Carthamus lanatus L. (Asteraceae: Cynareae) – A potentially serious plant pest in Oklahoma

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Plants in an isolated population in McClain County, Oklahoma, have been identified as distaff thistle, *Carthamus lanatus* L. The plant is widely distributed in Eurasia, Australia, and in California, but it has not been reported previously in Oklahoma. It has some potential applications in dyes and edible oils, but it reduces grazing values of land and has become a serious pest in Australia and some other locations. Because seed dispersion is rather slow during usual conditions in Oklahoma, current efforts to eliminate the McClain County infestation should protect adjacent areas.

INTRODUCTION

A population of thistle-like plants about 15 m in diameter was first noticed about 1975 in an upland bermudagrass pasture on the author's farm in McClain County (Sec 21, Twp 6N, R3W, 34°59'N × 97°31'W). By 1984 the population was about 30 m in diameter with a few plants 30 meters from center, the number of individual plants was more than 10^5, and cows would not graze the area. In 1985, specimens of the plants were deposited at the Bebb Herbarium, OKL (accession 146991) and identified there as *Carthamus lanatus* L., commonly known as distaff thistle or (in Australia) saffron thistle. Although previously reported as rare from the Edwards Plateau region of Texas, this member of the Asteraceae (Cynareae) was not known to occur in Oklahoma or other adjacent states (1,2,3). Comments on its morphology, distribution, and ecology are presented here.

DESCRIPTION AND DISTRIBUTION OF DISTAFF THISTLE

According to Munz and Keck (4) *Carthamus* is an Arabic name alluding to floral color, and Abrams and Ferris (5) report that this name is probably derived from the Arabic name for the safflower plant, *Carthamus tinctorius.* The species was well known by ancient botanists including Theophrastus, Pliny, and Dioscorides. The latter author indicates that the plant was used as an antidote for scorpion stings (6).

Detailed botanical descriptions of *C. lanatus* have been given, from one of which (7) much of the immediately following paragraphs is paraphrased. *C. lanatus* is a shallow-rooted annual that produces upright wiry stems, usually 0.1-1 m tall. The average mature height of the McClain County population is about 0.6 m, and a few plants approach 1 m. Meadly (8), however, indicates that the plant height in Australia can exceed 2 m, and Harradine (9) writes that the height of the mature plant in Tasmania varies with growing conditions from 0.5 to 2.0 m. Chisholm (10) describes tall thickets including stems 2 to 3 cm in diameter on moist alluvial Australian soils, virtually impenetrable by humans unless armed with machete or similar tool. The different heights of growth indicated for Australia and the United States may reflect the presence of distinct subspecies in these different places, or, as suggested above, responses of the same variety to differing regimes of climate and soil. Although Munz and Keck (4) give the diploid number as 34, Heller (6) refers to polymorphism in *C. lanatus,* with five distinct subspecies that differ in the number of chromosomes.

The seedlings have comparatively large cotyledons and grow into rosettes that rarely exceed 15 cm in diameter. Rosette leaves are dark green with a broad terminal lobe and irregular triangular lobes along the prominent midrib. As the stem grows, the rosette leaves wither and disappear. The stem leaves are alternate and very stiff with stout sharp spines at the tip and along the edges. They are narrow-triangular in outline, folded along the midrib. The bases are stem-clasping.

The flower buds are terminal to the stem and are enclosed in large spiny bracts

very similar to the stem leaves. When the buds break, sulfur-yellow florets appear, half hidden by the large bracts, and therefore rather inconspicuous. The seeds mature in the flower heads. They are about the size of a grain of wheat or barley, and when fully ripe are usually shaken out by the wind, and, not being equipped for wind dispersal, tend to fall at the base of the plant. Botanical drawings of *C. lanatus* are shown in Fig. 1.

Distaff thistle is native to and widely distributed in the Euro-Siberian, Mediterranean, and Irano-Turanian phytogeographic regions to an elevation of 1200 m. According to Heller (9), *Carthamus lanatus* L. in Eurasia "grows on rocky places, sunny hills, uncultivated ground, and tracksides . . ." In Australia, distaff (saffron) thistle became an object of control legislation as early as 1887. It has been reported from every Australian state, and is particularly widespread in the southeast quarter of the continent and in cereal-growing districts in the west (8). As already noted, distaff thistle has been reported from central Texas. It is "occasionally adventive" in coastal counties of California, from the San Francisco Bay area northward nearly to the Oregon line (4,14). Abrams and Ferris (5) state that it is also reported from southern California. Since some previous owner-residents of the author's farm had relatives and friends in California and Oregon, and traveled to and from there, it is plausible that seed was brought to the Oklahoma upland prairie site in connection with one of these trips or visits, perhaps as long ago as thirty years. It is possible but seems less likely that seed was deposited by oil field equipment or workers who had contacted the plant in its Eurasian or California habitats.

