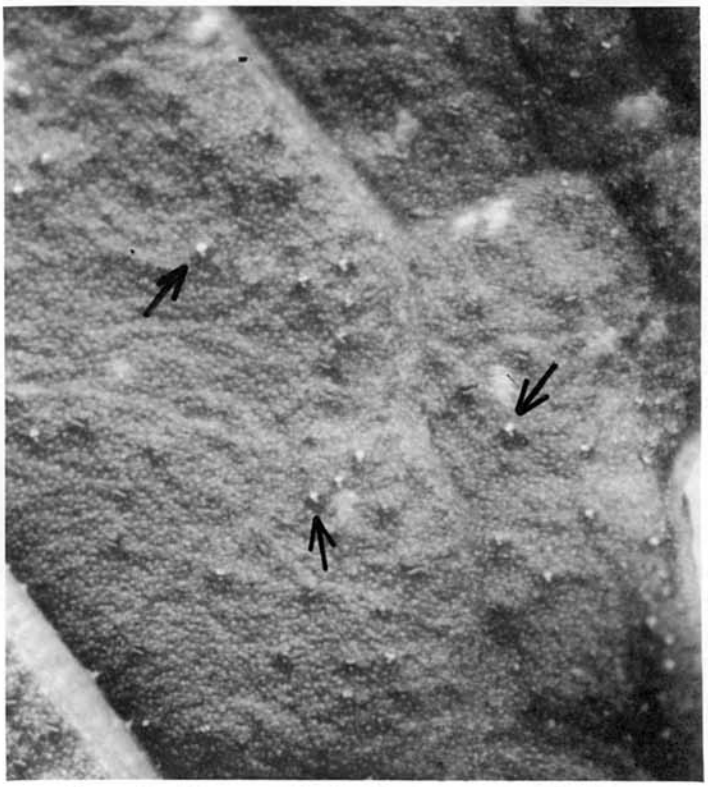

Figure 2. Close-up of leaf surface (see arrows) showing tiny glandular spots (Photography credit: Jeffery W. Lotz)

KEY TO FLORIDA CHENOPODIUM SPECIES:

Foliage with resinous glands (Subgenus *Ambrosia*, Scott 1978).
- Calyx with reticulate veins; South America, only in Walton Co.; "cutleaf goosefoot" ..... ***C. multifidum* L.**
- Calyx lacks obvious veins.
  - Erect plant; tiny yellow glands on foliage; calyx not obviously glandular ..... ***C. ambrosioides* L.**
  - Prostrate, spreading plant; large yellow glands on foliage and calyx; Australian (Gleason & Cronquist 1991), only in Hillsborough Co.; "clammy goosefoot" ..... ***C. pumilio* R. Br.**

Foliage not glandular (Subgenus *Chenopodium*, Scott 1978).
- Foliage densely white-mealy beneath.
  - Foliage malodorous; leaves broadly cuneate at base, broadly ovate, entire; Eurasian, only in Escambia Co.; "stinking goosefoot" ..... ***C. vulvaria* L.**
  - Foliage not malodorous; leaves lanceolate to oblong or ovate, usually toothed.
    - Seeds erect; sepals usually 3; European, Dade Co.; "oakleaf goosefoot" ..... ***C. glaucum* L.**
    - Seeds horizontal; sepals 5.
      - Pericarp surrounding seed smooth; European, throughout Florida;"lamb's-quarters" ..... ***C. album* L.**
      - Pericarp surrounding seed reticulated and rough; European, widely distributed in Florida; ..... "pitseed goosefoot:" ..... ***C. berlandieri* Moq.**
- Foliage only slightly white-mealy beneath; seed with sharp margin; European, in south and central Florida; "nettle-leaved goosefoot". ..... ***C. murale* L.**

RELATED SPECIES: Some well known edibles in the Chenopodiaceae are spinach (*Spinaca oleracea* L.), beets (*Beta vulgaris* L. ssp. *vulgaris*), and Swiss chard (*Beta vulgaris* ssp. *cicla* (L.) Koch), all of which get mixed opinions about their palatability. Much of the sucrose (refined sugar) of the world is derived from sugar beets, *Beta vulgaris* ssp. *vulgaris* (Simpson and Ogorzaly 1995). The sugar beet has up to 20 percent of its weight as sugar, while the beetroot (used for borscht, pickles, beets Harvard, etc.) has high concentrations of red betalains (Mabberley 1989).

