

A REVISION OF THE GENUS LACTUCA
(COMPOSITAE: LACTUCEAE) IN THE GREAT PLAINS

by

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Approved by:

A handwritten signature in dark ink, reading "A. Spencer Burt". The signature is written in a cursive style with a large, looping "B" at the end. It is positioned above a horizontal line.

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The fieldwork and SEM work of this study were supported by grants from the Kansas State Agricultural Experiment Station. Dr. Spencer Tomb is acknowledged for providing a research assistantship and research support from his NSF grant.

Acknowledgment is made to the curators and staff of the herbaria listed below. The symbols are those of Holmgren and Keuken (1974), and the numbers in parentheses indicate the number of specimens borrowed or critically examined at that herbarium.

- UC. University of California, Berkeley (20).
- KSC. Kansas State University, Manhattan (200).
- KANU. University of Kansas, Lawrence (800).
- MO. Missouri Botanical Gardens, St. Louis (81).
- OKL. University of Oklahoma, Norman (155).
- SD. University of South Dakota, Vermillion (44).
- SMU. Southern Methodist University, Dallas (50).

INTRODUCTION

Lactuca (Compositae: Lactuceae) is a cosmopolitan genus of about 100 species inhabiting north temperate regions worldwide and tropical Africa. Fifteen species occur in North America (8 native and 7 introduced), and seven of these (5 native and 2 introduced) occur in the Great Plains. Lactucas are known commonly as the 'wild lettuces', and L. sativa is the garden lettuce. These plants occupy a variety of habitats with some taxa being aggressive colonizing ('weedy') species and other taxa are natives with more narrow and ecological requirements.

As a member of the tribe Lactuceae of the Asteraceae, much of the taxonomic work on Lactuca has been contained in tribal treatments. Early authors used selected morphological features, especially papapus characters, which resulted in highly artificial treatments of the tribe (de Jussieu, 1789; Cassini, 1826; D. Don, 1828; Lessing, 1832; De Candolle, 1939; Bentham, 1873; Hoffman, 1891). The two most recent treatments of the tribe are those by Stebbins (1953) using cytotaxonomy and geography and by Jeffrey (1966) who added microcharacters. These treatments are believed to be much more natural.

Babcock et al. (1937) did a cytotaxonomic study of Lactuca and related genera and proposed a phylogenetic scheme based on chromosome number and karyotypic relationships. Stebbins (1937 a, b, 1939) studied some of the species relationships in detail and proposed several new species and combinations. The work of Babcock and Stebbins forms the modern foundation of systematic studies in the tribe Lactuceae.

Another important set of studies has been done because of the economic importance of the cultivated lettuce, L. sativa. Much genetic and cytotaxonomic work has been done with various species of Lactuca in the hope of improving the cultivar (Lindquist, 1956, 1958, 1960 a, b, c; Thompson, 1942, 1943; Thompson, Haney, & Kosar, 1948; Thompson & Kosar, 1938; Thompson, Whitaker & Bohn, 1958; Thompson, Whitaker & Kosar, 1941; Whitaker, 1944, 1950; Whitaker & Jagger, 1939; Whitaker & McCollum, 1954; Whitaker & Thompson, 1941). A taxonomic study of the North American Lactucas has been done as a doctoral dissertation by Radloff (1961). However, Radloff's treatment of the genus was a superficial alpha-taxonomic treatment and did not treat the biology of the group.

In the present treatment the North American species of Lactuca are considered to fall into four more or less distinct species groups¹ (the basis for these groups will be discussed under Species Relationships). Formally dividing the genus into sections or subgenera must await a comprehensive study of the genus.

Below are listed the North American species of Lactuca studied under a group name that will be used for purposes of discussion.

<u>Serriola</u> group	<u>Canadensis</u> group	<u>Biennis</u> group	<u>Oblongifolia</u> group
<u>L. serriola</u> ²	<u>L. canadensis</u> ²	<u>L. biennis</u> ²	<u>L. oblongifolia</u> ²
<u>L. saligna</u> ²	<u>L. ludoviciana</u> ²	<u>L. floridana</u> ²	

¹Four additional species are recognized by Radloff (1961). However, I have not seen material of these taxa and will not consider them in my study. These taxa are L. muralis (L.) Gaertn., L. Stolonifera (Gray) Benth and Hooker, L. intybacea Jacq, and L. terra-novae fern.

²Taxa present in the Great Plains.

L. virosa L. graminifolia

L. sativa³ L. hirsuta

It is important to note that the members of the Canadensis, Biennis, and Oblongifolia groups are indigenous to North America, and that the members of the Serriola group are introduced from Eurasia.

For the purposes of this study, the Great Plains is defined as the area extending from the beginning of continuous eastern deciduous woodlands west to the front range of the Rocky Mountains and from the Canadian border south to the Texas Panhandle and the northwest half of Oklahoma (Figure 1). This area includes the entire states of North Dakota, South Dakota, Nebraska, and Kansas. Extreme western Minnesota, Iowa, and Missouri form the eastern boundary, and the southern boundary is formed by the northwest half of Oklahoma, the Texas Panhandle, and extreme northeast New Mexico. The portions of Colorado, Wyoming, and Montana east of the front range of the Rocky Mountains form the western boundary of this study. This area encompasses a natural vegetation provenience composed mostly of prairie grasslands with the notable exception being the Black Hills of South Dakota. There is, however, only one species of Lactuca that can be referred to a prairie habitat, L. ludoviciana. This region (Figure 1) corresponds to the Flora of the Great Plains, currently in preparation by the Great Plains Flora Association, and the map is derived from the GPFA Atlas.

This study makes special reference to the Great Plains species of Lactuca, but data on all of the North American taxa are included in some chapters toward a more comprehensive study of the genus. The

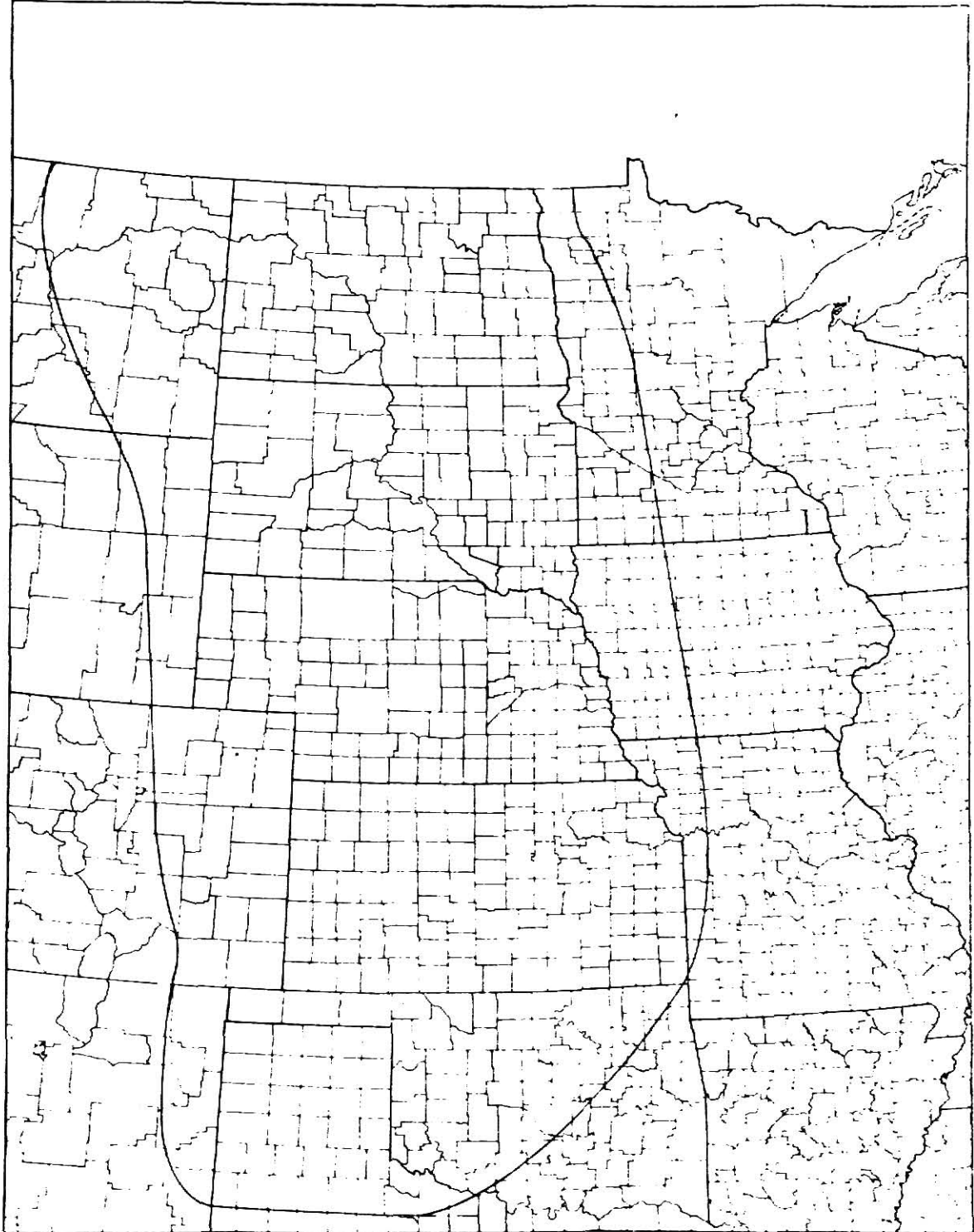
³Cultivar and type species.

goals of this study are to clarify the taxonomy of the Great Plains species of Lactuca, and to use a synthetic, biosystematic approach to elucidate the relationships among the North American Lactucas.

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FIGURE 1
The Great Plains



TAXONOMIC HISTORY

The genus Lactuca has had a very involved nomenclatural history; therefore, the only names considered will be those that pertain to the species being studied.

Tournfort (1719) established the genus Lactuca, and Linnaeus published the name in the Genera Plantarum (1737) and the Species Plantarum (1753). Linnaeus placed species with filiform beaked achenes in this genus, and those with unbeaked achenes were placed in the genus Sonchus. For example Linnaeus placed L. floridana in Sonchus. This trend of placing the species without filiform beaked achenes in Sonchus or other specially created genera persisted for almost two centuries.

The genus Cicerbita was erected by Wallroth (1822) to include those species without filiform beaks and L. canadensis. The genus was revised by Beauverd (1910) to include the lactucas with a short outer pappus plus portions of Sonchus and Prenanthes.

The genus Mulgedium was erected by Cassini (1824) for those species of Lactuca without filiform beaked achenes, and the genus Agathyrsus was created by D. Don (1828) also to include those species of Lactuca without filiform beaked achenes. Galathenium was a curious genus erected by Nuttall (1841) in which he included the species of Lactuca with filiform beaks and some species of Mulgedium. Nuttall (1841) did not recognize any species of Lactuca in North America. He split what is here called Lactuca between Mulgedium and Galathenium. The genus Wiestia was erected by Schultz-Bipontinus (1841) and this name is a synonym for much of Lactuca.

The nomenclatural history of this genus has followed a successive pattern of lumping. Because of the extreme polymorphism of many of the species, several of the phases were originally placed in separate species of Lactuca or other genera. These segregate species were later combined to forms or varieties of the same species, and in this study these infraspecific taxa are considered mere morphological phases of highly variable taxa.

CHROMOSOMAL STUDIES

Introduction. The chromosomes of Lactuca have been well studied (Babcock et al., 1937; Whitaker and Jagger, 1934; Whitaker and Thompson, 1941), and chromosome numbers of the North American species have been determined by these authors and others (Table 2). The chromosomes of Lactuca are large and heteromorphic enough to make a karyotypic study feasible. Consequently, the karyotypic approach has received much emphasis in the present study.

The genus Lactuca has three base chromosome numbers, $\underline{n} = 9$, $\underline{n} = 8$, and $\underline{n} = 17$. The $\underline{n} = 17$ species are presumed to be amphidiploids derived from a cross between an $\underline{n} = 9$ species and an $\underline{n} = 8$ species (Babcock et al., 1937; Thompson, et al., 1941). The $\underline{n} = 17$ species studied, the Canadensis and Biennis groups, are very similar karyotypically and the species cannot be distinguished from one another by their karyotypes. L. oblongifolia ($\underline{n} = 9$) shows some karyotypic relationship to the $\underline{n} = 17$ species but is very distinct from the introduced, $\underline{n} = 9$ species.

Materials and Methods. Bud material for meiotic counts was collected in the field into a modified carnoy's solution (4 parts chloroform: 3 parts absolute ethanol: 1 part glacial acetic acid). Counts were obtained by the aceto-carmin squash technique (Turner and Johnston, 1961). Selected meiotic slides were made semi-permanent by ringing the cover slip with krönig cement. If a permanent slide was desired, the semi-permanent slide was placed on a slab of dry ice for ca. 10 min and the krönig cement and the cover slip were removed. The

slide was then taken through 2 changes of absolute ethanol and one change of xylene. A new coverslip was then mounted in a drop of permount and the slide left to dry. Camera lucida drawings were made of all meiotic counts (Figures 2-9) at magnifications of 1250-2000 x. Voucher specimens have been placed in the Kansas State University Herbarium (KSC).

Mitotic material was used for karyotypic study and additional chromosome counts. The procedure used differs somewhat from most published accounts, so the technique will be reported in detail.

Achenes were placed in petri dishes on moist filter paper at room temperature, and germination usually occurred in a week to 10 days. When the root tips had elongated to about .5 cm, the seedlings were submerged in a .1% aqueous solution of colchicine and kept at ca. 5°C for 3-5 hours. The root tips were then removed from the seedling and placed in a watch glass containing 9 drops of 2% acetic-orcein and 1 drop of 1M HCl (Tijo and Levan, 1950). The watch glass was then heated for 3-4 seconds over a spirit flame (just long enough to cause a small "puff" of vapor to rise from the stain). Root tips were placed on a slide in a small drop of 1% acetic-orcein, and a cover slip was gently lowered onto the root tips. Before squashing, the cover slip was gently tapped over the root tips to help spread the cells. Pressure was then firmly applied to the cover slip. The slides were made semi-permanent and permanent using the same procedure described for meiotic preparations.

Karyotypes were made from metaphase plates in which the chromosomes had reached maximum contraction and which had a minimum of

overlapping chromosomes. The cells were photographed with Panatomic-X film at 1250x on a Zeiss Universal microscope, and the negative was then printed at ca. 4375x. Karyotypes were constructed by cutting the chromosomes out of these pictures and arranging them in putative pairs. Chromosomes were arranged in order of decreasing length with the most metacentric chromosomes first when several pairs of similar length were encountered.

Results. Thirty-six populations of Lactuca were examined for chromosome number (Table 1). Karyotypes were obtained from six species (Figures 10-15), and observations were made on the chromosome morphologies from many more populations. The meiotic studies (Figures 2-9) showed normal bivalent pairing in all cells observed.

The karyotypes of L. canadensis (Figure 10); L. ludoviciana (Figure 11); and L. biennis (Figure 12) were identical (Babcock et al., 1937) and showed chromosome pairs 6 and 11 to have satellites on the short arms and chromosome pair 7 was clearly acrocentric.

The karyotype of L. oblongifolia (Figure 13) has satellites on the short arms of the 4th largest pair and the 5th largest pair is clearly acrocentric. Based on chromosome size, morphology, and satellite position the chromosomes of L. oblongifolia can be matched with 9 pairs in the tetraploids. Chromosome pairs 4 and 5 of L. oblongifolia are very distinctive and match pairs 6 and 7 in the tetraploids (Figure 16).

The karyotype of L. serriola selected for Figure 14 was not at maximum contraction; however it was chosen to show the two pairs of satellited chromosomes. The karyotype of L. saligna (Figure 15) shows

pairs that have the same morphology as those of L. serriola except that they are more contracted. Babcock et al., (1937) report that the genomes of L. serriola and L. saligna are identical. The largest pair of L. serriola (Figure 14) has satellites on the short arm and a secondary constriction just below the centromere on the long arm, and pair 5 has satellites on the short arm. The chromosomes of the introduced species tend to be smaller than those of the native species.

Discussion. A close relationship among the $n = 17$ species is indicated by the resemblance of their karyotypes. This resemblance was also noted by Babcock et al., (1937).

Karyotypically, L. oblongifolia bears a resemblance to the $n = 17$ taxa. Particularly chromosome pairs 4 and 5 of L. oblongifolia match pairs 6 and 7 of the tetraploids. This evidence supports the hypothesis that L. oblongifolia or a closely related species was the $n = 9$ parent of $n = 17$ North American Lactucas.

Table 1

SPECIES OF LACTUCA EXAMINED FOR CHROMOSOME NUMBER

Species	Number	Voucher Collection
<u>L. oblongifolia</u>	$2n = 18$	<u>Tomb 958</u> , Fremont Co., Wyoming (KSC)
	$2n = 18$	<u>Brooks 8264</u> , Monona Co., Iowa (KANU)
	$n = 9$	* <u>D. 182</u> , Yuma Co., Colorado (KSC)
	$n = 9$	<u>D. 187</u> , Goshen Co., Wyoming (KSC)
<u>L. canadensis</u>	$2n = 34$	<u>Bare 2649</u> , Greenwood Co., Kansas (KANU)
	$2n = 34$	<u>Stephens 82778</u> , Linn Co., Kansas (KANU)
	$2n = 34$	<u>D. 221</u> , Ottawa Co., Kansas (KSC)
	$2n = 34$	<u>D. 246</u> , Jackson Co., Kansas (KSC)
	$2n = 34$	<u>D. 266</u> , Harrison Co., Iowa (KSC)
	$2n = 34$	<u>D. 274</u> , Lawrence Co., South Dakota (KSC)
	$2n = 34$	<u>D. 209</u> , Osage Co., Kansas (KSC)
	$2n = 34$	<u>D. 245</u> , Jackson Co., Kansas (KSC)
<u>L. ludoviciana</u>	$n = 17$	<u>D. 170</u> , Carson Co., Texas
	$n = 17$	<u>D. 190</u> , Pennington Co., South Dakota (KSC)
	$2n = 34$	<u>D. 205</u> , Geary Co., Kansas (KSC)
	$n = 17$	<u>D. 227</u> , Canadian Co., Oklahoma (KSC)
	$2n = 34$	<u>D. 232</u> , Dewey Co., Oklahoma (KSC)
	$2n = 34$	<u>D. 233</u> , Dewey Co., Oklahoma (KSC)
	$2n = 34$	<u>D. 236</u> , Ford Co., Kansas (KSC)
	$2n = 34$	<u>D. 238</u> , Ellis Co., Kansas (KSC)
	$2n = 34$	<u>D. 271</u> , Brookings-Moody Co. Line, South Dakota (KSC)
	$2n = 34$	<u>D. 273</u> , Lawrence Co., South Dakota (KSC)
	$2n = 34$	<u>D. 282</u> , Lancaster Co., Nebraska (KSC)

* Collections by Dille

Table 1 (Cont.)

Species	Number	Voucher Collection
<u>L. biennis</u>	<u>2n</u> = 34	* <u>D. 275</u> , Lawrence Co., South Dakota (KSC)
<u>L. floridana</u>	<u>2n</u> = 34	<u>Stephens 82860</u> , Bourbon Co., Kansas (KANU)
	<u>2n</u> = 34	<u>Stephens 83134</u> , Montgomery Co., Kansas (KANU)
<u>L. serriola</u>	<u>2n</u> = 18	<u>Stephens 82476</u> , Labette Co., Kansas (KANU)
	<u>n</u> = 9	<u>D. 150</u> , Geary Co., Kansas (KSC)
	<u>n</u> = 9	<u>D. 175</u> , Powers Co., Colorado (KSC)
	<u>2n</u> = 18	<u>D. 206</u> , Wabaunsee Co., Kansas (KSC)
	<u>2n</u> = 18	<u>D. 230</u> , Blaine Co., Oklahoma (KSC)
	<u>n</u> = 9	<u>D. 165</u> , Major Co., Oklahoma (KSC)
	<u>2n</u> = 18	<u>D. 262</u> , Cass Co., Nebraska (KSC)
<u>L. saligna</u>	<u>n</u> = 9	<u>D. 198</u> , Lincoln Co., Missouri (KSC)
	<u>2n</u> = 18	<u>D. 208</u> , Wabaunsee Co., Kansas (KSC)
	<u>2n</u> = 18	<u>D. 216</u> , Coffey Co., Kansas (KSC)

* Collections by Dille

Table 2

PREVIOUS CHROMOSOME COUNTS FOR THE NORTH AMERICAN LACTUCAS

Taxon	Number	Reference
<u>L. oblongifolia</u>	2n = 18	Mulligan, 1961
(<u>L. pulchella</u>)	2n = 34*	Turner <u>et al.</u> , 1962
<u>L. canadensis</u>	2n = 34	Babcock <u>et al.</u> , 1937 Whitaker & Jagger, 1939 Thompson <u>et al.</u> , 1941
<u>L. ludoviciana</u>	2n = 34	Babcock <u>et al.</u> , 1937
(<u>L. campestris</u>)		
<u>L. graminifolia</u>	2n = 34	Babcock <u>et al.</u> , 1937 Whitaker & Jagger, 1939 Thompson <u>et al.</u> , 1941
<u>L. hirsuta</u>	2n = 34	Mulligan, 1964
<u>L. biennis</u>	2n = 34	Mulligan, 1957
(<u>L. spicata</u>)		Packer, 1964 Babcock <u>et al.</u> , 1937 Thompson <u>et al.</u> , 1941
<u>L. floridana</u>	2n = 34	Babcock <u>et al.</u> , 1937
(<u>L. villosa</u>)		Thompson <u>et al.</u> , 1941 Ishikawa 1916, 1921
<u>L. serriola</u>	2n = 18	Gates & Rees, 1921
(<u>L. scariola</u>)		Ishikawa, 1921 Cooper & Mahony, 1935 Babcock <u>et al.</u> , 1937 Whitaker & Jagger, 1934 Mulligan, 1957 Mehra <u>et al.</u> , 1965 Heiser & Whitaker, 1948 Lindquist, 1960a Chatterjee & Sharma, 1969

* The voucher for this plant has not been examined by this author, but it is probably incorrectly determined. The citation locates this plant in Guatemala and L. oblongifolia does not grow south of the U.S.-Mexican border. This plant could possibly be L. graminifolia (2n = 34) since it resembles L. oblongifolia vegetatively, and Guatemala is in the potential distribution of L. graminifolia.