LIFE HISTORY

Seed of *Carthamus lanatus* can remain viable for up to 8 years according to Pierce and Quinlivan (11), or 10 years according to Gutterman (12). In Australia, most seed germinates from late summer to early

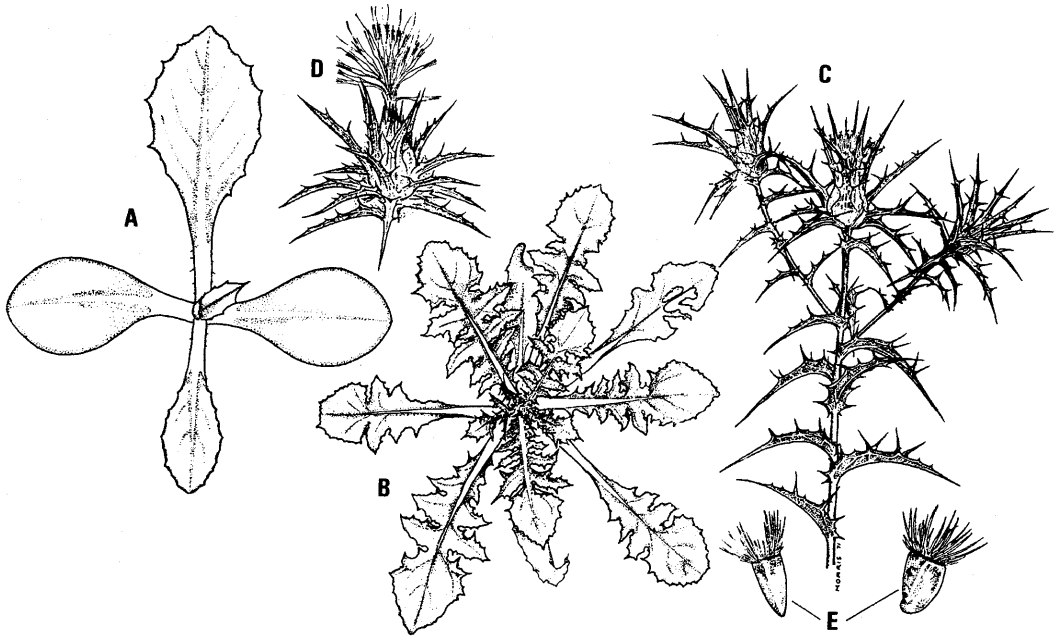

FIGURE 1. Botanical drawings of distaff (saffron) thistle. (A) cotyledon + 2 true leaf stage; (B) rosette; (C) flowering branch; (D) head of flower; (E) seeds; (from 7). (Reproduced with permission, Dept. of Agriculture, Tasmania).

winter, after cultivation of the land and rains that commonly follow a droughty summer. Effects of light and leaching on the breaking of seed dormancy, and attendant chemical changes, have been studied by Wright (13). Harradine (9) indicates a tendency for the seed in Tasmania to germinate whenever moisture is present, whatever the season. Seed of distaff thistle on the author's farm, as in Australia, germinates in late summer or fall, and rosettes that fairly hug the ground are conspicuous in early winter. Munz (14) reports that bloom in California occurs during July and August; Abrams and Ferris (5) observed that bloom in California occurs from April to December. In McClain County, bloom starts at the end of May and is concluded by the start of July; *Apis bombus* frequently visits the flowers. On June 13, 1986, with plants mature, 46, 27, and 34 distaff thistle plants were counted in three separated areas in the McClain County patch, each 0.25 m^2 and haphazardly selected within the region of principal growth. Where the plants are so dense they tend to have a single stalk, perhaps with one or two branches, whereas outliers are substantially larger individually, and have numerous branches. Two photographs of *C. lanatus* in McClain County are shown as Figs. 2 and 3.