Kunkel (1984) lists 35 species of Chenopodiaceae (including *C. ambrosioides*) which are used by man as food and states that several more species need to be investigated. Most of these species are eaten as pot-herbs, but seeds are consumed in some species. Originally from the Andes, *Chenopodium quinoa* Willd. is important in the diet of Amerindians of Peru, Ecuador and parts of Mexico for its seeds used in soup, ground into flour, used to make beer and as food for swine and poultry (Tindall 1983; Standley and Steyermark 1946; Wilson 1990). However, the seeds are bitter due to saponins (Ayensu 1978). Quinoa seed protein is quite high (12 to 19%) and fat is low (4-5%) (Ayensu 1978). Rehm and Espig (1991) list both lamb's-quarters and quinoa as "pseudo cereals" because their seeds are used similarly to the cereals. Annual production of quinoa in Ecuador, Bolivia, and Peru is 25,000 tons annually (Rehm and Espig 1991). Brouk (1975) lists quinoa as a substitute for maize in high elevation areas of Ecuador, Bolivia and Peru, as well as *C. nuttalliae* grown in pre-Columbian Mexico, and *C. album* (lamb's-quarters) seeds recovered from Iron Age European settlements.

Wilson (1990) lists three major pre-Columbian crop plants of western South America: maize, potatoes and quinoa. Quinoa was used in Aztec religious ceremonies and is probably one of the main reasons for Spanish elimination/suppression of this species (Wilson 1990), whereas the other two species have become important foods on a worldwide basis. Simpson and Ogorzaly (1995) suggest that promising crops are not more utilized because of the difficulty in changing eating habits.

Young, tender leaves of lamb's-quarters (native to India according to Rehm and Espig 1991, but Eurasian according to Correll and Correll 1982) are cooked and eaten by many North Americans in the same manner as spinach. However, care must be used since lamb's-quarters can accumulate excess nitrate and causes nitrate poisoning of livestock (Blackwell 1990). Apparently, the common name "fat-hen" refers to the use of the seeds as poultry food. Fernald and Kinsey (1958) mention use of the seeds to produce a black bread and report that Napoleon once survived on lamb's-quarters seed bread.

ETHNOBOTANICAL ASPECTS: *Chenopodium ambrosioides* is added to other foods as a flavoring agent (Mabberley 1989). Morton (1981) reports the use by Mayans of the leaves for flavoring corn, black beans, mushrooms, soup, fish and shellfish, and use as a popular tea in Mexico, Germany and the West Indies. Standley and Steyermark (1946) state that the leaves are especially useful in flavoring *jutes* (freshwater snails), but they describe the plant as having "a very distinctive and nauseous odor."

Chenopodium ambrosioides is well-known in several cultures as denoted by these common names in Rehm (1994): English (wormseed, American wormseed); French (*ambroisie du Mexique* =food of Mexicans); German (*Wurmsamen* =wormseed); Portuguese (*erva de Santa Maria* =herb of St. Mary) and (*anserina vermifuga* =silver-weed dewormer (Michaelis 1907)); Spanish (*apazote, pazote* =both are Aztec-derived and mean "dirty skunk" according to Rafael Perez Herrera, University of Yucatan, personal communication) and (*hierba hormiguera* =herb of the ants). Morton (1981) lists 46 common names from Middle America (the area of the Bahamas to Yucatan), but several of these are variant spellings of *apazote* and wormseed. Standley and Steyermark (1946) provide 13 common names, including variant spellings of *apazote* as well as *sicaj* and its variations.

As part of the traditional cuisine of the Mayans of Mexico, apazote is consumed by persons of all social levels. The herb is sold in small bundles the way parsley is packaged and sold in the United States (Artaud, personal observation). Unlike cilantro (foliage of *Coriandrum sativum* L., Umbelliferae) which is usually added to a dish just before serving, *apazote* is cooked into the rest of the ingredients. Visitors to the Yucatan Peninsula who partake of native foods are not aware that they are ingesting this herb because the flavor blends with other unusual flavors. When cooked, the flavor is not overwhelming. Many people supply their culinary needs from homegrown plants growing in the ground or in containers on their patios. In the Philippines, leaves and tops of *C. ambrosioides* are cooked with rice (Brown 1950). Some herb specialists in Florida are now offering *C. ambrosioides* for sale. The plant shown in Fig. 1 was purchased from a nursery in Dade County by Environmental Specialist Lynda F. Davis at our request.

MEDICINAL USES: In Mexico, Artaud has observed the daily use of the tender new growth of Mexican-tea as an additive to foods. Partially, this intensive daily use is for flavoring foods, but another reason is the vermifuge properties. The activity on the intestinal parasites is mild and does not completely kill these parasites. Therefore, repetitive usage is required to maintain a healthy body. Several of the common names refer to the vermifuge activity of this species, for example "wormseed" is a clear reference to its use as a de-wormer. Standley and Steyermark (1946) mention that *C. ambrosioides* was "official in the pharmacopoeias" of the United States and other countries and used for its efficiency in expelling intestinal parasites. The Merck Index (Windholz 1976) lists the active ingredient as ascaridole and describes oil of chenopodium as deriving from *C. ambrosioides* L. var. *anthelminticum* (L.) Aellen and useful as an anthelminthic.