Table 2 (Cont.)

Taxon	Number	Reference
<u>L. saligna</u>	$2n = 18$	Babcock <u>et al.</u> , 1937 Thompson <u>et al.</u> , 1941 Heiser & Whitaker, 1948 Lindquist, 1960a

- Figure 2. Camera lucida drawing of the meiotic chromosomes of L. ludoviciana, Diakinesis, 1600x, Dille 227, n = 17.
- Figure 3. Camera lucida drawing of the meiotic chromosomes of L. ludoviciana, Metaphase I, 1600x, Dille 170, n = 17.
- Figure 4. Camera lucida drawing of the meiotic chromosomes of L. ludoviciana, Diakinesis, 1600x, Dille 190, n = 17.
- Figure 5. Camera lucida drawing of the meiotic chromosomes of L. oblongifolia, Metaphase I, 1250x, Dille 187, n = 9.
- Figure 6. Camera lucida drawing of the meiotic chromosomes of L. oblongifolia, Metaphase I, 2000x Dille 182, n = 9.
- Figure 7. Camera lucida drawing of the meiotic chromosomes of L. serriola, Diakinesis, 2000x, Dille 165, n = 9.
- Figure 8. Camera lucida drawing of the meiotic chromosomes of L. serriola, Metaphase I, 2000x, Dille 175, n = 9.
- Figure 9. Camera lucida drawing of the meiotic chromosomes of L. serriola, Diakinesis, 2000x, Dille 150, n = 9.

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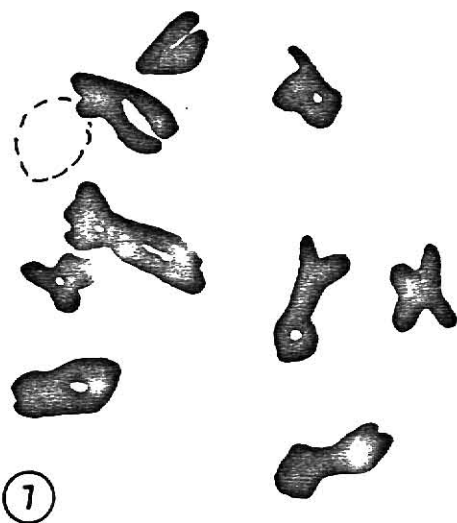
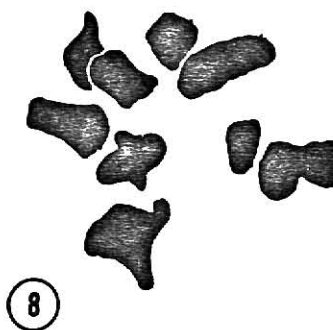
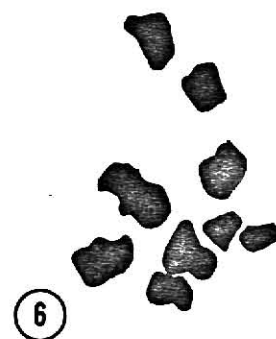
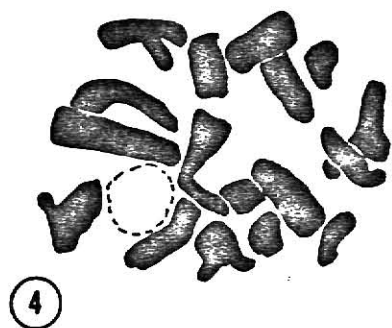


Figure 10. Karyotype of L. canadensis, 2200x, Dille 245, $2n = 34$.

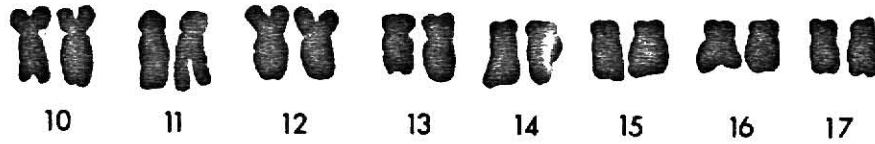
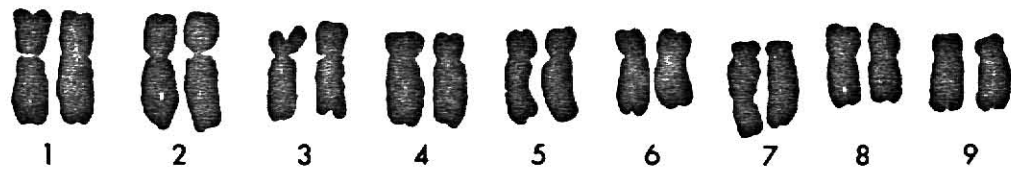
Figure 11. Karyotype of L. ludoviciana, 2200x, Dille 232, $2n = 34$.

Figure 12. Karyotype of L. biennis, 2200x, Dille 277, $2n = 34$.

Line equals 5 microns.

L. canadensis

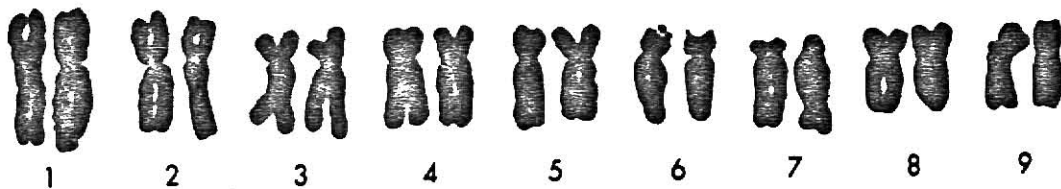
Dille 245



10

L. ludoviciana

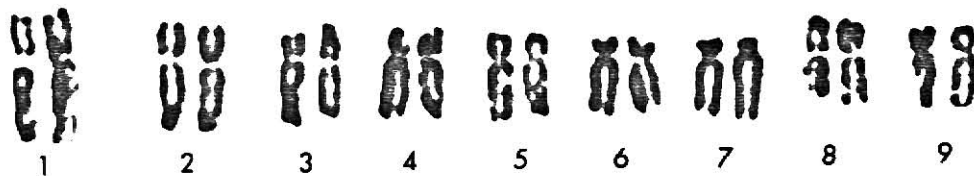
Dille 232



11

L. biennis

Dille 277



12

Figure 13. Karyotype of L. oblongifolia, 2200x, Tomb 958, $2n = 18$.

Figure 14. Karyotype of L. serriola, 2200x, Dille 230, $2n = 18$.

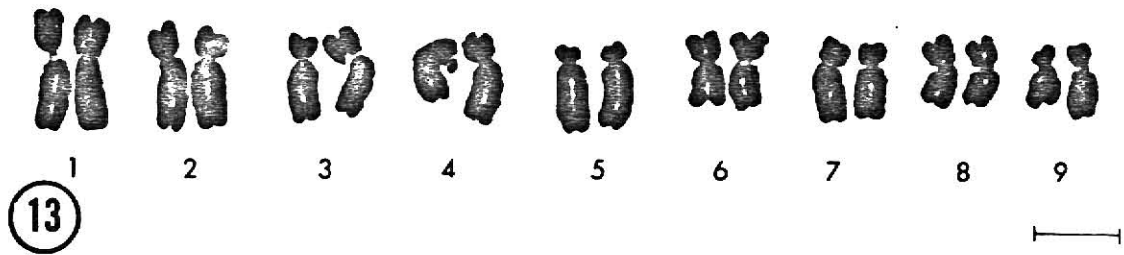
Figure 15. Karyotype of L. saligna, 2200x, Dille 216, $2n = 18$.

Figure 16. Marker chromosomes from (A) L. oblongifolia, Tomb 958, (B) L. biennis, Dille 277, and (C) L. ludoviciana, Dille 232, 2200 x.

Line equals 5 microns.

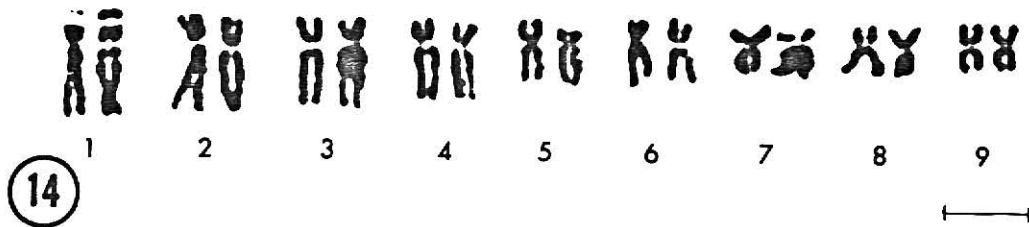
L. oblongifolia

Tomb 958



L. serriola

Dille 230



L. saligna

Dille 216



CHROMATOGRAPHIC STUDIES

Introduction. Studies of the chromatographic patterns of phenolic patterns have become a standard technique in systematic botany since the utility of this approach was dramatically demonstrated by Alston and Turner (1959), and since that time chromatographic profiles have been used to elucidate relationships at or below the generic level.

A populational study of the chromatographic patterns of the Great Plains species of Lactuca was undertaken with the goal of elucidating the interspecific relationships within the complex groups, especially within the Canadensis group. It was also hoped that a chromatographic study would help document suspected hybridization. However, the phenolic profiles of the native North American taxa are so similar that the incorporation of UV spectral data may be required before the full potential of this technique can be realized.

Materials and Methods. Bulk material was collected in the field, allowed to air dry, and ground to a fine powder in a blender. The plant material was then extracted in cold 85% methanol, agitated overnight, filtered, and kept at 0°C until use.

The extract was spotted on a 46 x 57 cm sheet of Whatman 3mm chromatography paper. The chromatograms were developed in a sealed cabinet using the standard two-dimensional decending chromatographic techniques (Mabry et al., 1970). The longer dimension was developed in 3 parts tertiary butyl alcohol: 1 part glacial acetic acid: 1 part distilled water (TBA) for 24 hours, dried, turned 90 degrees, and developed along the short dimension in 15% acetic acid (HOAC) for 5 hours. The chromatograms were then dried and examined with ultra-

violet light and with ultraviolet light in the presence of ammonia vapors. The spots were outlined, numbered, the Rf values were calculated in both solvents and the color changes in ammonia were noted (Table 3). Spots having similar Rf values and exhibiting the same color and color changes were co-chromatographed, and all spots appearing interspecifically were co-chromatographed. Co-chromatography was accomplished by cutting similar spots from two chromatograms, cutting them into small pieces, and eluting them in 85% methanol for at least four hours. The resultant extract was concentrated in a rotary evaporator, and spotted on chromatography paper. If the resultant chromatogram showed a single spot with uniform color and color change in ammonia, then the spots were considered to be the same.

Results. In this study only the spots that were purple or yellow under UV light were recorded. Spots appearing blue and green under UV light formed a complex of spots near the solvent front in HOAC that was very difficult to interpret. The composite chromatographic profiles of the populations studied (Table 5) appear in Figures 17-19, Table 3 lists the spots recognized along with their color and Rf values, and Table 4 presents the distribution of those compounds in the populations studied.

Lactuca canadensis and L. ludoviciana received the most attention in this study in the hope of elucidating the relationship between these two species. Spots 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, and 12 were found in both L. canadensis (Figure 18) and L. ludoviciana. Spot 9 and 13 were found only in L. canadensis and spot 14 was only found in

L. ludoviciana. However, spot 13 was found in only one population of L. canadensis and compound 9 was found in only two populations. Compound 14 in L. ludoviciana was found three of the six populations studied.

One population each of L. floridana and L. biennis (Figure 18) were examined for flavonoid compounds. The population of L. floridana had spots 1, 2, 3, 5, 7, and 12, and the population of L. biennis had spots 1, 2, 3, 5, 7, 8, and 12. All of these spots are found in common with L. ludoviciana and L. canadensis, and L. biennis and L. floridana differ only in the possession of spot 8 by L. biennis.

Two populations of L. oblongifolia (Figure 17) were examined and found to have spots 1, 2, 3, 5, 7, 8, 12, and 15 of which only compound 15 was not found in common with L. canadensis, L. ludoviciana, and L. biennis, and only spots 8 and 15 were not in common with L. floridana.

One population each of L. saligna and L. serriola (Figure 19) were examined. Both populations had spots 1, 2, 3, and 6 in common with L. canadensis, L. ludoviciana, L. biennis and L. floridana, and had spot 15 in common with L. oblongifolia. L. saligna had compound 11 in common with L. canadensis and L. ludoviciana but not with L. serriola. Compounds 16, 17, 18, 19, 20, 21, and 22 were common to L. serriola and L. saligna and to no other taxon examined.

Discussion. Flavonoid chemistry proved ineffective in separating L. canadensis and L. ludoviciana. However this approach has confirmed the close relationships among the native North American lactucas. One important observation from this study is the resemblance of the chromatographic pattern of L. oblongifolia to those of L. canadensis,

L. ludoviciana, L. biennis, and L. floridana. This resemblance supports the hypothesis that L. oblongifolia or a closely related species was the $n = 9$ parent of the tetraploid species (see section on Chromosomal Studies).

The two introduced species, L. saligna and L. serriola, are chromatographically distinct from the native species by virtue of having 7 spots not found in any of the natives.

The identification of the individual compounds would be a significant addition to this study and may identify species-specific compounds useful in documenting hybridization.

Table 3

Spots Recognized in Species of Lactuca Examined for Flavonoids

Spot	Color		Rf Values	
	U.V.	+NH ₃	TBA	HOAC
1	y	y	.15	.05
2	p	y	.24	.14
3	p	y	.35	.12
4	y	y	.42	.10
5	p	y	.70	.02
6	y	y	.05	.20
7	p	y	.24	.26
8	p	y	.36	.14
9	y	y	.36	.41
10	p	y	.55	.41
11	y	y	.49	.41
12	p	y	.57	.27
13	y	y	.34	.07
14	y	y	.29	.31
15	p	y	.87	.07
16	y	y	.39	.18
17	p	y	.45	.18
18	y	y	.61	.13
19	y	y	.71	.01
20	p	y	.45	.28
21	p	y	.42	.43
22	p	y	.65	.52

Table 4

Distribution of Spots in Populations of Lactuca Examined for Flavonoids

Species and population	Spot																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
<u>L. ludoviciana</u> 161*	X	X	X	X	X	X	X		X	X	X			X								
177	X	X	X	X	X	X	X	X		X	X	X										
181	X	X	X	X	X	X	X															
196	X	X	X	X	X	X	X			X	X			X								
233	X	X	X	X	X	X	X			X	X			X								
235	X	X	X	X	X	X	X	X	X	X	X	1	0	3	0	0	0	0	0	0	0	0
<u>L. canadensis</u> 156	X	X	X	X	X	X	X			X	X	X										
209	X	X	X	X	X	X	X			X	X	X										
211	X	X	X	X	X	X	X	X	X													
218	X	X	X	X	X	X	X	X	X													
225	X	X	X	X	X	X	X	X	X													
245	X	X	X	X	X	X	X	X	X													
255	X	X	X	X	X	X	X	X	X													
267	X	X	X	X	X	X	X				X		X									
280	X	X	X	X	X	X	X	6	2	3	4	2	1	0	0	0	0	0	0	0	0	0
<u>L. oblongifolia</u> 179	X	X	X	X	X	X	X	X	X			X			X							
184	1	2	2	0	2	0	2	2	0	0	0	1	0	0	2	0	0	0	0	0	0	0
<u>L. biennis</u> 275	X	X	X	X	X	X	X	X				X										
<u>L. floridana</u> 215	X	X	X	X	X	X	X					X										
<u>L. serriola</u> 174	X	X	X	X	X	X	X								X	X	X	X	X	X	X	X
<u>L. saligna</u> 153	X	X	X	X	X	X	X				X				X	X	X	X	X	X	X	X

* All collections by Dille

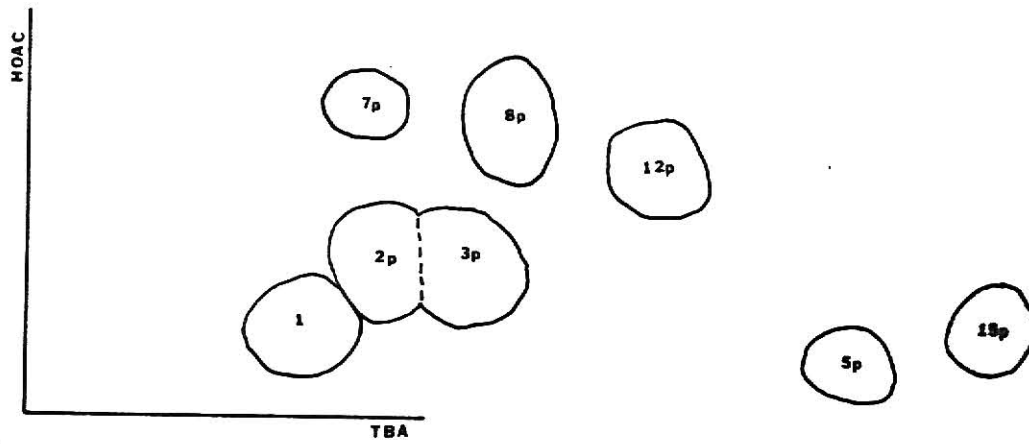
Table 5

Species by Lactuca Examined for Flavonoids by Paper Chromatography

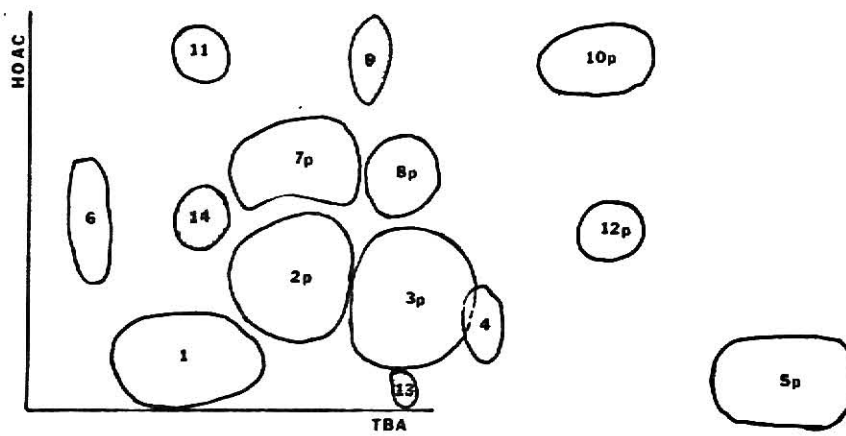
Species	Voucher Collection
<u>L. oblongifolia</u>	*D. 184, Banner Co., Nebraska (KSC) D. 179, Yuma-Kit Carson Co. Line, Colorado (KSC)
<u>L. canadensis</u>	D. 156, Chase Co., Kansas (KSC) D. 204, Osage Co., Kansas (KSC) D. 211, Osage Co., Kansas (KSC) D. 218, Coffey Co., Kansas (KSC) D. 225, Osage Co., Oklahoma (KSC) D. 245, Jackson Co., Kansas (KSC) D. 267, Monona Co., Iowa (KSC) D. 280, Lawrence Co., South Dakota (KSC)
<u>L. ludoviciana</u>	D. 161, Sedgwick Co., Kansas (KSC) D. 177, Kit Carson Co., Colorado (KSC) D. 181, Yuma Co., Colorado (KSC) D. 196, Stanton Co., Nebraska (KSC) D. 233, Dewey Co., Oklahoma (KSC) D. 235, Ford Co., Kansas (KSC)
<u>L. biennis</u>	D. 275, Lawrence Co., South Dakota (KSC)
<u>L. floridana</u>	D. 215, Coffey Co., Kansas (KSC)
<u>L. serriola</u>	D. 174, Powers Co., Colorado (KSC)
<u>L. saligna</u>	D. 153, Chase Co., Kansas (KSC)

* Collections by Dille

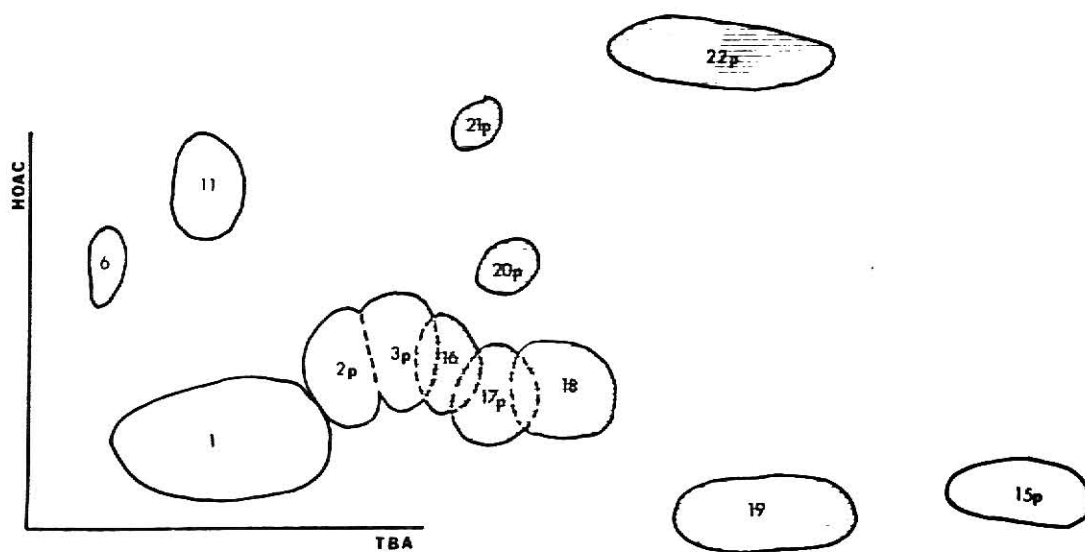
- Figure 17. Composite chromatogram of L. oblongifolia. Stippled spot found in L. oblongifolia but in none of the tetraploids.
- Figure 18. Composite chromatogram of the tetraploid species, L. canadensis, L. ludoviciana, L. biennis, and L. floridana. Spot with vertical lines found only inly L. canadensis.
- Figure 19. Composite chromatogram of L. saligna and L. serriola. Spots with horizontal lines found only in L. saligna and L. serriola.