CHEMISTRY

Several species of *Carthamus* are cultivated, primarily as economic crops for edible oils and dyes (15). Chemistry of *Carthamus* and of other composites has been presented by Heywood, et al. (16). Familiar safflower oil, produced commercially from *Carthamus tinctorius*, is a mixture of glycerides of linoleic and oleic acids in proportions that differ with plant variety. San Feliciana, et al. (17) report that a sesquiterpene glycoside is the major component of the hexane extract from aerial parts of *C. lanatus*, and that this type of compound seems to be characteristic of *Carthamus.* Czerpak and Obrusiewicz (18) reported that *Silybum marianum* or milk thistle, a closely related plant, had a crude protein content above 25% when harvested in the flowering stage and dried.

ECONOMIC IMPORTANCE AND CONTROL

C. lanatus has been crossed with *C. tinctofius* in the laboratory in an effort to develop a cultivar resistant to wilts and root rot, while retaining qualities of oil production typical of *C. tinctorius.* The paper on this by Heaton and Klisiewicz (19) shows that crosses thus far obtained in their experiments were disease resistant but provided very little oil. The author has determined for himself that the rosettes of distaff thistle are palatable, with a taste somewhat like a moderately strong lettuce; its nutritional value has been suggested (18).

Meadly (8) discusses ecological relationships of *Carthamus lanatus.* Its dispersal in Australia has been "due, in the main, to the distribution of hay, chaff, and grain containing seeds of the weed", an appraisal also given by the Tasmanian Journal of Agricul-

FIGURE 2. Portion of bermudagrass pasture in McClain County, OK, heavily populated with *Carthamus lanatus* L., distaff thistle, May 22, 1986.

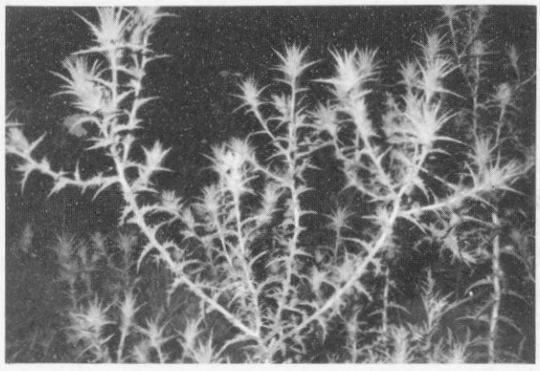

FIGURE 3. *Carthamus lanatus* L. on June 2, 1986.

ture (7). Chisholm (10) states that its spread in Australia has also been facilitated by sheep, which, while grazing in and around the thistle, collect spiny parts of the plant in their wool, where they are costly contaminants. Chisholm also indicates that goats graze distaff thistle to some extent, and help to spread the plant by carrying fallen seed in their cloven hooves.

Meadly (8) reports that saffron thistle in crops of grain both increases difficulties in harvesting and substantially reduces yields. Furthermore, mouths of livestock have been ulcerated following their efforts to graze this plant, and lameness has been caused by spines that penetrate hooves.

In Tasmania and southern Australia, *C. lanatus* promotes attacks of the major insect pest of pastures there, *Oncopera intricata* Walk. (Lepidoptera, Hepialidae) (7). According to Harradine (9), where infestations of *C. lanatus* prevent access of grazing animals, resultant patches of taller grass present ideal sites for egg-laying by the adult moths.

Control methods, viz., mowing, grazing, spraying, cultivating, and burning, usually in various combinations or sequences have been discussed (7,8). Meadly cautions that mowing must be timed very carefully, because plants mowed too early renew their growth, and stems cut after flowers are formed can still produce some viable seed. Meadly considers that there is no prospect for eliminating this plant from Australia, but only for controlling its numbers in selected areas; in Tasmania, where the plant is less numerous, Harradine writes that eradication is being attempted but is proving to be very difficult. Of course, the germination of seed over extended periods and, in Australia and Tasmania, the presence at once of plants in many stages of development, greatly increases difficulties of control.

If *C. lanatus* were widespread in Oklahoma, it would severely impact the raising of cattle and small grains. Fortunately, its rate of spread from pasture not harvested for hay is slow in the absence of sheep and goats. The McClain County population discussed here is being reduced by pulling up all the plants that appear each year, just as the flower buds open.

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