Lewis and Elvin-Lewis (1977) suggest that oil of wormwood [sic, wormwood is *Artemisia absinthium* L.] extracted from *C. ambrosioides* is very dangerous because the therapeutic dose is close to minimum toxic levels. Overdoses of chenopodium oil lead to vomiting, convulsions, weakness, sleepiness, and cardiac and respiratory difficulties (Watt and Breyer-Brandwijk 1962). Muenscher (1964) states that poisoning from the plant is unknown, but that wormseed oil can be poisonous. Watt and Breyer-Brandwijk (1962) recommend chenopodium oil as a household remedy for athlete's foot and report that in Mauritius, the plant is used as a vermifuge, antispasmodic, abortifacient, diaphoretic and stomachic; however, chenopodium oil produces a toxic action of the liver in experiments and, when severe poisoning occurs, induces a fatal coma.

Now that *C. ambrosioides* is dispersed worldwide, many peoples have used this species. Amazonian Indians consider *C. ambrosioides* a purgative, vermifuge, contraceptive, and labor inducer (Schultes and Raffauf 1990). Poultices of *C. ambrosioides* are applied to abdomens of children in the Philippines to cure stomachaches (Brown 1950). The Sotho and Zulu of Africa use an infusion of *C. ambrosioides* for colds, stomachache and enemas (Watt and Breyer-Brandwijk 1962). They also report that the Xhosa of Africa use the seed as an insecticide.

ECOLOGICAL ASPECTS: Certain weeds, including *C. ambrosioides*, are reported by Altieri and Whitcomb (1979a) for manipulation to increase the predators and parasitoids that attack phytophagous insects. Altieri and Whitcomb (1979b) concluded that Mexican-tea probably plays an important role as a host for 33 arthropod predator species. Twenty-eight species of insects and nine species of spiders were associated with Mexican-tea. Forty three percent (14 species) of the predator arthropods were also collected in nearby cultivated fields.

Kishore *et al.* (1989) found that oil from *C. ambrosioides* inhibits growth of *Rhizoctonia solani* Kuehn, a fungal disease, and treatment of soil with leaves of *C. ambrosioides* controls damping-off by 70 percent. The minimum concentration of chenopodium oil for inhibition of mycelial growth is 1000 ppm and is one to five times more effective than benlate. Dubey and Kishore (1987) found a fourfold increase in fungicidal activity of *Rhizoctonia solani* with a combination of oils from *C. ambrosioides* and *Lippia alba* (Mill.) N.E. Br. ex Britt. & P. Wilson (lippia, Verbenaceae) or *C. ambrosioides* and *Ocimum canum* Sims (hoary basil, Labiatae) as compared with use of a single oil. There were no phytotoxic effects on seed germination, seedling growth and general morphology of *Vigna radiata* (L.) R. Wilczek (= *Phaseolus aureus*, mung bean) with use of these oils.

Infection by tobacco mosaic and sunnhemp rosette viruses on several natural hosts was reduced up to 98 percent with an aqueous extract of ground *C. ambrosioides* leaves (Verma and Baranwal 1983). Verma and Baranwal report that several persons suggest the active substance in *C. ambrosioides* possibly alters the cellular metabolism of the host which causes the host then to produce interfering substances.

When Su (1991) applied 2000 ppm of chenopodium oil to wheat (*Triticum aestivum* L.) or black-eyed peas (*Vigna unguiculata* (L.) Walp.), the oil reduced infestations of cowpea weevil, *Callosobruchus maculatus* (F.), by 98.8 percent and rice weevils, *Sitophilus oryzae* (L.), by 83.6 percent. Su also found chenopodium oil is almost nontoxic to the confused flour beetle, *Tribolium confusum* du Val. However, it is highly toxic to cowpea weevils and cigarette beetles, *Lasioderma serricorne* (F.); moderately toxic to rice weevils; and strongly repellent to rice weevils.

Murphy *et al.* (1996) list six species of Amaranthaceae as weeds of southern turfgrasses; however, no species of Chenopodiaceae are listed by them. Five Chenopodiaceae species and 10 species of Amaranthaceae are treated in the Southern Weed Science Society's "Weed Identification Guide" (Elmore, undated).

CONCLUSIONS: Due to the information we have uncovered, this "weed" shows remarkable qualities which are underutilized in the United States. The aromatic leaves impart an unusual flavor to cooked dishes. Anti-parasitic, anti-bacterial, anti-fungal and anti-viral properties without noticeable side effects to people and higher plants show potential for benefit to both man and crop. These plants are hosts for effective predator arthropod biocontrol agents. If used carefully, pest control could be accomplished with this natural pesticide rather than the organophosphate and chlorinated hydrocarbon pesticides. With further study, who knows what promising attributes of this "weed" may be uncovered? Yes, in the U.S.A., it is a weed; but, can it become more than a weed?

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