17



18



19

POLLEN STUDIES

Introduction. Pollen morphology in the tribe Lactuceae has been shown to be a useful character in systematic studies (Stebbins, 1953; Boulos, 1973; Tomb, 1970, 1972; Tomb, Larson & Skvarla, 1974. The present study was initiated to determine the utility of pollen characters in assessing the interspecific relationships among the North American lactucas. This study used Scanning Electron Microscopy (SEM) and Light Microscopy (LM) of specimens collected in the field and from herbarium material.

Wodehouse (1935) did the first modern treatment of the pollen grains within the tribe. Pollen grains of Lactuca are characterized by a distinct and beautiful sculpturing pattern consisting of elaborate systems of spine bearing ridges. This pattern, termed echinolphate by Wodehouse (1935), is found in most of the tribes Lactuceae and Vernoneae. Some of the taxa in the Lactuceae have pollen without elaborate systems of ridges and are simply echinate (as in most of the subtribe Stephanomeriinae (Tomb et al, 1974)). The terminology used to describe the exomorphology of the grains is that of Wodehouse (1935), and the terminology used to describe pollen shape is that of Faegri and Iversen (1964).

Materials and Methods. Mature, unopened heads were obtained from herbarium specimens of Kansas State University (KSC), the University of California, Berkeley (UC), the Missouri Botanical Garden (MO) and from dried material collected in the field (Table 7).

The heads were softened in 10% potassium hydroxide overnight and acetolized in the method described by Erdtman (1960) and modified by

Faegri and Iverson (1964) (Radford et al., 1974 also describe this method). For light microscopic examination, slides with a small amount of glycerin jelly were placed on a slide warmer, a drop of water containing the pollen was mixed with the glycerin jelly, cover slipped, and the cover slip was ringed with clear fingernail polish for permanence. For SEM studies, a drop of water containing pollen was placed on double stick tape on an aluminum specimen stub, allowed to air dry, and coated with a gold-paladium alloy in an evaporator with the specimens rotating at a 45° angle with respect to the vapor source.

Measurements were made in the light microscope at a magnification of 1000x, and the dimensions were measured to the nearest micron. The equatorial diameter is the dimension used as an indicator of the average size of the grains of each taxon. Measurements were obtained from at least four populations in each species and 20 grains were measured per population. The sample, therefore, is based on 80-100 or more individual measurements for each species.

Results. The results of the pollen measurements are presented in Table 6, and the combined results for each taxon are shown in Figure 20. Table 7 lists the material used for pollen measurements and SEM photographs.

An SEM study of pollen exomorphology was done for all native North American taxa, the introduced species L. saligna and L. serriola, and the Asian species L. tatarica. Figures 22-43 are the scanning electron micrographs of these grains. A generic description of Lactuca and descriptions of the species examined follows.

Generic Pollen Description

The pollen grains of the taxa studied are echinolophate, tri- or tetracolporate, oblate in equatorial view and circular to semi-angular in polar view. The spines are restricted to the equatorial and paraporal ridges which define 15 lacunae (6 abporal, 3 poral, and 6 paraporal) in the tricolporate grains and 20 lacunae (8 abporal, 4 poral, and 8 paraporal) in the tetracolporate grains (Figure 21). The pollen of L. canadensis (Figures 22 and 23) is typical of the tetracolporate grains and the pollen of L. oblonifolia (Figures 30 and 31) is typical of the tricolporate grains. The small channels between the abporal and poral lacunae are called interlacunar gaps. The polar thickenings, the areas at each pole above the paraporal ridges, are large in the native North American taxa or small in the introduced taxa studied. The pollen of L. serriola (Figures 39 and 40) is typical of the type of polar thickening found in the introduced species studied. The spines of both the ridges and polar thickenings have globose, microperforate bases and nonperforate, acute conical apices. The apertures are colporate, annulate with the germ pores taking up most of the poral lacunae, and the colpi extend through the interlacunar gaps into the abporal lacunae.

Species Descriptions

Within each of the species groups, the pollen morphologies are similar enough to warrant description as a group.

Canadensis group (Figures 22-29) and Floridana group (Figures 33-36).

Tetracolporate, oblate in equatorial view and circular to semi-angular or rarely angular in polar view; polar thickening large, spiny

throughout in the canadensis group and mostly spineless and indented in the biennis group.

Oblongifolia group. (Figures 30 and 31)

Tricolporate (occasionally with tetracolporate grains), oblate in equatorial view and circular to semi-angular in polar view; polar thickening large, spiny throughout, and the spines are separate at the base.

Because of the close relationship of the Asian species L. tatarica to L. oblongifolia and the possibility that they may be the same species (Lindberg, 1936; Stebbins, 1939; section on Species Relationships), pollen of L. tatarica was studied to help clarify the relationship.

The pollen morphology of L. tatarica (Figures 41-43) is essentially the same as L. oblongifolia. However, no tetracolporate grains were found and the spines of the polar thickening may or may not be separate at the base. This is only a preliminary survey pending a study of other species which are closely related to L. tatarica.

Serriola group. (Figures 39-42)

Tricolporate, oblate in equatorial view and circular in semi-angular in polar view; polar thickening narrow, consisting of two parallel rows of spines.

Discussion. The native North American species of Lactuca have similar pollen sculpturing patterns yet one can, on a combination of exomorphological characters, separate them into three more or less distinct groups, and the groups are the same as those based on gross morphology (see list on p. 1). The two species of the Serriola group

studied, L. saligna and L. serriola, are distinct from the native taxa based on the narrow polar thickening of the introduced species as compared the large polar thickening of the indigenous species.

The essentially spineless polar thickening of the Biennis group may have some relationship to a polar lacuna as found in Scorzonera (Wodehouse, 1935) and some species of Sonchus (Boulos, 1973). Transmission electron microscopy of sections of pollen grains of the Biennis group needs to be done to help elucidate that possible relationship.

The appearance of tetracolporate pollen grains in L. oblongifolia was noted in material from one herbarium specimen (Fraser 373 (KSC)). The specimen is phenotypically normal, there were many distorted grains noted, and the tetracolporate condition was noted in a very small percentage of the pollen. The occurrence of tri- and tetracolporate pollen in the same plant may be a result of unreduced microgametophytes, hybridization, or other cytological anomalies. However, since no populational and cytological data are available to support any conclusions, one can only state that more populational and cytological study is needed within this and other populations that show this condition.

The North American tetraploid ($n = 17$) taxa have tetracolporate grains almost exclusively. Tricolporate grains occur in small numbers in certain aberrant plants that are possible products of hybridization (see the section on Species Relationships). Polyploidy is generally known to have the effect of increasing mean pollen diameter and the number of apertures, and this phenomenon has been well documented (Lewis, 1964; Chuang and Constance, 1969; Lewis, W.H., 1965). In the

species of Lactuca studied, the tetraploid, tetracolporate taxa had larger mean equatorial diameters than the diploid, tricolporate species (Figure 20).

The pollen of the Asian species, L. tatarica, is similar to the pollen of L. oblongifolia which certainly does not detract from the conclusions of Stebbins (1939) and Lindberg (1936) that the two entities are the same species. However, a more comprehensive study taking in other related species as well as more populations of L. tatarica is needed before any conclusions can be drawn from this data.

TABLE 6
POLLEN GRAIN MEASUREMENTS

Taxon and Population		Range of Measure- ments in Microns	Mean Eq. Dia. * in Microns	Stan- dard Devia- tion	Grand Mean	Range of Means
<u>L. oblongifolia</u>	182	36-42	39.4	1.3		
	183	37-42	39.8	1.1		
	186	40-41	40.2	.44		
	179	40-45	42.0	1.5		
	185	36-42	39.8	1.3	<u>40.3</u>	<u>39.4-42.0</u>
<u>L. canadensis</u>	156	40-55	46.4	4.4		
	211	39-45	41.8	1.9		
	212	38-43	40.1	1.5		
	214	39-42	40.6	1.0		
	246	40-42	40.3	.71		
	249	40-49	43.8	2.5		
	250	40-55	45.0	3.4		
	251	36-46	41.2	3.0		
	253	40-50	44.8	3.2		
	257	38-46	42.9	2.7	<u>43.0</u>	<u>40.1-46.4</u>
<u>L. ludoviciana</u>	ASH	37-43	34.8	1.6		
	s.n.					
	157	40-46	44.8	1.4		
	161	40-50	45.8	2.7		
	197	40-50	46.6	2.4		
	235	40-53	45.0	3.2	<u>44.9</u>	<u>39.8-46.6</u>
<u>L. biennis</u>	SENN	43-50	45.7	2.2		
	2112					
	275	45-55	49.9	3.5		
	277	40-52	44.5	3.6		
	HAS	40-45	42.3	2.2	<u>45.2</u>	<u>42.3-49.9</u>
	7215					
<u>L. floridana</u>	RLM	40-47	43.0	2.1		
	15973					
	255	44-47	45.7	1.0		
	200	40-47	44.0	2.2		
	FISH	35-41	39.4	1.4	<u>43.3</u>	<u>39.4-45.7</u>
	871					

TABLE 6 (Cont.)

Taxon and Population		Range of Measure- ments in Microns	Mean Eq. * Dia. in Microns	Stan- dard Devia- tion	Grand Mean	Range of Means
<u>L. serriola</u>	RKB	34-40	37.4	2.1		
	175					
	WM	37-40	39.1	1.1		
	s.n.					
	174	37-43	39.9	1.3		
	RJL	35-40	38.9	1.7	<u>38.4</u>	<u>37.4-39.9</u>
	1830					
<u>L. saligna</u>	RB	35-40	38.1	1.3		
	7712					
	208	33-38	36.3	1.5		
	216	33-40	37.8	1.8		
	RLM	35-40	36.6	1.3	<u>36.9</u>	<u>36.3-38.1</u>
	15972					

* Equatorial Diameter

ASH = A.S. Hitchcock (KSC)

FISH = M.C. Fish (KSC)

HAS = H.A. Stevens (KANU)

RB = Ralph Brooks (KANU)

RJL = R.J. Lemaire (KSC)

RKB = R.K. Baumgardner (KSC)

RLM = R.L. McGregor (KANU)

SENN = H.A. Senn (KANU)

WM = W. McMurphy (KSC)

All collections not preceded by initials are those of Dille (KSC).

Figure 20. Graphical representation of pollen size for the Great Plains species of Lactuca (see table 6). Horizontal lines indicate the range of the populational means. Vertical lines indicate the mean of these populational means (grand mean).

FIGURE 20

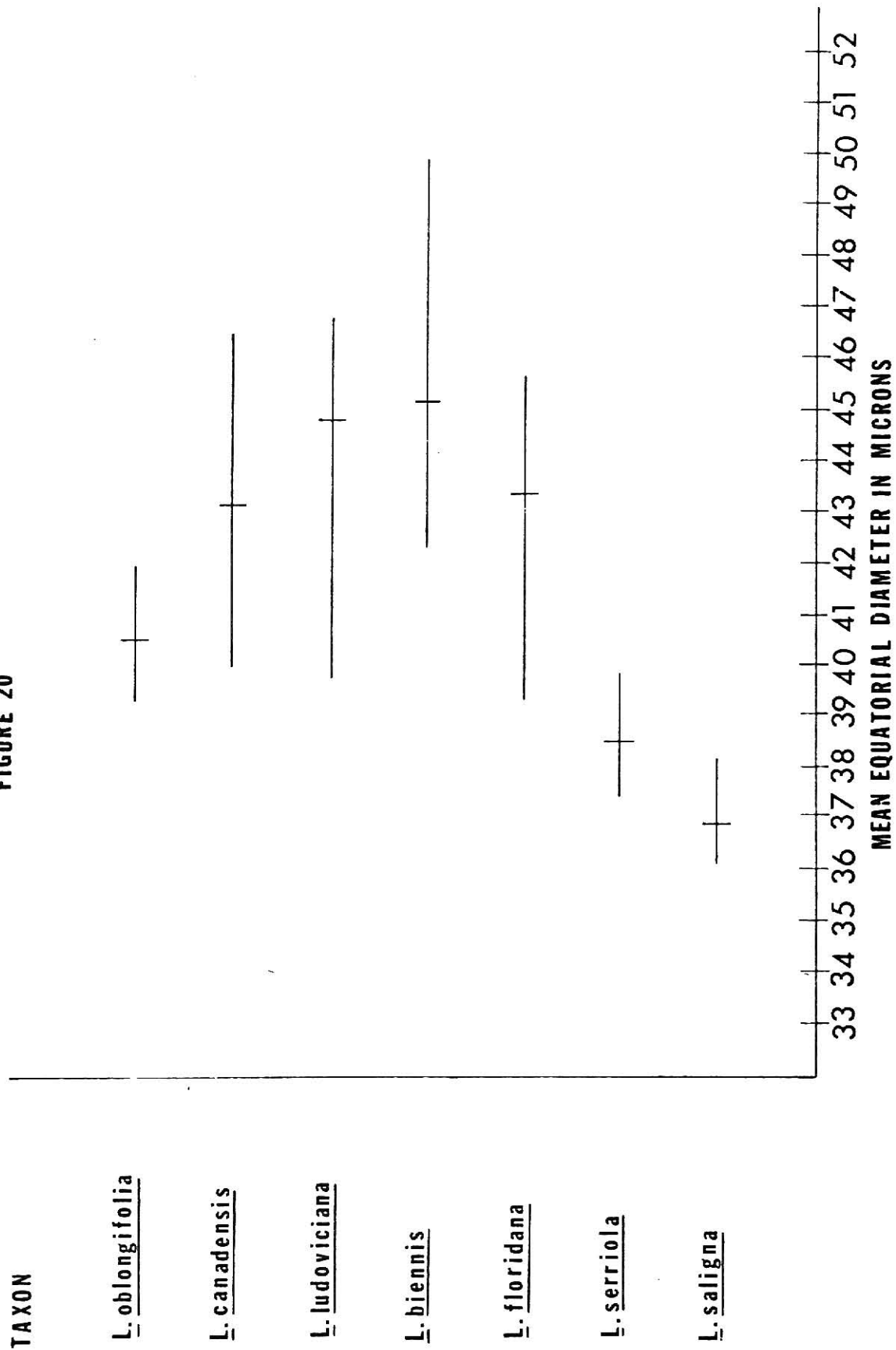
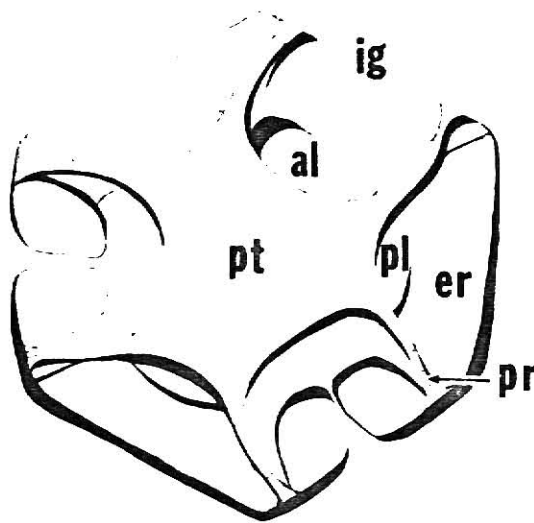


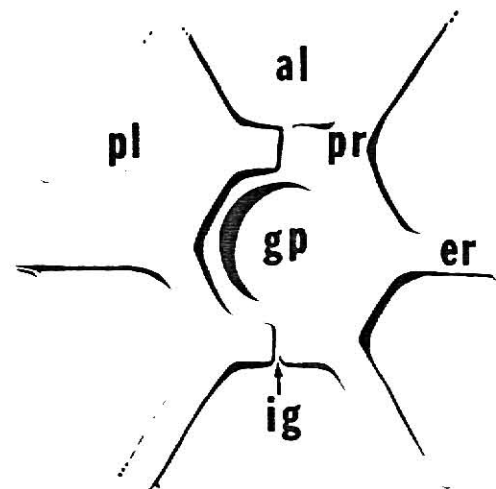
FIGURE 21

DIAGRAMS OF THE STRUCTURES OF LACTUCA POLLEN

Polar View



Equatorial View



al. abporal lacuna

er. equatorial ridge

gp. germ pore within
poral lacuna

ig. interlacunar gap

pl. paraporal lacuna

pr. paraporal ridge

pt. polar thickening

Diagrams and terminology from Wodehouse (1935)

- Figure 22. SEM micrograph of a pollen grain of L. graminifolia, polar view, 1787x, J. G. Lemmon s.n. (UC).
- Figure 23. SEM micrograph of a pollen grain of L. graminifolia, equatorial view, 1780x, J. G. Lemmon s.n. (UC).
- Figure 24. SEM micrograph of a pollen grain of L. canadensis, polar view, 2112x, Gates 15428 (KSC).
- Figure 25. SEM micrograph of a pollen grain of L. canadensis, equatorial view, 1911x, Gates 15428 (KSC).
- Figure 26. SEM micrograph of a pollen grain of L. ludoviciana, polar view, 2400x, Weber 401 (KSC).
- Figure 27. SEM micrograph of a pollen grain of L. ludoviciana, equatorial view, 2400x, Weber 401 (KSC).

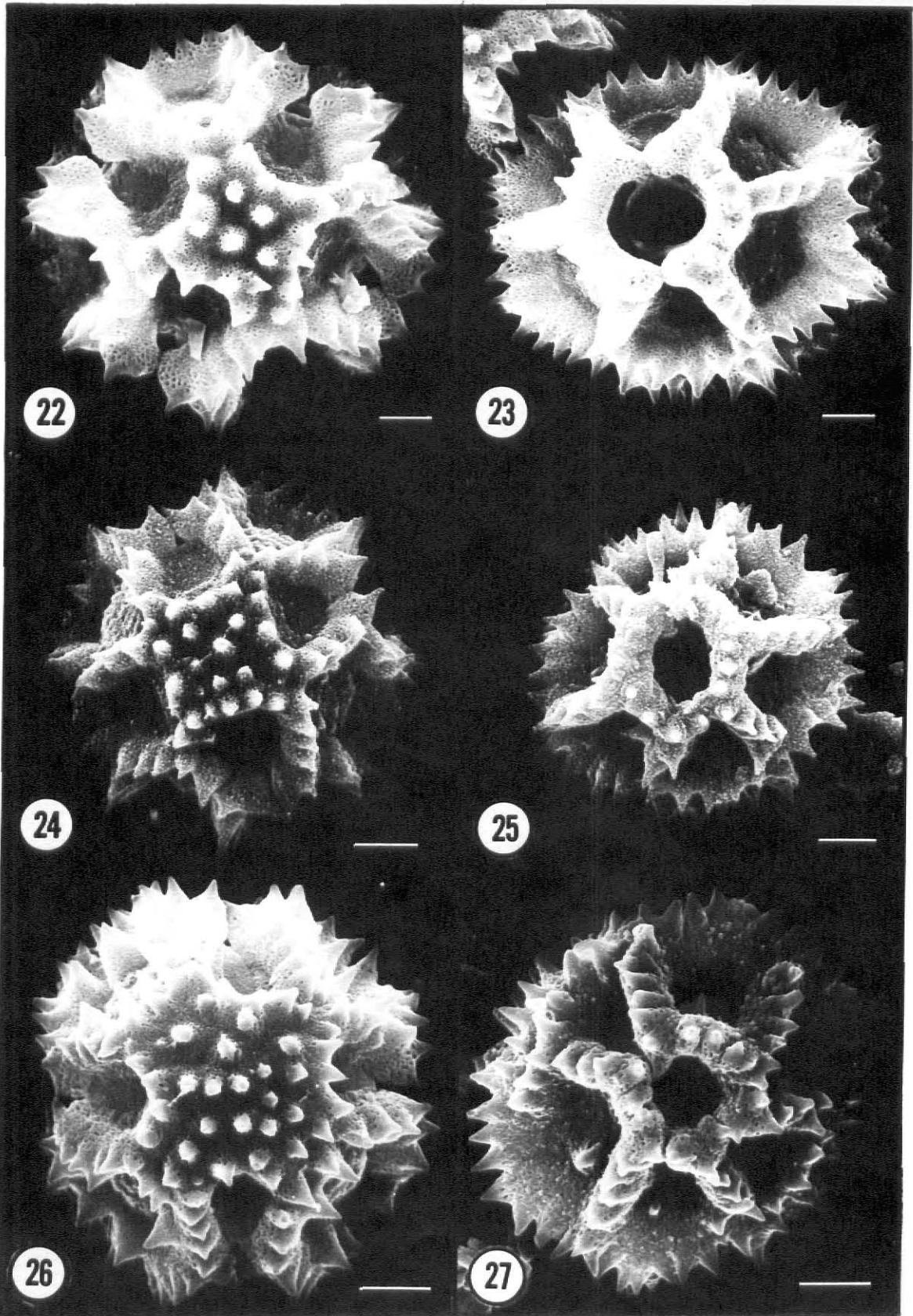
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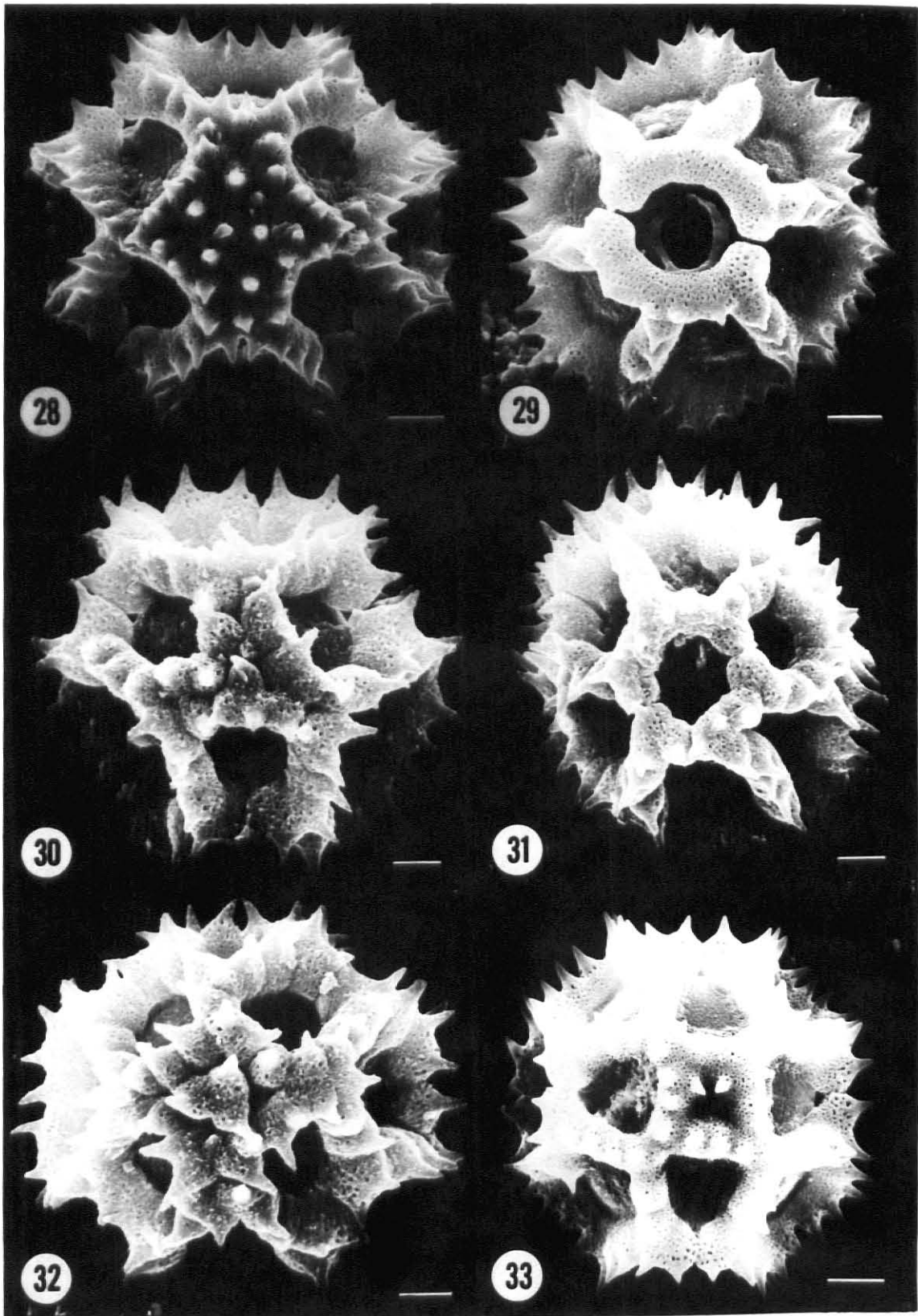
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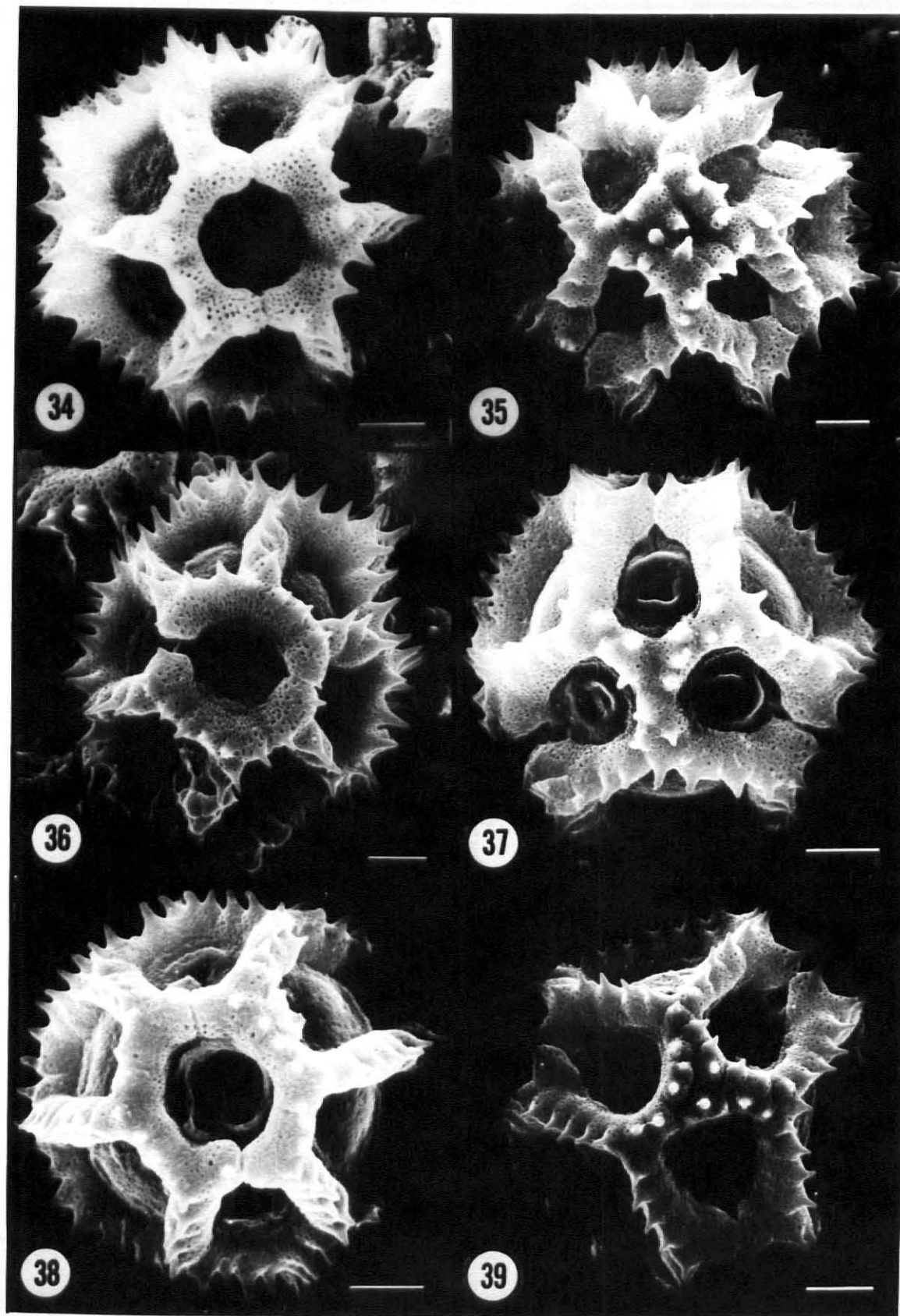
- Figure 28. SEM micrograph of a pollen grain of L. hirsuta, polar view, 1890x, Lakela 5120 (UC).
- Figure 29. SEM micrograph of a pollen grain of L. hirsuta, equatorial view, 1800x, Lakela 5120 (UC).
- Figure 30. SEM micrograph of a pollen grain of L. oblongifolia, polar view, tricolporate grain, 1584x, Fraser 373 (KSC).
- Figure 31. SEM micrograph of a pollen grain of L. oblongifolia, equatorial view, 1584x, Fraser 373 (KSC).
- Figure 32. SEM micrograph of a pollen grain of L. oblongifolia, polar view, tetracolporate grain, 1728x, Fraser 373 (KSC).
- Figure 33. SEM micrograph of a pollen grain of L. floridana, polar view, 1827x, Fraser 924 (KSC).

Line equals 5 microns.



- Figure 34. SEM micrograph of a pollen grain of L. floridana, equatorial view, 1931x, Fraser 924 (KSC).
- Figure 35. SEM micrograph of a pollen grain of L. biennis, polar view, 2053x, Senn 2112 (KANU).
- Figure 36. SEM micrograph of a pollen grain of L. biennis, equatorial view, 2053x, Senn 2112 (KANU).
- Figure 37. SEM micrograph of a pollen grain of L. saligna, polar view, 2600x, Brooks 7712 (KANU).
- Figure 38. SEM micrograph of a pollen grain of L. saligna, equatorial view, 2600x, Brooks 7712 (KANU).
- Figure 39. SEM micrograph of a pollen grain of L. serriola, polar view, 2426x, Maus 862 (KSC).

Line equals 5 microns.



- Figure 40. SEM micrograph of a pollen grain of L. serriola, equatorial view, 2545x, Maus 862 (KSC).
- Figure 41. SEM micrograph of a pollen grain of L. tatarica, polar view, 1776x, Hohenacker s.n. (MO).
- Figure 42. SEM micrograph of a pollen grain of L. tatarica, polar view, 2000x, Koelz 6988 (UC).
- Figure 43. SEM micrograph of a pollen grain of L. tatarica, polar view, 1727x, Chaney 287 (UC).

Line equals 5 microns.

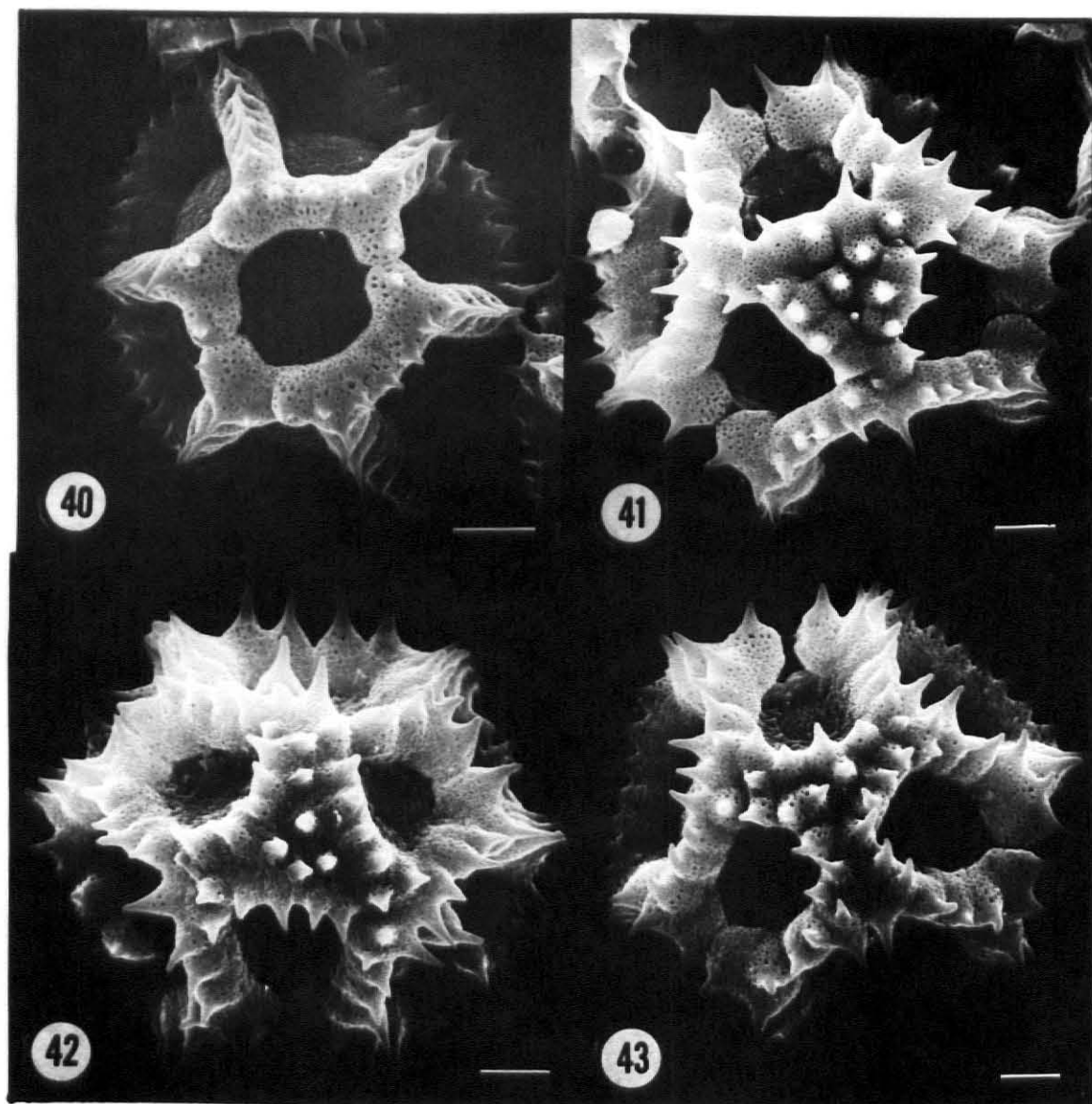


TABLE 7
SPECIMENS EXAMINED IN POLLEN STUDY

Taxon	Voucher Collection
<u>L. oblongifolia</u>	<u>Frasier 373</u> , Cloud Co., Kansas (KSC)
	* <u>D. 179</u> , Yuma-Kit Carson Co. Line, Colorado (KSC) <u>D. 182</u> , Yuma Co., Colorado (KSC) <u>D. 183</u> , Phillips Co., Colorado (KSC) <u>D. 185</u> , Banner Co., Nebraska (KSC) <u>D. 186</u> , Scott's Bluff Co., Nebraska (KSC)
<u>L. canadensis</u>	<u>D. 156</u> , Chase Co., Kansas (KSC) <u>D. 211</u> , Osage Co., Kansas (KSC) <u>D. 212</u> , Osage Co., Kansas (KSC) <u>D. 214</u> , Coffey Co., Kansas (KSC) <u>D. 246</u> , Jackson Co., Kansas (KSC) <u>D. 249</u> , Jackson Co., Kansas (KSC) <u>D. 250</u> , Jefferson Co., Kansas (KSC) <u>D. 253</u> , Atchinson Co., Kansas (KSC) <u>D. 257</u> , Nemaha Co., Nebraska (KSC) <u>Gates 15428</u> , Emmet Co., Michigan (KSC)
<u>L. ludoviciana</u>	<u>A.S. Hitchcock S.N.</u> , Ames, Iowa (KSC) <u>D. 157</u> , Chase Co., Kansas (KSC) <u>D. 161</u> , Sedgwick Co., Kansas (KSC) <u>D. 197</u> , Saunders Co., Nebraska (KSC) <u>D. 235</u> , Ford Co., Kansas (KSC) <u>Weber 401</u> , Sheridan Co., Kansas (KSC)
<u>L. biennis</u>	<u>Senn 2112</u> , Ottawa District, Quebec, Canada (KANU) <u>Stevens 7215</u> , Pennington Co., South Dakota (KANU) <u>D. 275</u> , Lawrence Co., South Dakota (KSC) <u>D. 277</u> , Lawrence Co., South Dakota (KSC)
<u>L. floridana</u>	<u>McGregor 15973</u> , Anderson Co., Kansas (KANU) <u>Fish 871</u> , Pottawatomie Co., Kansas (KSC) <u>Frasier 924</u> , Cloud Co., Kansas (KSC) <u>D. 255</u> , Doniphan Co., Kansas (KSC) <u>D. 200</u> , Waupaca Co., Wisconsin (KSC)

TABLE 7 (Cont.)

Taxon	Voucher Collection
<u>L. serriola</u>	<u>McMurphy S.N., Riley Co., Kansas (KSC)</u> <u>Baumgardner 175, Stillwater, Oklahoma (KSC)</u> <u>Lemaire 1830, Hitchcock Co., Nebraska (KSC)</u> <u>D. 174, Powers Co., Colorado (KSC)</u> <u>Maus 862, Shawnee Co., Kansas (KSC)</u>
<u>L. saligna</u>	<u>Brooks 7712, Johnson Co., Kansas (KANU)</u> <u>McGregor 15972, Anderson Co., Kansas (KANU)</u> <u>D. 208, Wabaunsee Co., Kansas (KSC)</u> <u>D. 216, Coffey Co., Kansas (KSC)</u>
<u>L. graminifolia</u>	<u>Lemmon S.N., St. Francisco Mts., Arizona (UC)</u>
<u>L. hirsuta</u>	<u>Lakela 5120, St. Louis Co., Minnesota (UC)</u>
<u>L. tatarica</u>	<u>Hohenacker S.N., in Arenosis Maritimis Prope Lankuran (MO)</u> <u>Koelz 6988, N.W. India (UC)</u> <u>Chaney 287, Outer Mongolia (UC)</u>

* refers to collections by Dille

MORPHOLOGY STUDIES

Introduction. This section deals primarily with the morphology of the achene because historically the members of the tribe Lactuceae have been finely divided on the basis of achene shape and the nature of the pappus. At times, however, these characters have been relied upon much too heavily in making taxonomic decisions, and Lactuca is no exception (Stebbins, 1937a). Stebbins (1937a) cites the following series of morphological criteria that separate Lactuca from related genera: (1) the corolla tube is more than half as long as the ligule or may equal the ligule, (2) the pappus bristles are relatively weak and at least some of the bristles are not more than four cells in thickness, (3) the achene is definitely flattened and has two prominent lateral ridges or wings, and (4) the achene may or may not be beaked, but the pappus is borne on a strongly expanded pappus disk. Anatomical data cited by Stebbins states that the ovaries of Lactuca usually have two or three (sometimes four) vascular bundles while Crepis usually has five and Prenanthes usually has between five and 18. Jeffrey (1966) cites additional characters that separate Lactuca and Prenanthes from the rest of the Lactuceae. These characters are long style arms with long, prominent collecting hairs, corolla tube glabrous or with crisped hairs in the upper part, and achenes smooth or hairy on the ribs.

Materials and Methods. An SEM study of the apicies of mature achenes was accomplished by removing the pappus bristles from the achene, separating the beak from the achene body, and mounting the beak in a drop of silver paste on an SEM specimen stub. The specimens

were then coated with a gold-palladium alloy in an evaporator with the specimens rotating at a 45° angle with respect to the vapor source.

Studies of flower morphology were accomplished by making whole mounts. Flowering heads were removed from material collected in the field by this author, soaked in Pohl's solution (1 part aerosol: 25 parts methanol: 75 parts water) for ca. 15 min, and individual florets were removed and mounted in Hoyer's solution.¹

Results. Morphological characters associated with leaf shape, flower color, and floral morphology proved to be of little taxonomic significance, and these results are reported in each species description.

A photograph of the achenes of the species of Lactuca in the Great Plains is presented in Figure 44. Figures 45 and 46 are photographs of the ranges of variation found in the size of the achenes of the Canadensis and Biennis groups. Figures 47 and 48 are photographs of achenes from each species of the Canadensis and Serriola groups in North America.

The morphology of the fruit apicies was examined with SEM, and the nature of the insertion of the pappus bristles into this area is of particular interest. The results of this study for each species will be discussed in the following paragraphs.

L. canadensis and L. ludoviciana (Figures 49 and 50) have pappus bristles that are 3-4 cells in thickness and occur in 2-3 series. The bristles are inserted laterally near the apex of the fruit.

L. oblongifolia (Figures 51 and 52) has pappus bristles that are 5-9 cells in thickness. This observation is an exception to Stebbins'

¹30 gm. gum arabic, 50 ml. water, 200 gm. chloral hydrate, and 20 ml. glycerine.

(1937a) statement that at least some of the bristles are four cells or fewer in thickness. The bristles occur in 3-4 series and are inserted laterally at the apex of the fruit.

L. serriola and L. saligna (Figures 53 and 54) have pappus bristles that are mostly two cells in thickness and occur in 2-3 series. The pappus bristles appear to be inserted distally into the fruit apex.

L. biennis and L. floridana (Figures 55-59) have heteromorphic bristles. The innermost bristles are mostly four cells in thickness and occur in 2-3 series, and the outermost bristles are much shorter and one cell in thickness (Figure 59). The pappus bristles of L. biennis (Figures 55 and 56) are inserted laterally slightly below the apex of the fruit, and the pappus bristles of L. floridana (Figures 57 and 58) are inserted laterally near the apex of the fruit.

Discussion. The characters observed in the SEM study of the fruit apices support the separation of these species into four species groups. This type of study could provide valuable new characters for making systematic decisions within the tribe Lactuceae, but the total significance of these characters will not be known until this study is broadened to include several other genera and until anatomical evidence is included to help determine the nature of this area.

- Figure 44. Photographs of achenes of the species of Lactuca in the Great Plains. L. to R., L. oblongifolia, Tomb 958; L. canadensis, Dille 266; L. ludoviciana, Dille 231; L. biennis, Dille 277; L. floridana, Stephens 63694 (KANU); L. serriola, Dille 230; L. saligna, Dille 216.
- Figure 45. Photographs of achenes of L. canadensis and L. ludoviciana showing size variation. L. to R., L. canadensis, Dille 254, 281, 211, 250; L. ludoviciana, Dille 273, 269, 234, 233.
- Figure 46. Photographs of achenes of L. biennis and L. floridana showing size variation. L. to R., L. biennis, Hitchcock s.n. (MO), Dille 277; L. floridana, Wagenknecht 3370 (KANU), Ross 245 (KSC), Stephens 83430 (KANU), Gates 18887 (KSC).
- Figure 47. Photographs of achenes of the species of the canadensis group in North America. L. to R., L. canadensis, Dille 266; L. graminifolia, Genelle and Flemming 772 (MO); L. hirsuta, Jermy s.n. (MO); L. ludoviciana, Dille 231.
- Figure 48. Photographs of achenes of the species of the serriola group in North America. L. to R., L. saligna, Dille 216; L. sativa, Marlat s.n. (KSC); L. serriola, Dille 230; L. virosa, Howell 19310 (MO).

Bottom line is millimeter scale.

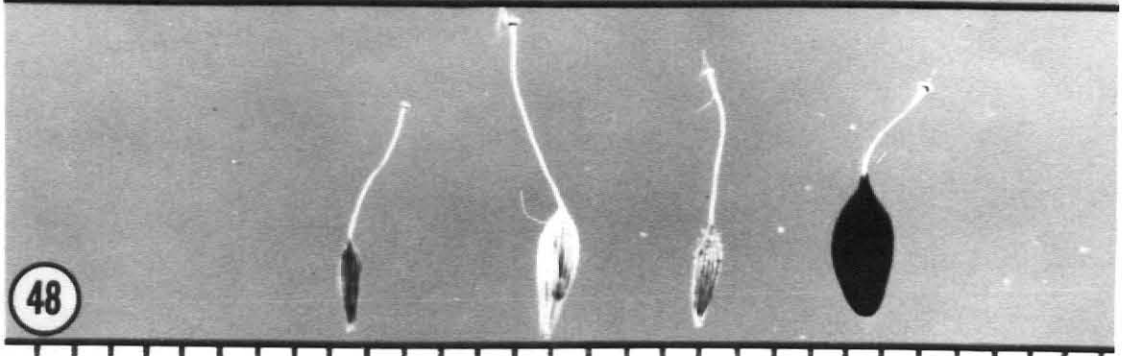
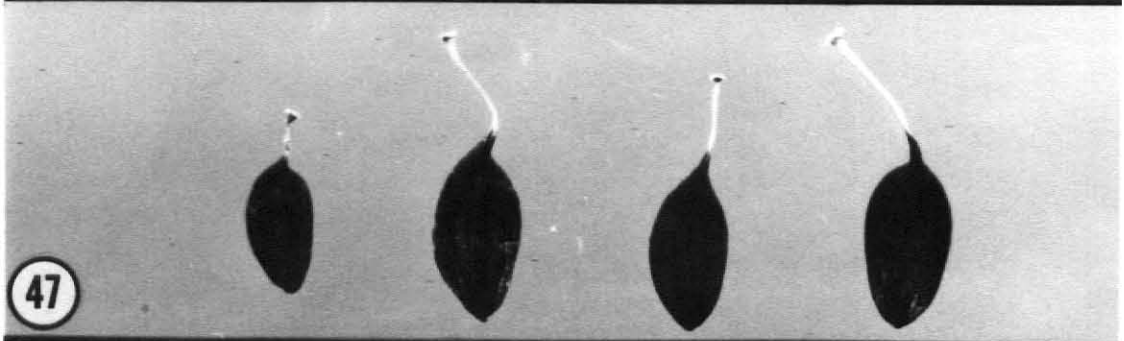
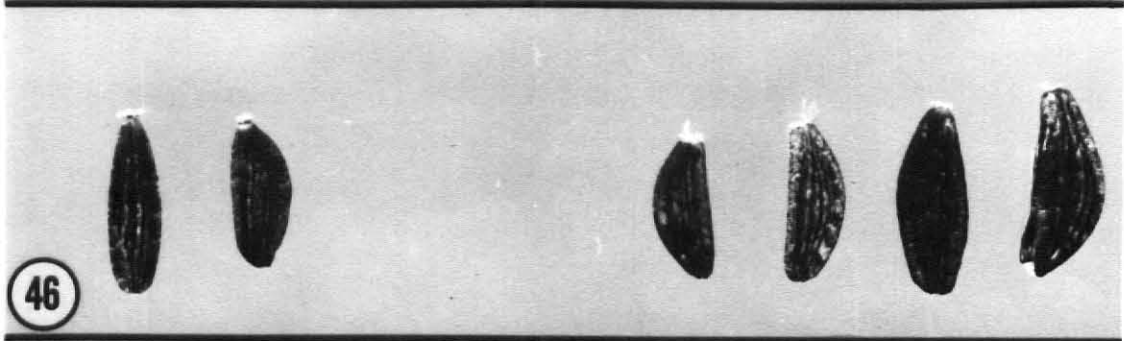
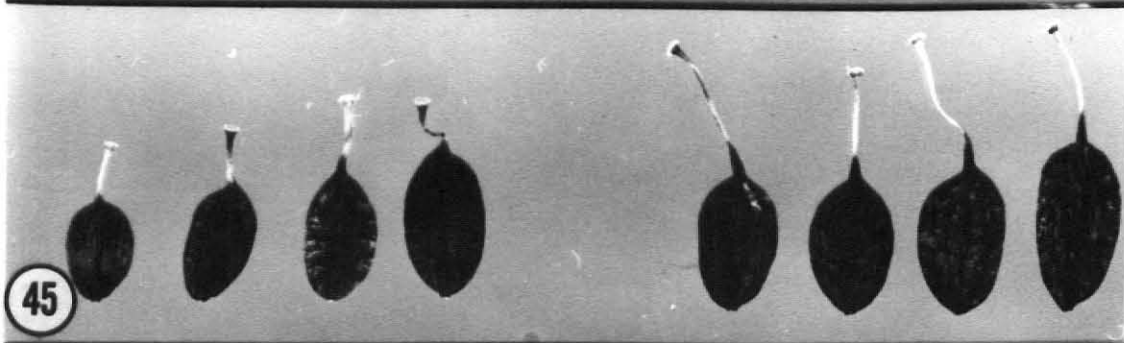
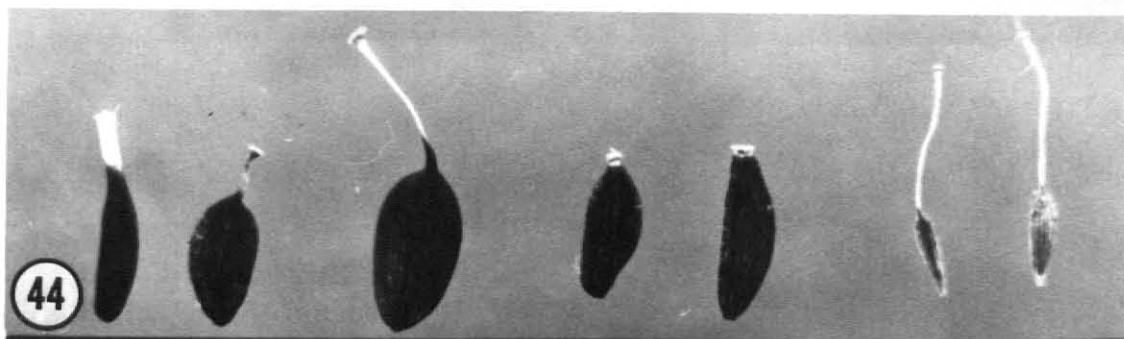


Figure 49. SEM micrograph of a fruit apex of L. canadensis, top view, 150x, Dille 214 (KSC).

Figure 50. SEM micrograph of a fruit apex of L. canadensis, side view, 150x, Dille 214 (KSC).

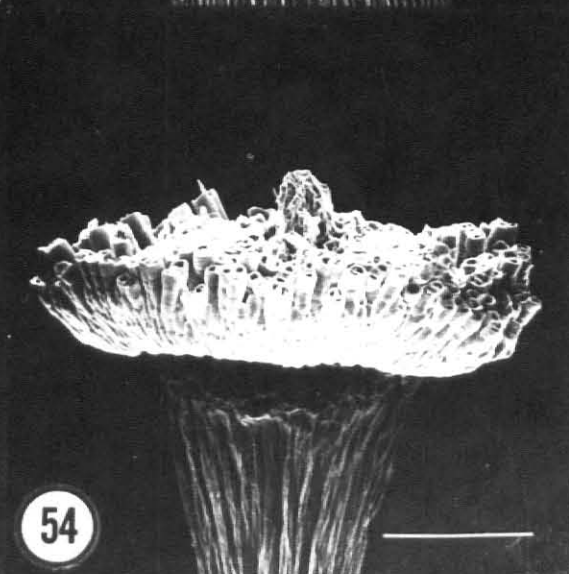
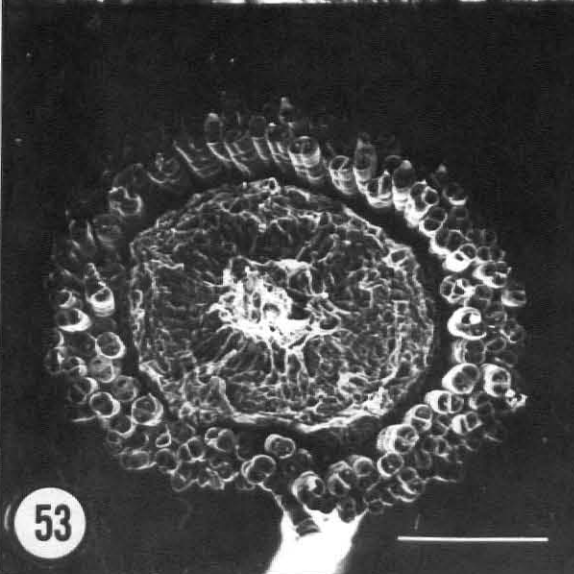
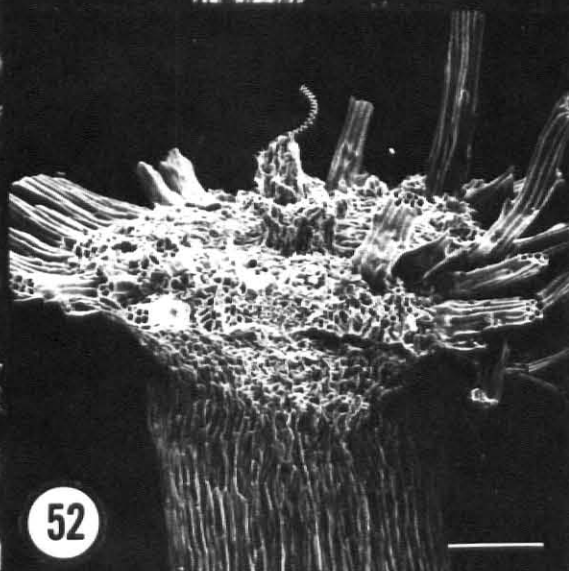
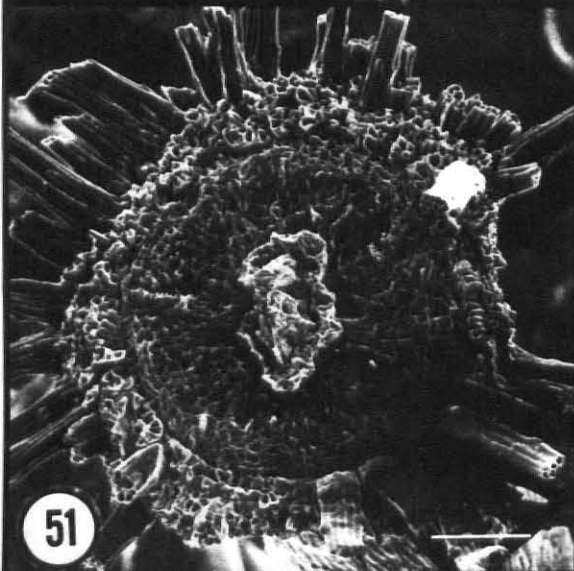
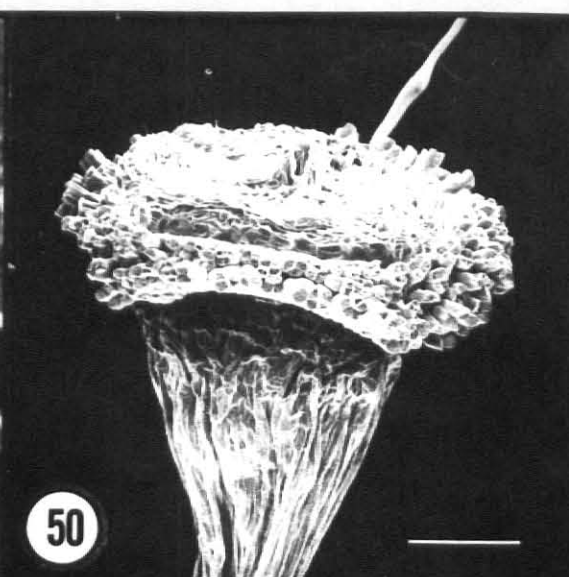
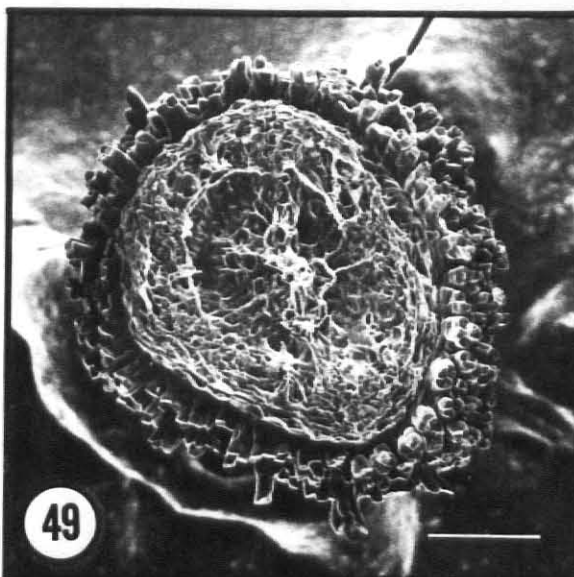
Figure 51. SEM micrograph of a fruit apex of L. oblongifolia, top view, 130x, Tomb 958 (KSC).

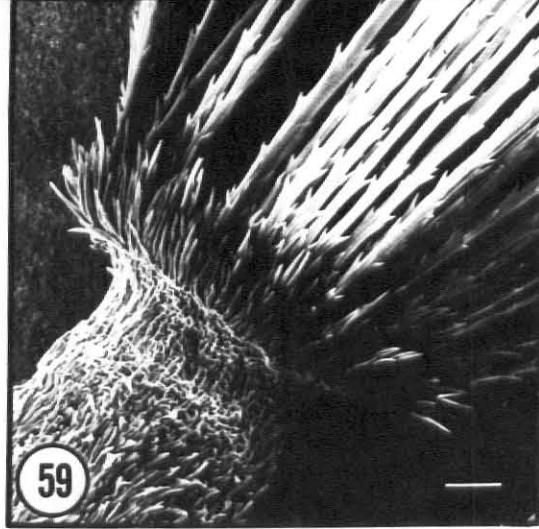
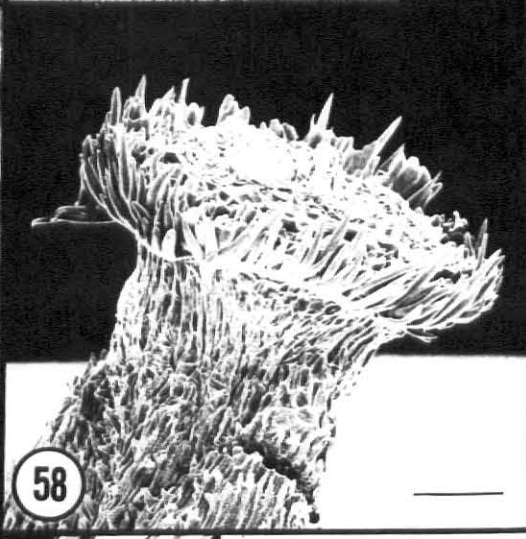
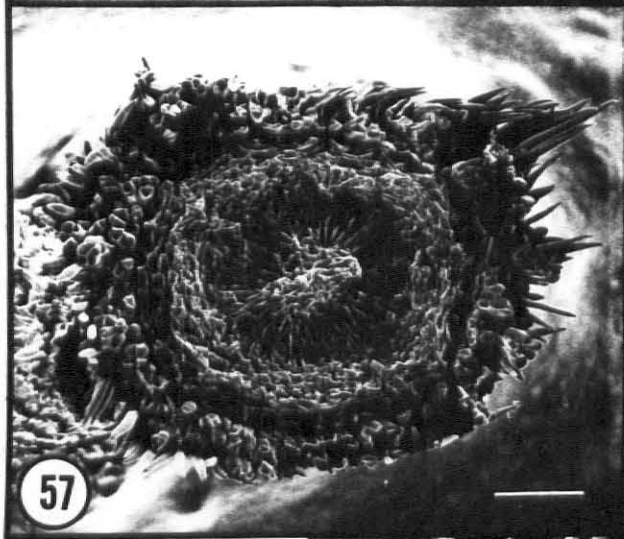
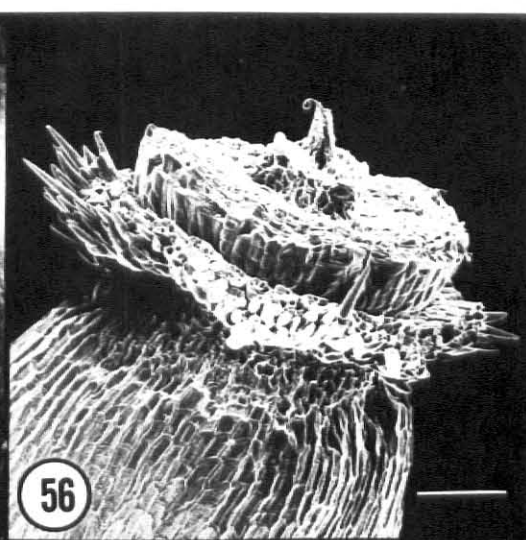
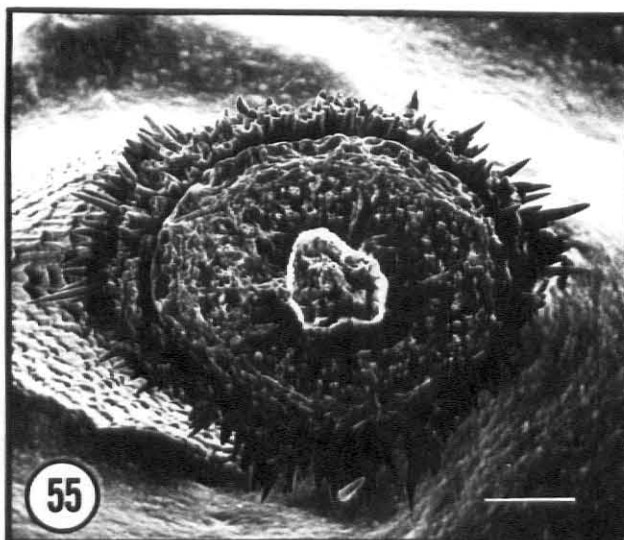
Figure 52. SEM micrograph of a fruit apex of L. oblongifolia, side view, 130x, Tomb 958 (KSC).

Figure 53. SEM micrograph of a fruit apex of L. serriola, top view, 200x, Dille 165 (KSC).

Figure 54. SEM micrograph of a fruit apex of L. serriola, side view, 200x, Dille 165 (KSC).

Line equals .1 millimeter.





- Figure 55. SEM micrograph of a fruit apex of L. biennis, top view, 120x, Dille 277 (KSC).
- Figure 56. SEM micrograph of a fruit apex of L. biennis, side view, 120x, Dille 277 (KSC).
- Figure 57. SEM micrograph of a fruit apex of L. floridana, top view, 120x, McGregor 15079 (KANU).
- Figure 58. SEM micrograph of a fruit apex of L. floridana, side view, 120x, McGregor 15079 (KANU).
- Figure 59. SEM micrograph of a fruit apex of L. floridana, side view showing short outer pappus and main pappus, 74x, Stephens 83430 (KANU).

Line equals .1 millimeter.

SPECIES RELATIONSHIPS

The North American species of Lactuca considered in this study comprise four species groups. These groups are the Canadensis group (L. canadensis*, L. ludoviciana*, L. graminifolia and L. hirsuta), the Biennis Group (L. biennis* and L. floridana*), the Oblongifolia group (L. oblongifolia*) and the Serriola Group (L. serriola*, L. saligna*, L. virosa and L. sativa). The basis for the recognition of these species groups is presented in Table 8.

The Canadensis group comprises several very closely related autogamous species all of which have a chromosome number of $n = 17$. These species are probably very interfertile as Whitaker (1944) obtained a highly fertile F_3 generation from a cross between L. canadensis and L. graminifolia. Natural hybrids are believed to occur between members of this group in areas of sympatry. J.B. Norton (in Whitaker, 1944) reports the observation of populations with plants intermediate between L. canadensis and L. graminifolia in South Carolina. These two species are temporally isolated (Thompson in Whitaker, 1944) with L. graminifolia flowering well in advance of L. canadensis so the opportunity for hybridization is kept to a minimum.

L. ludoviciana and L. canadensis are sympatric in the eastern Great Plains and hybridization between these two species is suspected. Correll and Johnston (1970) note that the two taxa intergrade or have merely contaminated each other through introgression, and two populations of apparent hybrid origin (Dille 209 and 245; Figure 60 and 61) were collected in the field. This hybridization proved very difficult to document because the two suspected parents are so close in every

* Taxa present in the Great Plains.

respect. These two unusual populations are similar and a brief description of them will be presented. However, more field study of these populations needs to be done before their nature is fully understood. These populations had plants that were "typical" L. canadensis with large dark green leaves and dense inflorescences, and other plants that were smaller, had narrow, light green leaves, and sparse inflorescences. This phase was observed to segregate out in crossing experiments by Whitaker et al., (1941). These two extremes appeared to grade into each other judging by the plants collected (Figures 60 and 61). The effect of cross-pollination on autogamous plants was noted by Stebbins (1950). He states that the progeny of such a cross, being highly heterozygous, would segregate extensively producing an explosion of variation for six to eight generations. The populations collected may represent this explosion several generations after the original hybridization. If this is the case, natural selection and inbreeding will serve to stabilize the populations, and field observations in future seasons will help elucidate the nature of these populations. It should be noted that the opportunity for hybridization between these two species is reduced because L. ludoviciana flowers two to four weeks before L. canadensis (R.L. McGregor, in verb; Johnson and Iltis, 1963).

The two species of the biennis group ($n = 17$), L. biennis and L. floridana, are autogamous, very similar morphologically and their sympatric in the eastern United States, but no hybridization has been reported between them. L. terra-nove Fern (Fernald, 1927) received no attention in this study, but according to Fernald (1927) it is allied very closely with L. biennis. Fernald described this species from one

plant he had collected in Newfoundland among a population of L. biennis, so further investigation is indicated to uncover the nature of this entity.

An intergroup hybrid between L. biennis and L. canadensis has been observed in the eastern United States and named L. morssii Robins (Robinson, 1899). This plant was not examined in this study, and a biosystematic study of this problem is indicated to fully document this hybrid. Whitaker et al. (1941) obtained hybrid plants by crossing L. canadensis with L. biennis and L. floridana, and by crossing L. graminifolia with L. floridana and L. biennis. Cytological observations of meiosis in pollen mother cells (Whitaker and Thompson, 1941) from the above hybrids showed the L. canadensis x L. biennis, L. canadensis x L. floridana, and L. graminifolia x L. floridana F_1 's to have normal pairing of 17 bivalents in almost all cells observed. The L. biennis x L. graminifolia cross produced a sterile hybrid.

The close relationships among the $n = 17$ taxa as indicated by the results of the crossing experiments and the biosystematic data presented in this study give strong evidence that the separation of the Biennis and Canadensis groups into different subgenera is not warranted. A tentative reclassification of the species examined is discussed in Appendix I.

L. oblongifolia is the only diploid, perennial and obligate outcrossing Lactuca native to North America. This species is very closely allied to the Asian species L. tatarica and has been considered a subspecies of it (Lindberg, 1936; Stebbins, 1939); however, the name L. oblongifolia is retained in this study until more biosystematic data can be gathered on this problem.

L. tatarica was used in crossing experiments by Whitaker et al. (1941) and Whitaker and Thompson (1941). The L. tatarica ($n = 9$) x L. floridana ($n = 17$) mating produced hybrids that had between 9 and 11 bivalents and 8 and 4 univalents upon cytological examination of pollen mother cells, and the L. graminifolia ($n = 17$) x L. tatarica ($n = 9$) mating produced hybrid plants that had 8 bivalents and 10 univalents.

The results of the crossing experiments and the biosystematic data presented in this study show a close relationship between L. tatarica - L. oblongifolia and the tetraploid North American taxa. This relationship gives evidence to support the hypothesis that L. oblongifolia or a closely related species was the $n = 9$ parent of the tetraploids. The possibilities for the origin of the $n = 17$ North American species will be outlined in the phylogeny section.

In North America, the Serriola group is represented by introduced species only. Lindquist (1956, 1958, 1960, a, b, c) has done extensive work on these plants because they are closely related to the cultivated lettuce, L. sativa. These taxa have a chromosome number of $n = 9$ and are distinct from L. oblongifolia and its relatives which are also $n = 9$ (Whitaker and Thompson, 1941; Whitaker et al., 1941).

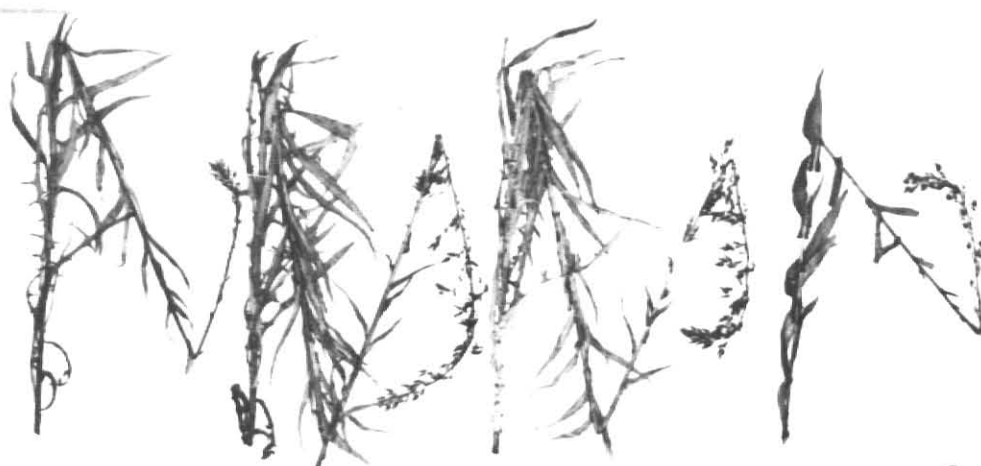
TABLE 8

COMPARISON OF THE SPECIES GROUPS OF THE LACTUCAS STUDIED

<u>Oblongifolia</u> group	<u>Canadensis</u> group	<u>Biennis</u> group	<u>Serriola</u> group
Achenes flattened with 5-6 ridges on each face; unwinged; beak short, stubby and white.	Achenes severely flattened; 1 ridge on each face; 2 lateral wings; beak filiform.	Achenes flattened with 4-5 ridges on each face; unwinged; beak absent or very short and stubby; short outer pappus present.	Achenes flattened with 5-6 ridges on each face; unwinged (winged in <u>L. virosa</u>); beak very long and filiform.
Chromosome number: $\underline{n} = 9$.	Chromosome number: $\underline{n} = 17$.	Chromosome number: $\underline{n} = 17$.	Chromosome number: $\underline{n} = 9$.
Pollen grains usually tricolporate; polar thickening large, spint throughout, spines separate at the base.	Pollen grains tetracolporate; polar thickening large, spiny throughout.	Pollen grains tetracolporate; polar thickening large, indented, essentially spineless.	Pollen grains tricolporate; polar thickening small.
Distribution: 1 sp. native to North America; most taxa are Asian.	Distribution: 4 spp. endemic to North America.	Distribution: 2 spp. endemic to North America.	Distribution: 4 spp. introduced to North America; these and related species European.
Breeding system: obligate outcrossing.	Breeding system: autogamous.	Breeding system: autogamous.	Breeding system: autogamous.
Latex color: white.	Latex color: brown.	Latex color: white.	Latex color: white.

Figure 60. Population of L. canadensis of apparent hybrid origin.
Dille 245.

Figure 61. A close-up of the two extremes of the above population.



60



61

PHYLOGENY

This section is devoted to outlining several possible routes of evolution of the native North American species of Lactuca. A major problem in elucidating the phylogeny of the North American lactucas is the determination of the origin of the $n = 17$ taxa. Determination of the progenitors of the $n = 17$ taxa is also important in understanding how the North American lactucas related to the rest of the genus on a worldwide scale.

The biosystematic evidence presented in this study and the results of crossing experiments from other studies have led to the following conclusions: (1) the $n = 17$ North American species are of amphidiploid origin most probably from a hybridization between an $n = 9$ and an $n = 8$ species, (2) the $n = 17$ taxa are very closely related to each other, and (3) L. oblongifolia is closely related to the $n = 17$ taxa, and L. oblongifolia or a closely related species was probably the $n = 9$ parent of the amphiploids. Stebbins (1939) points out that the ancestors of L. oblongifolia probably migrated across the Siberian-Alaskan land bridge in late Pliocene or Pleistocene time. The possibility of long distance dispersal of the ancestors of L. oblongifolia from Asia is also possible, but this route would have to involve two separate dispersal events because L. oblongifolia is self compatible and is not very probable. There are no $n = 17$ species of Lactuca in Asia so the assumption is made that the hybridization between the $n = 9$ and $n = 8$ species and consequent speciation of the $n = 17$ taxa occurred in North America. At the present time there are no $n = 8$ lactucas in North America. The lactucas with chromosome numbers of

$n = 8$ are all old world species and do not appear to be closely related to the new world $n = 17$ species. Consequently, the $n = 8$ probably had to come from either an extinct $n = 8$ Lactuca or from a closely related genus such as Prenanthes.

The North American members of the genus Prenanthes (base chromosome number, $x = 8$) are also believed to have migrated across the Siberian-Alaskan land bridge (Milstead, 1964). Several members of this genus would have been in an excellent geographical position to be the $n = 8$ parent of the $n = 17$ taxa. Prenanthes is considered to be in the same evolutionary line as Lactuca and closely related to it (Babcock et al., 1937; Jeffrey, 1966).

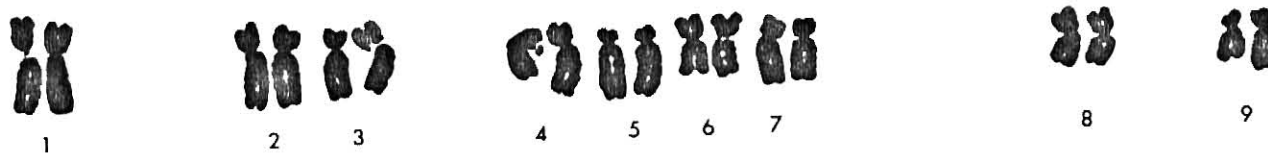
Accounting for two rather distinct yet closely related amphiploid groups presents another problem. The hybridization could have happened between the ancestral L. oblongifolia and two closely related ancestral species of Prenanthes thus starting two lines, the Canadensis group and the Biennis group, or the hybridization could have happened with one ancestral species of Prenanthes and two different segregates could have started the two lines.

A hypothetical karyotype of the $n = 8$ taxa involved in the hybridization was constructed by removing chromosome pairs from the karyotype of L. canadensis that match pairs from the karyotype of L. oblongifolia (Figure 62). Chromosome pairs 1, 3, 4, 6, 7, 8, 9, 12, and 14 of L. canadensis match pairs 1-9 of L. oblongifolia. Chromosome pairs 2, 5, 10, 11, 13, 15, 16, and 17 of L. canadensis, therefore, remain as the hypothetical $2n = 16$ karyotype. Chromosome pair 11 of this hypothetical karyotype has satellites on the short arms. This hypothesis is speculative and detailed biochemical, morphological, and karyotypic data need to be gathered before it can be vigorously supported.

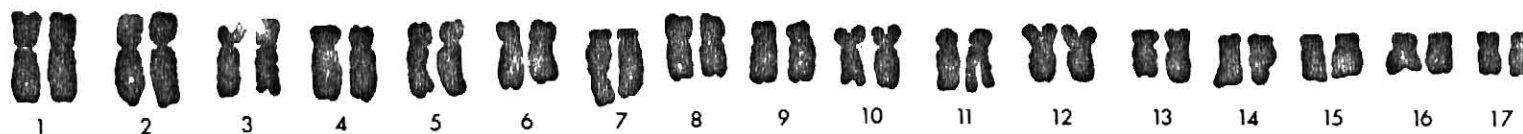
Figure 62. The derivation of a hypothetical karyotype of the $2n = 16$ species involved in the amphiploid origin of the $2n = 34$ Lactucas. Top, karyotype of the L. oblongifolia matched with similar pairs in L. canadensis, middle. Bottom, hypothetical $2n = 16$ karyotype, 1800x.

Line equals 5 microns.

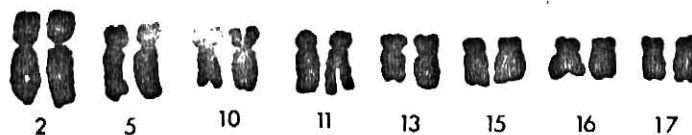
L. oblongifolia
Tomb 958



L. canadensis
Dille 245



Hypothetical
 $2n = 16$
Karyotype



SPECIES CONCEPT

Species based on morphological criteria best represent the populational systems encountered in the North American lactucas. Many of the taxa have been successfully crossed under artificial conditions, and intermediate populations have been found in areas of sympatry. In nature, though, the species generally remain distinct through a combination of temporal isolation and autogamy (most of the species are antogamous and predominantly selfing. The exception is L. oblongifolia which is self incompatible).

Adherence to a strict biological species concept (Grant, 1963) would force the lumping of entities with distinct distributions and combinations of characters. Therefore, the species recognized represent the geographical modes of morphological variation. The species of Lactuca recognized in this study are the same as those of most modern authors (Gleason and Cronquist, 1963; Steyermark, 1963; Correll and Johnston, 1970).

No infraspecific taxa are recognized in this study, and in this way the present study departs from most of the previous treatments of Lactuca. Numerous infraspecific taxa have been proposed in each of the species of Lactuca in North America, especially in L. canadensis. In this taxon Fernald (1950) and Steyermark (1963) recognize nine forms distributed in four varieties and Radloff (1961) recognizes 15 forms. These taxa are based totally on variations in leaf morphology and the amount of hair on the midrib of the lower leaves and lower stem. These characters have been shown by Thompson et al., (1941) and Whitaker (1944) to be based on single gene differences in the presence

of modifiers, and these characters segregate to the point that several of the forms recognized by Radloff (1961), Fernald (1950) or Steyermark (1963) may be found on the same plant. Intraspecific taxa must be based on distinct morphological, distributional or ecological differences (Lewis, 1963; Davis and Heywood, 1965), and although a few variations in Lactuca may approach the necessary criteria for recognition as intraspecific taxa, none are recognized in this treatment pending a more comprehensive populational study.

TAXONOMIC TREATMENT OF LACTUCA IN THE GREAT PLAINS

Lactuca Linnaeus, Sp. Pl. 795. 1753. Type Species: L. sativa Linn.

Lactuca Tournefort, Inst. 1:473 Tab 267. 1719.

Cicerbita Wallroth, Sched. Crit. Fl. Hal. 433. 1822. (pro parte)

Mulgedium Cassini, Dict. Sci. Nat. 33:296. 1824.

Agathyrsus D. Don, Edin. N. Phil. Jour. 6:310. 1828.

Galathenium Nuttall, Trans. Am. Phil. Soc., N.S., 7:442. 1841.

Wiestia Sch. Bip., Herb. and Winckl. Jahrb. Pharm. 4:154. 1841.

Herbaceous annuals, biennials or perennials; stems erect, arising singly or rarely loosely clustered in L. oblongifolia, branching only in upper third or occasionally branched from base, glabrous, hirsute or with stiff bristles; taprooted but may become fibrous at maturity; latex white or brown. Basal leaves early deciduous; lowermost cauline leaves sessile, linear-ovate to obovate or lanceolate, variously dentate or pinnatifid to deeply pinnate-lobed or runcinate; middle and upper cauline leaves about equalling the lower cauline leaves in size but frequently differing in shape; uppermost leaves reduced to bracts. Inflorescence a diffuse conical panicle, corymbose in L. oblongifolia or virgate in L. saligna. Heads few to many; cylindrical at anthesis, becoming urceolate at maturity; involucral bracts imbricate in 3-4 series, progressively longer inward; outer bracts ovate, inner bracts lanceolate, apex dark, tomentose, margin scarious; receptacle flat, naked; florets 9-45; ligule yellow, blue, violet, reddish or rarely white; corolla tube over half as long as ligule, with or without ring of hairs at summit; anther bases sagittate; pappus of capillary bristles, white or brown; beak filiform and prominent to stubby or absent;

achene body dorsiventrally compressed with prominent lateral ridges or wings. Pollen echinolophate, tricolporate or tetracolporate. $\underline{n} = 9$ or $\underline{n} = 17$.

Lactuca is the ancient name of lettuce, L. sativa. The name is derived from Lac, milk, in reference to the milky juice (Fernald, 1950).

Key to the Great Plains Species

1. Achene beak distinctly filiform, at least 2 mm long.
 2. Achene at least 2 mm wide; beak no longer than achene body; latex brown.
 3. Achene and beak 5-6 mm long; involucral bracts 8-12 mm long; pappus bristles 5-6 mm long . . .1. L. canadensis
 3. Achene and beak 7-9 mm long; involucral bracts 13-20 mm long; pappus bristles 8-9 mm long . .2. L. ludoviciana
 2. Achene about 1 mm wide; beak conspicuously longer than achene body; latex white.
 4. Achene body with conspicuous bristles at base of beak; stiff bristles present on lower stem and abaxial midrib of most leaves3. L. serriola
 4. Achene body without conspicuous bristles at base of beak; stem glabrous and abaxial midrib of leaves glabrous or merely hirsute4. L. saligna
1. Achene beak stubby, less than 2 mm long or absent.
 5. Beak whitish; involucral bracts 12-17 mm long; plants 1 m tall or less at maturity5. L. oblongifolia

5. Beak brown or absent; involucre bracts 8-11 mm

tall; plants 1.5-2(+) m tall at maturity.

6. Pappus white; involucre of 14-17 bracts . . . 6. L. floridana

6. Pappus brown; involucre of 23-25 bracts . . . 7. L. biennis

1. Lactuca canadensis Linn.

Lactuca canadensis Linn., Sp. Pl. 799. 1753. Cicerbita canadensis (Linn.) Wallr., Sched. Crit. Fl. Hal. 433. 1822. Weistia canadensis (Linn.) Sch. Bip., Herb. & Winckl. Jahrb. Pharm. 4:154. 1841. Lactuca canadensis Linn. var. typica Wieg., Rhodora 22:10. 1920. Type locality: "Habitat in Canada. Kalm." (not seen).

Lactuca longifolia Michx., Fl. Bor. Am. 2:85. 1803. Lactuca elongata Muhl. & longifolia (Michx.) T. & G., Fl. N. Am. 2:496. 1843. Lactuca canadensis Linn. var. longifolia (Michx.) Farwell, Mich. Acad. Sci. 2:45. 1923. Type locality: "Hab in Carolina Superiore." (not seen).

Sonchus pallidus Willd., Sp. Pl. 3:1521. 1804.

Lactuca elongata Muhl., in Willd. Sp. Pl. 3:1525. 1804. Cicerbita elongata (Muhl.) Wallr., Sched. Crit. Fl. Hal. 433. 1822. Galathenium elongatum (Muhl.) Nutt., Trans. Am. Phil. Soc., N.S., 7:430. 1841. Lactuca canadensis Linn. var. elongata (Muhl.) Farwell, Mich. Acad. Sci. 2:45. 1923. Type locality: "Habitat in Pennsylvania." (not seen).

Lactuca sagittifolia Elliot, Sketch 2:253. 1823.

Lactuca integrifolia Bigelow, Fl. Bost. ed. 2. 287. 1824. Galathenium integrifolium (Bigel.) Nutt., Trans. Am. Phil. Soc., N.S., 7:430. 1841. Lactuca elongata Muhl. var. integrifolia (Bigel.) T. & G., Fl. N. Am. 2:296. 1843. Lactuca canadensis Linn. var. integrifolia (Bigel.) Gray, Gray Man. ed. 5. 281. 1896. Not Lactuca integrifolia Nutt., Gen. 2:124. 1818.

Lactuca canadensis Linn. var. latifolia O. Ktze., Rev. Gen. 1:349. 1891.

Lactuca canadensis Linn. var. angustifolia O. Ktze., Rev. Gen. 1:349. 1891.

Lactuca canadensis Linn. var. montana Britton, Brit. & Brn. Illus. Fl. 3:274. 1898. Type Localities: "Pocono Mt., Penn. and Catskill Mts. N.Y." (not seen).

- Lactuca steelei Britton, Man. Fl. Ne. States and Can. 899. 1901.
Lactuca canadensis Linn. var. obovata Wieg. f. steelei (Britton)
 Fern., Rhodora 40:481. 1938. Type coll.: E. S. Steele, near
 Washington, D.C., July 10, 1897. (not seen)
- Lactuca canadensis Linn. var. albocaerulea Farwell, Mich. Acad. Sci.
 19:250. 1917. Lactuca canadensis var. longifolia (Michx.)
 Farwell f. albocaerulea Farwell, Mich. Acad. Sci. 2:45. 1923.
- Lactuca canadensis Linn. var. typica Wieg. f. angustipes Wieg., Rhodora
 22:10. 1920. Lactuca canadensis Linn. var. longifolia (Michx.)
 Farwell f. angustipes (Wieg.) Farwell, Mich. Acad. Sci. 3:108.
 1924. Type Coll.: Eames & Wiegrand, Sheldrake, Cayuga Co., New
 York (N.Y. St. Coll. Ag., not seen)
- Lactuca canadensis Linn. var. integrifolia (Bigel.) Gray f. angustata
 Wieg., Rhodora 22:11. 1920. Lactuca canadensis Linn. var.
canadensis f. angustata (Wieg.) Steyerl., Fl. Mo. 1640. 1963.
 Type Coll.: C. H. Bissel 333, Southington, Conn., 1892 (GH, not
 seen).
- Lactuca canadensis Linn. var. obovata Wieg. Rhodora 2:11. 1920. Type
 Coll.: G. W. Stevens 1812, Kay Co., Oklahoma, 1913 (GH, not seen).
- Lactuca canadensis Linn. var. spinulosa Jennings, Ann. Carnegie Mus.
 13:444. 1922. Type Coll.: Jennings, 1 mi N. Glenshaw, Allegheny
 Co., Pennsylvania, July 21, 1918 (CM, not seen).
- Lactuca canadensis Linn. var. laciniata Farwell, Mich. Acad. Sci.
 2:45. 1923.
- Lactuca canadensis Linn. var. latifolia O. Ktze. f. pallida Farwell,
 Mich. Acad. Sci. 3:108. 1924.
- Lactuca canadensis Linn. var. latifolia O. Ktze. f. villicaulis Fern.
 Rhodora 41:574. 1939. Type Coll.: Fernald and Long 8903,
 Dinwiddle Co., Virginia, July 16, 1938 (GH-Holotype, PH, not
 seen).

Herbaceous biennial (.5) 1-2 (3) m tall; stem glabrous or rarely
 hirsute; latex brown. Basal and lower cauline leaves highly variable,
 sessile, often falcate, linear-ovate, obovate to ovate, variously
 weakly dentate or pinnatifid to deeply pinnate-lobed, margins ciliolate,
 base sagittate to cuneate, 20-30 cm long, 5-15 cm wide, abaxial midrib
 often hirsute; middle and upper cauline leaves linear-ovate, obovate

to ovate or lanceolate, variously subentire to pinnate-lobed, margin ciliolate or rarely glabrous, base sagittate to cuneate, abaxial midrib glabrous. Inflorescence a diffuse, conical panicle of 50-100(+) heads. Heads cylindric, involucre bracts 17, 8-9 mm long at anthesis, 11-12 mm long in fruit; florets 17-22; ligule reddish at the apex becoming yellow at the base or entirely yellow in the eastern portion of the range, 3.5-4 mm long; corolla tube 4-4.5 mm long with a ring of hairs at the summit; anthers yellow, exerted ca. 2 mm; style branches reddish, exerted ca. 1 mm beyond anther tube; pappus white, in 3-4 series, each bristle 5-6 mm long, 3-4 cells thick; beak filiform, 2-2.5 mm long; achene body dk. brown, 3(4) mm long, ca. 2 mm wide, dorsiventrally compressed with prominent lateral wings and a conspicuous ridge on the abaxial and adaxial surfaces. Pollen tetra-colporate. $\bar{n}$ = 17.

Common in forest clearings and margins from Manitoba and e. Texas east to Nova Scotia and n. Florida. It flowers in July and August.

REPRESENTATIVE SPECIMENS

IOWA: Burden Co.: 1 mi. W. Hillsboro, 1 Sep 1952, Davidson 118 (SMU). Clinton Co.: near Toronto, 18 June 1956, Cooperrider 2088 (SMU). Harrison Co.: Iowa 183 2 mi N. Pisqa, 18 Aug 1975, Dille 264 (KSC). Keokuk Co.: 8 June 1953, Davidson 262 (SMU). Louisa Co.: 13 Sep 1953, Davidson 1320 (SMU). Monona Co.: Iowa 183 1 mi S. Soldier, 18 Aug 1975 Dille 267 (KSC). Warren Co.: Lake Ahquabi State Park, 4 July 1957, VanBruggen 2627 (SD).

KANSAS: Allen Co.: 17 July 1896 Hitchcock s.n. (KSC). Anderson Co.: 3 mi N. Garnett, 13 Aug 1960, McGregor 15963 (KANU). Atchison Co.: Atchison Co. State Lake, 17 Aug 1975, Dille 253 (KSC). Bourbon Co.: 11 Aug 1975, Clothier & Whitford s.n. (KSC). Brown Co.: Aug 1925, Garner s.n. (KSC). Butler Co.: July 1893, Eggert s.n. (MO). Chase Co.: 1.7 mi W Cottonwood, 7 July 1975, Dille 156 (KSC). Chautauqua Co.: 4.5 mi W. Peru, 21 Sep 1974, Stephens 83195 (KANU). Cherokee Co.: 23 July 1937, Jacobs 41 (KSC); 3 mi. N. Galena, 10 Aug 1964 Kolstad 1869 (KANU). Cloud Co.: 1930 Fraser 371 (KSC). Clay Co.:

1929, Weber 166 (KSC). Coffey Co.: K31 2 mi E Jct. 75-31, 11 Aug 1975, Dille 214 (KSC). Cowley Co.: Cowley Co. State Lake, 8 July 1966, Stephens 6593 (KU). Crawford Co.: Sep 1939, Ross 244 (KSC); .5 mi W. Opolis, 12 Aug 1971, Stephens 50873 (KANU). Doniphan Co.: 31 July 1897, Clothier & Whitford s.n. (KSC); .5 mi N. White Cloud, 16 Aug 1960, McGregor 16005 (KANU). Douglas Co.: 20 July 1887, Kellerman s.n. (KSC). Elk Co.: .5 mi NE Longton, 16 Aug 1964, Kolstad 1571 (KANU). Gove Co.: near Park, 1945, Weber s.n. (KSC). Greenwood Co.: 1 mi W 6 mi N Fall River, 31 July 1974, Base 2649 (KANU). Jackson Co.: 1 mi S Denison, 17 Aug 1975, Dille 247 (KSC). Jefferson, Co.: 3.6 mi S. Valley Falls on K4, 31 July 1965, Barker 1686 (KANU). Labette Co.: 18 Aug 1897, Clothier & Whitford s.n. (KSC). Leavenworth Co.: 1 mi SW Reno, 31 July 1972, Brooks 3995 (KANU). Linn Co.: 17 July 1887, Kellerman s.n. (KSC). Montgomery Co.: Montgomery Co. State Lake, 17 Aug 1972, McGregor 24606 (KANU). Morris Co.: Aug 1895 Hitchcock s.n. (KSC). Nemaha Co.: 1.6 mi SW & 2.3 mi S Goff, 20 Aug 1969, Magrath 4513 (KANU). Neosho Co.: 2 mi N. erie, 14 July 1964, Holland 691 (KANU). Osage Co.: 18 July 1896, Brown s.n. (KSC); Osage Co. State Lake, 2 Sep 1972, Stephens 59998 (KU). Pottawatomie Co.: 2 mi W, 2 mi N. Manhattan. 22 Sep 1967, Barker 4817 (KANU); 31 July 1895, Norton 313 (KSC). Republic Co.: 15 Aug 1961, Morley 1309 (SMU). Saline Co.: N.E. Salina, 28 July 1930, Hancin 570 (KSC). Shawnee Co.: 2 mi E #24 cutoff Topeka, 5 Aug 1949, Volle 423 (KANU). Topeka, 5 Aug 1949, Volle 423 (KANU). Wabaunsee Co.: 21 July 1927, Maus s.n. (KSC). Wilson Co.: 20 July 1896, Haller s.n. (KSC). Woodson Co.: 29 Aug 1897, Clothier & Whitford s.n. (KSC). Wyandotte Co.: 16 Aug 1896 Mackenzie s.n. (KSC).

MINNESOTA: St. Louis Co.: Bass Lake, 14 Aug 1942, Lakela 5120 (SMU).

MISSOURI: Boone Co.: US 63 about 5 mi. N. Columbia, 1 July 1966, Henderson 66-553 (KANU). Cass Co.: 4½ mi east 1½ mi South Harrisonville, 1 Aug 1961, Richards 3310 (KANU). Christian Co.: 4 mi. SE Chadwick, 7 July 1937, Steyermark 23085 (MO). Clinton Co.: 6 mi. S Cameron, 27 Aug 1934, Steyermark 14907 (MO). Dallas Co.: E Buffalo, 17 July 1934, Steyermark 13568 (MO). Dent Co.: 5 mi. NW Stone Hill, 6 Aug 1936, Steyermark 12655 (MO). Franklin Co.: Gray Summit, 13 Aug 1972, Shea 267 (MO). Hickory Co.: E Jordan, 10 July 1934, Steyermark 13317 (MO). Hawell Co.: 5 mi. NE Peace Valley, 12 Aug 1934, Steyermark 14470 (MO). Jackson Co.: Courtney, 21 Aug 1896, Bush 225 (MO). Jefferson Co.: 4 mi. NW Festus, 20 June 1929, Steyermark 1264 (MO). Lincoln Co.: 2 mi. W. Poley, 22 Sept 1932, Steyermark 8623 (MO). Mississippi Co.: 12 mi. SW Wolf Island, 3 Oct 1932, Steyermark 8089 (MO). St. Genevieve Co.: N. Nations Mills, 21 Aug 1936, Steyermark 21117 (MO). Taney Co.: 2 Aug 1961, Richards 3375 (KANU); 2 mi. N. Miney, 29 May 1938, Steyermark 5547a (MO).

NEBRASKA: Cass Co.: 18 Aug 1975, Dille 260 (KSC). Lancaster Co.: Hy77-10 mi South Lincoln, 21 Aug 1975, Dille 281 (KSC). Nemaha Co.: Hy73-Hy75 4.5 mi S. Auburn, 17 Aug 1975, Dille 257 (KSC). Otoe Co.: Hy 73 5 mi N. Nebraska City, 18 Aug 1975, Dille 254 (KSC). Richardson Co.: Salem Fairground, 14 Sept 1974, Shildneik 7179 (KANU). Sioux Co.: 5 mi. NW Harrison, 12 Aug 1967, Stephens 16347 (KANU). Washington Co.: ¼ mi W Arlington, 8 Sept 1972, Stephens 60735 (KANU); 2 mi. N Ft. Calhoun, 18 Aug 1975, Dille 263 (KSC).

OKLAHOMA: Atoka Co.: 3 2/3 mi SW Caney, 23 July 1949, Cory 56828 (KANU). Bryan Co.: Lake Texoma, 12 June 1963, Taylor, Taylor 1830 (OKL); Bottomland land Blue R., 24 Jun 1967, Taylor, Taylor 4105 (OKL, SMU). Canadian Co.: 10 Sept 1960, C. Taylor 373 (OKL). Cherokee Co.: 1/2 mi. N 1 mi. W of Peggs, 20 July 1958, Wallis 7633 (SMU, OKL). Craig Co.: U.S. 60 3 1/2 mi W of U.S. 66, 12 Aug 1975, Dille 222 (KSC). Cleveland Co.: Norman, 25 Oct 1936, Hopkins 1104 (OKL). Creek Co.: Fischer, 30 Oct 1913, G.W. Stevens 2960-M (OKL). Delaware Co.: 3 mi. W 2 mi. N. State Line, 27 July 1949, Waterfall 9185 (OKL); 1/2 mi S. Little Kansas, 13 July 1958, Wallis 7593 (SMU, OKL). Le Flore Co.: 6 mi N. 8 mi W. Big Cedar, 19 Aug 1968, Stephens 27825 (KANU). Logan Co.: 1 mi N. Jct 35 and 33 on Hy 33, 10 July 1966, Croat 2487 (KANU). Marshall Co.: Lake Texoma, 16 Aug 1950, Basler SN (OKL); 1/2 mi N. Willis, 11 July 1955, Goodman 6137 (OKL); 4 1/2 mi N Willis, 25 July 1960, C. Taylor 354 (OKL). Mayes Co.: 5 mi E 1 3/4 mi N. Maize, 4 July 1969, First 27 (OKL); 4.8 mi NE Locust Grove, 21 July 1957, Willis 5250 (SMU). McCurtain Co.: 1/2 mi E Broken Bow, 20 July 1947, Waterfall 7629 (OKL). Murray Co.: Platte N.P., 19 July 1957, Goodman 6504 (OKL). Muskogee Co.: 4 mi SE Braggs, 14 July 1950, Kondos 108 (KANU); 11 Sept 1927, Little 2772 (OKL). Nowata Co.: US 60 17.2 W U.S. 66, 12 Aug 1975, Dille 223 (KSC); Oklahoma Co.: Lincoln Park, 17 July 1927, Meyers 475 (OKL); 2 mi E Woods, 25 Aug 1941, Waterfall 3542 (OKL). Osage Co.: Hy 99 2 mi SW Hy. 60, 12 Aug 1975, Dille 225 (KSC). Ottawa Co.: Hy 60 2.2 W Hy 37, 12 Aug 1975, Dille 220 (KSC). Payne Co.: Hy 35 8.7 W Hy. 18, 12 Aug 1975, Dille 224 (KSC). Pontotoc Co.: 1 mi NW Ada, 29 July 1950, Alder SN (OKL). Sequoyah Co.: 7 1/2 mi NE Gore, 13 July 1958, Wallis 7547 (SMU, OKL). Tulsa Co.: Mohawk Park, 11 Aug 1957, Clark 509 (OKL).

SOUTH DAKOTA: Lawrence Co.: Spearfish Canyon, 19 Aug 1975, Dille 274 (KSC). Roberts Co.: 8 mi W 6 mi N. Sisseton, 23 July 1967, Stephens 14538 (KANU). Union Co.: Mo. river flood plain, 1 Sept 1961, Eslick SN (SD); I 29 4.5 mi S SD 50, 18 Aug 1975, Dille 208 (KSC).

L. canadensis is by far the most variable of the North American lactucas, and many infraspecific taxa have been described on the basis of variation in leaf morphology. There are four phases with perhaps as many intermediate individuals as there are 'distinct' members of each phase. Little distributional data are available for these phases and they often grow in mixed populations.

The phase with lanceolate upper cauline leaves and unlobed lower cauline leaves is probably the phase upon which Linnaeus based the species (Farwell, 1923). Linnaeus (1753) described L. canadensis as

follows: "Foliis lanceolato-ensiformibus dentatis intermibus." The names L. integrifolia and L. sagittifolia are based on this phase.

The phase with obovate upper cauline leaves and unlobed lower cauline leaves has been recognized as var. obovata. This phase grades completely into the preceeding one with no distinct break.

The phase with lobed lower cauline leaves having linear-falcate lobes is the basis for the names var. typica and L. longifolia. The upper cauline leaves of this phase may be pinnatifid, lanceolate, or obovate.

The fourth phase with lobed lower cauline leaves having broad triangular lobes has been recognized as var. latifolia and L. elongata. The upper cauline leaves of this phase may be ovate, obovate or lanceolate, and the very lowermost cauline leaves may be pinnatifid. These lowermost leaves, on the botton 3-4 inches of the stem, are deciduous early in the season.

Two geographically distinct phases based on flower color also exist in this species. In the Great Plains and as far east as St. Louis the flower color is always reddish or orange, and farther east, the flower color is brilliant yellow. The areas of sympatry of these two phases have not been determined.

2. Lactuca ludoviciana (Nutt.) Riddell

Sonchus ludovicianus Nutt., Gen. 2:125. 1818. Lactuca ludoviciana (Nutt.) Riddell, Fl. West. St. 51. 1835. Lactuca ludoviciana (Nutt.) DC., Prod. 7:141. 1838. Galathenium ludovicianum Nutt., Trans. Am. Phil. Soc., N.S., 7:441. 1841. Type locality: "Around Ft. Mandan on the Missouri" (not seen).

Lactuca campestris Greene, Pittonia 4:37. 1899. Lactuca ludoviciana (Nutt.) Riddell f. campestris (Greene) Fern., Rhodora 40:481. 1938. Type Coll.: Greene, Prairie Junction, Minnesota, 7 July, 1898 (not seen).

Herbaceous biennial 1-2 m tall; stem glabrous; latex brown.

Basal and lowermost cauline leaves sessile, ovate to obovate, variously dentate or pinnatifid to deeply pinnate-lobed or lyrate, margins glabrous or rarely ciliate, base sagittate to clasping, 20-30 cm long, 5-10 cm wide, abaxial midrib often hirsute; middle and upper cauline leaves ovate to obovate, variously dentate or pinnate-lobed to sinuate, margin glabrous, base sagittate to clasping, abaxial midrib glabrous.

Inflorescence a diffuse, conical panicle of 50-100(+) heads. Heads cylindric, involucral bracts 17, 13-15(17) mm long at anthesis, 18-20 mm long in fruit; florets 20-30; ligule blue, blue with yellow apex or yellow, 5-5.5 mm long; corolla tube 7-7.5 mm long with a ring of hairs at the summit; anthers white, exerted ca. 3 mm; style branches white, exerted ca. 1 mm beyond anther tube; pappus white, in 3-4 series, each bristle 8-9 mm long, 3-4 cells thick; beak filiform 3-4 mm long; achene body dk. brown 4-5 mm long, 2-3 mm wide, dorsventrally compressed with strong lateral wings and a conspicuous ridge on the abaxial and adaxial surfaces. Pollen tetracolporate. $n = 17$.

Common in prairies and open places from central Saskatchewan and w. central Texas east to central Ontario and Mississippi. It flowers in June, July, and August.

REPRESENTATIVE SPECIMENS:

COLORADO: Kit Carson Co.: $\frac{1}{2}$ mi S Bethune, 10 July 1975, Dille 177 (KSC). Yuma Co.: 1.8 mi S US 385/US 36, 10 July 1975, Dille 181 (ISC).

IOWA: Harrison Co.: 3 mi N Hy 30 to Modale, 18 Aug 1975, Dille 265 (KSC). Story Co.: 12 July 1949, C. Wingo 209 (SMU). Warren Co.: 1 July 1957, Van Bruggin 2526 (SD).

KANSAS: Allen Co.: 1 mi E. Moran, 13 Sept 1974, Stephens 83026 (KANU). Anderson Co.: July 1896, Hitchcock s.n. (KSC). Atchinson Co.: Hy 59 1.5 N Hy 159, 17 Aug. 1975, Dille 252 (KSC). Barton Co.: 6 mi. S. Ellinwood, 23 July 1929, Rydberg and Imler 1311 (KANU). Bourbon Co.: 3 mi. N 1 mi. E Heattville, 7 Sept 1974, Stephens 82834 (KANU). Butler Co.: 3 mi W $\frac{1}{2}$ mi N Latham, 25 July 1972, Stephens 57747 (KANU). Chase Co.: 1.7 mi W. Cottonwood, 7 July 1975, Dille 155 (KSC). Cherokee Co.: 1 mi S. Riverton, 12 Aug 1960, McGregor 15929 (KANU). Clark Co.: Hy 183/34 14.3 mi N Buffalo, 13 Aug 1975, Dille 234 (KSC). Cloud Co.: 1930, Fraser 370 (KSC). Cowley Co.: 5 mi. E, $1\frac{1}{2}$ mi. N. Arkansas City, 24 July 1969, Stephens 34939 (KANU). Decatur Co.: 2 June 1897, Hitchcock s.n. (KSC). Edwards Co.: 1 Sept 1897, Hitchcock s.n. (KSC). Ellis Co.: Hy 183, 10.7 mi N. I70, 14 Aug 1975, Dille 238 (KSC). Ellsworth Co.: July 1895, Hitchcock s.n. (KSC). Ford Co.: $3\frac{1}{2}$ mi N. and 1 mi W. Bucklin, 11 Aug 1965, Barker 1965 (KANU). Franklin Co.: $1\frac{1}{2}$ mi SW Ottawa, 14 Oct 1972, Stephens 63557 (KANU). Geary Co.: On K-177 12 mi S I70, 11 Aug 1975, Dille 205 (KSC). Gove Co.: July 1895, Hitchcock s.n. (KSC). Gray Co.: 1 Sept 1897, Hitchcock s.n. (KSC). Hamilton Co.: 5 mi. E Kendall, 15 July 1929, Rydberg & Imler 1061A (KANU). Harvey Co.: 24 Aug 1897, Clothier & Whitford s.n. (KSC). Hodgeman Co.: Aug 1895, Hitchcock s.n. (KSC). Jackson Co.: 1.5 mi. W. Hoyt, 19 Aug 1969, Magrath 4388A (KANU). Jewell Co.: 5 mi. S $4\frac{1}{2}$ W. Mankato, 2 June 1936, Osborn 894R (KSC). Kingman Co.: S side Kingman St. Lake, 9 Aug 1965, Barker 1763 (KANU). Lincoln Co.: July 1895, Hitchcock s.n. (KSC). Lyon Co.: 13 Aug 1929, Horr 731 (KANU). Marion Co.: 1 mi. E 2 mi. S Marion, 14 Oct 1974, Stephens 83470 (KANU). Marshall Co.: 8 mi. N Frankfort, 22 July 1967, Barker 4282 (KANU). McPherson Co.: 7 mi. N Galua, 29 July 1960, McGregor 15844 (KANU). Meade Co.: 8 mi. S Meade, 1 Sept 1951, Horr & McGregor 4055 (KANU). Miami Co.: Aug 1892, Hitchcock s.n. (KSC). Mitchell Co.: 18 June 1897, Hitchcock s.n. (KSC). Montgomery Co.: Aug 1896, Hitchcock s.n. (KSC). Morris Co.: Aug 1895, Hitchcock s.n. (KSC). Ness Co.: Aug 1895, Hitchcock s.n. (KSC). Osage Co.: US 56 5.4 mi. E Hy 31, 11 Aug 1975, Dille 213 (KSC). Osborne Co.: 4 mi. S Covert, 17 Aug 1972, Stephens 59221 (KANU). Ottawa Co.: 5 mi. N 1 mi. E Bennington, 16 Aug 1972, Stephens 59162 (KANU). Pawnee Co.: Aug 1895, Hitchcock s.n. (KSC). Phillips Co.: 2.5 mi. S. Agra, 14 Aug 1975, Dille 240 (KSC). Potawatomie Co.: Blue River, 4 Sept 1920, F.C. Gates 12584 (KSC). Reno Co.: 25 Aug 1897, Hitchcock s.n. (KSC). Republic Co.: $\frac{1}{2}$ mi W. Bellville, 10 Sept, 1970, McGregor 23504 (KANU). Rice Co.: Aug 1895, Hitchcock s.n. (KSC). Riley Co.: 2 mi. E 6 mi. S Manhattan, 7 Aug 1967, Barker 4353 (KANU). Rush Co.: Aug 1895, Hitchcock s.n. (KSC). Russell Co.: $4\frac{1}{2}$ mi. N Russell, 26 Aug 1972, Stephens 59841 (KANU). Saline Co.: 27 July 1892, Carleton s.n. (KSC). Scott Co.: 1.8 mi. N Hy 83 on Hy 75, 13 Aug 1975, Dille 237 (KSC). Sedgwick Co.: 17.3 mi. SW I235 & K-2 on K-2, 8 July 1975, Dille 181 (KSC). Sheridan Co.: 1931, Weber 21 (KSC). Stafford Co.: 13 July 1896, Porter s.n. (KSC). Sumner Co.: 23 mi. SW I-235 & K-2 on K-2, 8 July 1975, Dille 162 (KSC). Trego Co.: July 1895, Hitchcock s.n. (KSC). Washington Co.: 24 July 1897, Clothier & Whitford s.n. (KSC).

MISSOURI: Atchison Co.: 23 Aug 1953, Bush s.n. (MO).

MONTANA: Richland Co.: 23 mi. S Sidney, 14 July 1973, Stephens 67571 (KANU).

NEBRASKA: Cass Co.: US 75 2 mi. N Hy 34, 18 Aug 1975, Dille 261 (KSC). Douglass Co.: 25 Aug 1898, C.S. Williamson s.n. (SMU). Gage Co.: Hy. 77 15 mi. N Marysville, Ks., 14 Aug 1975, Dille 244 (KSC). Hall Co.: Grand Island, 21 July 1962, Lemaire 2255 (KSC). Jefferson Co.: 2½ mi. E Plymouth, 5 Aug 1972, Stephens 58635 (KANU). Kearney Co.: 3 mi. E Kearney, 13 July 1966, Stephens 6715 (KANU). Lancaster Co.: 2 mi. N, 4½ mi. W Sprague, 4 Aug 1972, Stephens 58560 (KANU). Laup Co.: 1 mi. N, 1 mi. W Taylor, 14 July 1966, Stephens 6874 (KANU). Nemaha Co.: Hy. 73-75 4.5 mi. S Hy. 136, 17 Aug 1975, Dille 258 (KSC). Phelps Co.: 2 mi. E, 5 mi. S Bertrand, 21 July 1968, Stephens 25300 (KANU). Richardson Co.: ½ mi. N of NW corner Salem Village limits, 7 Aug 1974, Shildnelk C-6915 (KANU). Saunders Co.: On US-77, 4 mi. N Jct. NB-92, 13 July 1975, Dille 197 (KSC). Seward Co.: 3 mi. N Garland, 7 Sept 1967, Koch 4328 (SMU, KANU). Stanton Co.: On US 278, 8 mi. W Jct. US 20, 13 July 1975, Dille 196 (KSC). Thayer Co.: Hy 4, 2.3 mi E Carlton, 14 Aug 1975, Dille 243 (KSC). Webster Co.: Hy 78, 2 mi N Hy. 136, 14 Aug, 1975. Dille 242 (KSC).

NORTH DAKOTA: Benson Co.: Seeds, 17 Sept 1909, Swiell 2191 (SD). Dickey Co.: July 1922, Brenckle s.n. (SD). Stutsman Co.: 14 mi. S Jamestown, 13 Sept 1972, Stephens 61468 (KANU).

OKLAHOMA: Adair Co.: 23 mi. NE Tahlequah St. Rd. 10, 14 June 1958, Wallis 7381-1 (SMU, OKL). Canadian Co.: Hy. 281 20 mi. S Watonga, 12 Aug 1975, Dille 231 (KSC). Cleveland Co.: OU Campus, 16 July 1921, Stemen 219 (OKL). Comanche Co.: 4 July 1941, Waterfall 2913 (OKL). Custer Co.: 7 mi. SW Custer City, Mericle 1835 (OKL). Dewey Co.: Hy. 183, 4 mi. S Taloga, 13 Aug 1975, Dille 232 (KSC). Ellis Co.: 4.7 mi. E Harmon on US 70, 8 July 1975, Dille 167 (KSC). Geer Co.: N Granite, 21 June 1947, Waterfall 7226 (OKL). Major Co.: Cleo, 14 July 1913, G.W. Stevens 1737 (OKL). Murray Co.: Turner Falls, 21 June 1951, Cory 59059 (SMU). Pawnee Co.: 12 mi. SW Cleland on Hy. 99, 12 Aug 1975, Dille 227 (KSC). Payne Co.: Hy. 33, ½ mi. W Hy. 18, 12 Aug 1975, Dille 228 (KSC). Roger Mills Co.: 1 July 1934, Engelman 3073 (OKL). Sequoyah Co.: 6 mi. NE Gore, 31 May 1958, Wallis 7006 (OKL).

SOUTH DAKOTA: Bon Homme Co.: 10 mi. SE Tyndall, 10 Sept 1972, Stephens 60931 (KANU). Buffalo Co.: 6 mi. E, 4 mi. S Ft. Thompson, 31 July 1967, Stephens 15348 (KANU). Charles Mix Co.: 2 mi. W Platte, 1 Aug 1967, Stephens 15453 (KANU). Clay Co.: Missouri River Bottoms, 2 Aug 1954, Winter s.n. (SD). Hamlin Co.: Hy. 81, 2.5 mi. N Hy 28, 18 Aug 1975, Dille 272 (KSC). Lawrence Co.: Spearfish Canyon, 19 Aug 1975, Dille 273 (KSC). Lyman Co.: 5 mi. N Iona, 14 July 1964, Stephens 34049 (KANU). Pennington Co.: Rapid City, Jct. I-90 & Lacrosse Rd., 12 July 1975, Dille 190 (KSC). Union Co.: I29, 4.5 mi. S SD-50, 18 Aug 1975, Dille 269 (KSC).

TEXAS: Carson Co.: 4.5 mi. SE Skellytown TX-152, 8 July 1975, Dille 170 (KSC). Roberts Co.: 4.5 mi. NE Miami on US 60, 8 July 1975, Dille 169 (KSC). Tarrant Co.: June 1922, Ruth 845 (KSC). Wheeler Co.: E edge of Wheeler, 31 July 1974, Stephens 81746 (KANU).

This taxon has several phases defined by variations in flower color and leaf morphology. The phases based on leaf shape often grow in mixed populations, but little data have been gathered on flower color distribution.

The phase with all leaves obovate and unlobed is relatively uncommon as is the phase with all leaves pinnatifid. The phase most commonly observed has the lower cauline leaves pinnate-lobed to sinuate and the upper cauline leaves ovate and unlobed to sinuate. This last phase is probably an intermediate between the two more 'distinct' phases.

The ligule color may be yellow, blue, or blue with a yellow apex. The blue phase is the basis for the name L. campestris.

3. Lactuca serriola Linnaeus

Lactuca serriola Linn., Cent. Pl. II. 26. 1756. Lactuca scariola Linn., Sp. Pl. 1119. 1763. Type locality: "Habitat in Europa Australi. (not seen).

Lactuca scariola β integrata Green et Godr., Fl. France. 2:320. 1850. Lactuca integrata (Green et Godr.) A. Nelson, New Man. Rcky. Mtn. Bot. 596. 1909. Lactuca serriola Linn. var. integrata (Green et Godr.) Farwell, Am. Mid. Nat. 10:46. 1946.

Lactuca plicata Balb., Cat. Hort. Taur. 45. 1813. Lactuca serriola Linn. var. integrata (Green et Godr.) Farwell Subvar. plicata (Balb.) Farwell, Am. Mid. Nat. 10:46. 1946.

Lactuca scariola Linn. var. integrifolia Bogenh., Fl. Jena. 269. 1840. Lactuca scariola Linn. f. integrifolia (Bogenh.) G. Beck.

Lactuca virosa senu Rydberg, Fl. Rcky. Mts. 1036. 1922; Fl. Prairies & Plains of N.A. 898. 1932. Not Lactuca virosa Linn. Sp. Pl. 795. 1753.

Lactuca virosa sensu Small, Man. Se. Fl. 1497. 1933. Not Lactuca virosa Linn. Sp. P. 795. 1753.

Herbaceous winter annual .5-1.5 m tall; stem with stiff bristles on lower third; latex white. Basal and lower cauline leaves sessile, obovate to ovate, variously dentate to deeply pinnate-lobed, base sagittate, 15(20) cm long, 5(8) cm wide, abaxial midrib with stiff bristles; middle and upper cauline leaves lanceolate to lance-ovate, variously dentate to pinnate-lobed; abaxial midrib glabrous or rarely with stiff bristles. Inflorescence a diffuse. Conical panicle of 50-100(+) heads. Heads cylindric; Involucral bracts 17, 7-8 mm long at anthesis, 11-12 mm long in fruit; florets 18-25; ligule yellow with dark blue stripe on abaxial side, 4.5-5 mm long; corolla tube 3-3.5 mm long with a ring of hairs at the summit; anthers yellow, exerted ca 2-2.5 mm; style branches yellow, exerted ca. 1 mm beyond anther tube; pappus white, in 2-3 series, each bristle 4 mm long, 2 cells thick; beak filiform 4 mm long; achene body lt. brown, 3 mm long, 1 mm wide, dorsiventrally compressed with prominent lateral ridges, 5-7 conspicuous ridges on the abaxial and axaxial surfaces, and conspicuous bristles at base of beak. Pollen tricolporate. $\underline{n} = 9$.

Common in disturbed habitats and waste areas throughout the continental United States. Flowers in June, July, and August.

REPRESENTATIVE SPECIMENS:

COLORADO: Boulder Co.: Lyons, 9 Aug 1970, Stephens & Brooks 43279 (KANU). El Paso Co.: 9 mi. SW Colorado Springs, 5 Aug 1968, Stephens & Brooks 27002 (KANU). Kit Carson Co.: $\frac{1}{4}$ mi. N Bethune Exit I-70, 10 July 1975, Dille 178 (KSC). Larimer Co.: Masonville, 9 Aug 1970, Brooks & Stephens 43362 (KANU). Powers Co.: 8 mi. S Lamar US 287, 9 July 1975, Dille 174 (KSC). Pueblo Co.: 2 mi. W Seloam, 4 Aug 1968, Stephens & Brooks 26861 (KANU). Yuma Co.: W Wray, 25 Sept 1972, Stephens 62464 (KANU).

KANSAS: Anderson Co.: 22 July 1929, Harr s.n. (KANU). Atchison Co.: State Lake, 30 July 1972, Stephens 57991 (KANU). Barber Co.: Kiowa, 5 July 1929, Rydberg & Inter 649 (KANU). Bourbon Co.: Bourbon Co. St. Lake, 10 July 1972, Stephens 56698 (KANU). Brown Co.: 6½ mi. S Hiawatha, 18 Sept 1966, Stephens 9416 (KANU). Butler Co.: 6 Aug 1929 Harr s.n. (KANU). Chase Co.: 2.9 mi. W Strong City on US-50, 7 July 1975, Dille 154 (KSC). Chautaupus Co.: 5 July 1930, Harr s.n. (KANU). Cherokee Co.: 4 mi. E Baxter Springs, 12 Aug 1960, McGregor 15903 (KANU). Cheyenne Co.: St. Francis, 17 Aug 1931, Jacobs s.n. (KSC). Clark Co.: 13 mi. S Minneola, 6 July 1974, Stephens 79210 (KANU). Clay Co.: Clay Center, 1929, Weber 262 (KSC). Cloud Co.: 1930, Fraser 375 (KSC). Comanche Co.: 2 mi. E Wilmare, 5 July 1974, Stephens 49146 (KANU). Cowley Co.: 4 mi. N Udall, 16 July 1966, Koch 1500 (KSC). Crawford Co.: State Park #1, 8 July 1972, Stephens 56481 (KANU). Dickinson Co.: 19 July 1930, Harr s.n. (KANU). Doniphan Co.: 5 mi. N, 2 mi. E of Troy, 5 Sept 1952, Horrr 4311 (KANU). Douglas Co.: W Lawrence, 15 Aug 1940 McGregor 260 (KANU). Edwards Co.: E Kinsley, 6 Aug 1971, Stephens 50522 (KANU). Elk Co.: 2 mi. S Fall River, 22 Sept 1974, Stephens 83260 (KANU). Ellis Co.: 8 July 1901, Baalman 199 (OKL). Ellsworth Co.: E Wilson, 27 Aug 1972, Stephens 59901 (KANU). Finney Co.: 3 Aug 1935, Murphy s.n. (KSC). Ford Co.: 3 mi. SW Dodge City, 18 Sept 1973, Stephens 73972 (KANU). Geary Co.: 5.7 mi. S I-70 & K-177, 7 July 1975, Dille 130 (KSC). Graham Co.: S Hill City, 20 Aug 1972, Stephens 59367 (KANU). Grant Co.: 5 mi. W Ulysses, 16 July 1974, Brooks & McGregor 7512 (KANU). Gray Co.: Cimmarron River, 5 Aug 1971, Stephens 50425 (KANU). Greely Co.: 4 mi. NE Greely, 10 July 1974, Brooks 7170 (KANU). Hamilton Co.: S Syracuse, 2 Aug 1971, Stephens 50303 (KANU). Harper Co.: 2.3 mi. W Attica, 30 July 1959, McGregor 14690 (KANU); NE Harper, 5 July 1974, Stephens 79070 (KANU). Harvey Co.: 3 mi. NE Burrton, 23 July 1969, Stephens & Brooks 34793 (KANU). Haskell Co.: 10 mi. NW Satarta, 17 Sept 1973, Stephens 73910 (KANU). Hewell Co.: Montrose, 12 Sept 1952, Harr 4386 (KANU). Hodgeman Co.: 7 mi. NE Hanston, 15 July 1974, Brooks & McGregor 7450 (KANU). Johnson Co.: Edgerton, 24 Aug 1970, Stephens 44120 (KANU). Kearney Co.: 3 mi. NE Lakin, 16 July 1974, Brooks & McGregor 7472 (KANU). Kingman Co.: State Lake, 9 Aug 1965, Barker 1764a (KANU). Kiowa Co.: E. Greenburg, 17 July 1974, Brooks & McGregor 7570 (KANU). Labette Co.: Chetopa, 7 July 1970, Stephens & Brooks 41121 (KANU). Leavenworth Co.: State Lake, 2 Aug 1947, McGregor 847 (KANU). Lincoln Co.: 8 mi. S, 5 mi. W Lincoln, 16 Sept 1967, Stephens 17983 (KANU). Logan Co.: 10 mi. W Russell Springs, 14 Aug 1970, Harms 1168 (KANU). McPherson Co.: State Lake, 15 July 1972, Stephens 57054 (KANU). Marion Co.: 3 mi. W Marion, 15 Oct 1974, Stephens 83500 (KANU). Marshall Co.: S Frankfort, 3 Sept 1972, Stephens 60068 (KANU). Meade Co.: 8 mi. S Meade, 1 Sept 1951, Harr & McGregor 4056 (KANU). Mitchell So.: Glen Elder, 7 July 1974, McGregor 26072 (KANU). Montgomery Co.: 5 July 1930, Harr s.n. (KANU). Morris Co.: 4 mi. E Council Grove, 4 Sept 1958, Richards 1783 (KANU); Kelso, 1939, Good 13, (KSC). Morten Co.: 3 mi. N Rolla, 9 July 1961, Richards 2984 (KANU). Neosho Co.: State Park, 20 July 1961, Richards 3185 (KANU). Ness Co.: W Beeler, 11 July 1974, Brooks 7383 (KANU). Norton Co.: Lenora Lake, 19 Aug 1972, Stephens 59344 (KANU). Osage Co.: State Lake, 2 Sept 1972, Stephens 59938 (KANU). Osborne Co.: 5 mi. E Osborne, 18 July 1965, Richardson & Robertson 852 (KANU).

Ottawa Co.: State Lake, 16 Aug 1972, Stephens 59125 (KANU). Phillips Co.: 2 mi. W Kirwin, 10 July 1974, McGregor 26205 (KANU). Pottawatomie Co.: 5 mi. SE Olsburg, 18 Aug 1961, Hulbert 4122 (KSC). Pratt Co.: 6 mi. SW Coats, 6 Oct 1972, Stephens 63249 (KANU). Rawlins Co.: 2 mi. W Atwood, 10 July 1974, McGregor 26169 (KANU). Republic Co.: salt marsh, 26 July 1960, Morley 685 (KANU). Rice Co.: 4 mi. S Chase, 22 July 1969, Stephens & Brooks 34536 (KANU). Riley Co.: 6 mi. NW Manhattan, 28 July 1962, McMurphy s.n. (KSC). Rush Co.: 9 mi. E LaCrosse, 7 Aug 1971, Stephens 50710 (KANU). Russell Co.: E Luray, 8 July 1974, Brooks 7053 (KANU). Saline Co.: NE of Salina, 28 July 1930, Hancin 570a (KSC). Scott Co.: State Lake, 10 July 1974, Brooks 7170 (KANU). Seward Co.: Cimmaron River, 22 July 1964, Harms & Kolstad 1708 (KANU). Shawnee Co.: NE Topeka, 5 Aug 1949, Vole 400 (KANU). Sheridan Co.: State Lake, 9 July 1974, McGregor 26119 (KANU). Sherman Co.: State Lake, 18 July 1972, Stephens 57232 (KANU). Stafford Co.: W of salt flats, 13 Aug 1958, Ungar 675 (KANU). Stanton Co.: 4 mi. N Johnson, 16 July 1974, Brooks & McGregor 7492 (KANU). Stevens Co.: SW Hugoton, 17 Sept 1973, Stephens 73851 (KANU). Sumner Co.: E Gueda Springs, 24 July 1969, Stephens & Brooks 34923 (KANU). Thomas Co.: NE Colby, 9 July 1974, McGregor 26138 (KANU). Trego Co.: 4 mi. S Collyer, 9 July 1974, Brooks 7082 (KANU). Washington Co.: 5 mi. W Washington, 11 July 1974, McGregor 26235 (KANU). Wabaunsee Co.: on K-4, 4 mi. E Hy 180, 11 Aug 1975, Dille 206 (KSC). Wilson Co.: 12 July 1930, Horr s.n. (KANU). Wichita Co.: 8 mi. SE Leota, 10 Sept 1974, Brooks 7192 (KANU). Woodson Co.: 11 July 1930, Horr s.n. (KANU). Wyandotte Co.: Muncie, 27 July 1961, Richards 3224 (KANU).

MINNESOTA: Big Stone Co.: 3 mi. N Ortonville, 18 Aug 1974, Brooks, McGregor, Stephens 8315 (KANU).

MISSOURI: Clay Co.: 9 Aug 1933, Bush 12846 (MO). Courtney Co.: 14 Aug 1920, Bush 9114 (MO). Jackson Co.: 4 Aug 1893, Bush s.n. (MO). LaCade Co.: 2 mi. S Lebanon, 2 Aug 1961, Richards 3371 (KANU). Platte Co.: Riverside, 10 July 1965, Henderson 65-551 (KANU). Wayne Co.: Mingo Swamp, 12 July 1936, Steyermark 11714 (MO). Wright Co.: 2 mi. S Hartville, 2 Aug 1961, Richards 3361 (KANU).

MONTANA: Big Horn Co.: N Hardin, 30 July 1973, Stephens 69464 (KANU). Fergus Co.: 5 mi. W Lewistown, 25 July 1973, Stephens 68887 (KANU). Garfield Co.: 18 mi. W Sand Springs, 26 July 1973, Stephens 69087 (KANU). Hill Co.: 6 mi. SW Havre, 21 July 1973, Stephens 68411 (KANU). Judith Basin Co.: 9 mi. N Stanford, 23 July 1973, Stephens 68673 (KANU). Powder River Co.: 40 mi. W Broadus, 31 July 1973, Stephens 69614 (KANU). Rosebud Co.: SE Rosebud, 28 July 1973, Stephens 69189 (KANU). Treasure Co.: 4 mi. E Sanders, 28 July 1973, Stephens 69255 (KANU).

NEBRASKA: Boyd Co.: N Butte, 17 Sept 1972, Stephens 61928 (KANU). Butler Co.: 3 mi. SE David City, 7 Sept 1972, Stephens 60598 (KANU). Cass Co.: Hy 75, 2 mi. N of Hy 34, 18 Aug 1975, Dille 262 (KSC). Cherry Co.: Merriman, 24 Aug 1948, Rohrbaugh 62 (OKL). Custer Co.: S Arnold, 31 Aug 1965, McGregor 19581 (KANU); 3 mi. NW Anselmo, 27 Aug 1968, Stephens 28174 (KANU). Dawes Co.: White River, 21 Sept 1970, Stephens 45480 (KANU). Dundy Co.: Indian Cree, 23 Sept 1970, Stephens

45616 (KANU). Furnas Co.: 4 mi. W Holbrook, 23 Sept 1972, Stephens
62260 (KANU). Gage Co.: NW Wymore, 4 Sept 1972, Stephens 60175
 (KANU). Garden Co.: 3 mi. SE Lewellen, 29 Aug 1966, McGregor 2018
 (KANU). Hitchcock Co.: Swanson Lake, 28 Sept 1960, Lemaire 1830
 (KSC). Holt Co.: S Atkinson, 2 Aug 1967, Stephens & Brooks 15544
 (KANU). Howard Co.: 5 mi. N Dannebrog, 3 Aug 1967, Stephens & Brooks
15738 (KANU). Johnson Co.: N Tecumseh, 1 Aug 1972, Stephens 58206
 (KANU). Nemaha Co.: S Nemaha, 31 July 1972, Stephens 58137 (KANU).
 Otoe Co.: 6 mi. SE Syracuse, 6 Sept 1967, Stephens 17592 (KANU).
 Phelps Co.: 4 mi. E 10 mi. N Bertrand, 21 July 1968, Stephens &
Brooks 25271 (KANU). Polk Co.: 11 mi. N Osceola, 4 Aug 1974, Brooks
7793 (KANU). Richardson Co.: NE Quarter of Co., 9 July 1974, Shildneck
6700 (KANU). Saline Co.: 2 mi. E Dorchester, 4 Aug 1972, Stephens
58514 (KANU). Sarpy Co.: 9 mi. SE Gretna, 2 Aug 1972, Stephens 58319
 (KANU). Saunders Co.: 12 mi. W. Wahoo, 7 Sept 1972, Stephens 60612
 (KANU); 3 mi. N Cesesco, 3 Aug 1972, Stephens 58401 (KANU). Seward
 Co.: 3 mi. SW Milford, 4 Aug 1972, Stephens 58497 (KANU). Sioux Co.:
 Ardmore (SD), 28 Aug 1968, Stephens 28388 (KANU). Wayne Co.: E
 Wayne, 9 Sept 1972, Stephens 60829 (KANU).

NORTH DAKOTA: Bowman Co.: 4 mi. S Scranton, 28 July 1960, Seiler 905
 (KANU). Burleigh Co.: 4 mi. SE Menoken, 15 Sept 1969, Stephens 36817
 (KANU). Dickey Co.: 6 mi. W Ludden, 26 Aug 1971, Stephens 51696
 (KANU). Emmons Co.: Beaver Creek, 15 Sept 1972, Stephens 61665
 (KANU). Griggs Co.: Cheyenne River, 1 Sept 1970, Stephens 45167
 (KANU). Hettinger Co.: 14 mi. W Regent, 24 July 1971, Stephens 50043
 (KANU). Kidder Co.: 18 mi. N Tuttle, 14 Sept 1972, Stephens 61611
 (KANU). McKenzie Co.: 14 mi. E Watford City, 3 Sept 1968, Stephens
28694 (KANU). Pembina Co.: N Mauntain, 11 Aug 1969, Seiler 1218
 (KANU). Ransom Co.: 17 mi. W Enderlin, 11 Sept 1968, Stephens 29069
 (KANU). Stark Co.: 12 mi. S Belfield, 1 Sept 1968, Stephens 28583
 (KANU). Walsh Co.: 9 mi. W Park River, 9 Sept 1968, Stephens 28995
 (KANU). Ward Co.: along river, 30 July 1963, Lautenschlager 719
 (KANU).

OKLAHOMA: Alfalfa Co.: 1.9 mi. W US64-OK-8 on OK-8, 8 July 1975,
Dille 164 (KSC). Beaver Co.: N Beaver, 8 July 1974, Stephens 79316
 (KANU). Blaine Co.: Hy 281, 11 mi. S Watonga, 12 Aug 1975, Dille 230
 (KSC). Canadian Co.: Water Canyon, 10 Aug 1960, C. Taylor 901 (OKL).
 Cimerron Co.: Between Felt and Beaver Creek, 9 July 1975, Dille 173
 (KSC). Comanche Co.: 14 July 1928, McMurry 506 (OKL). Cotton Co.:
 14 July 1934, Potzy s.n. (OKL). Custer Co.: 6 mi. NW Butter, Mericle
384 (OKL). Dewey Co.: N Talaga, 13 Aug 1968, Stephens 27218 (KANU).
 Grant Co.: 1 mi. N OK-11 & OK-132 on OK-132, 8 July 1975, Dille 163
 (KSC). Harper Co.: 14 mi. E Buffalo, 23 Aug 1973, Stephens 71404
 (KANU). Kay Co.: 9 mi. S Newkirk, 10 Aug 1968, Stephens 27033 (KANU).
 Kingfisher Co.: 27 June 1935, Grace s.n. (OKL). Major Co.: Orion, 8
 July 1975, Dille 165 (KSC). Marshall Co.: 27 June 1960, C. Taylor
309 (OKL). Murray Co.: 16 June 1954, Goodman 5945 (OKL). Muskogee
 Co.: 16 June 1927, Little 773 (OKL). Osage Co.: 3 mi. N Grainola,
 17 Aug 1971, Stephens 51069 (KANU). Payne Co.: Stillwater, 11 July
 1946, Wheling 83 (OKL). Pontotoc Co.: 3 mi. SE Union Valley, 19 July

1964, J. & H. Massey 2479 (OKL). Texas Co.: 10 mi. E Hardesty, 8 July 1974, Stephens 79380 (KANU). Tulsa Co.: 4 July 1941, Hawk s.n. (OKL). Woods Co.: 8 mi. NW Alva, 14 Aug 1971, Nighswonger 892 (OKL).

SOUTH DAKOTA: Aurora Co.: N Stickney, 11 Sept 1972, Stephens 61064 (KANU). Bennet Co.: La Creek Wildlife Refuge, 31 July 1965, Harms 3144 (KANU). Brown Co.: 8 mi. N Claremont, 26 Aug 1971, Stephens 51645 (KANU). Butte Co.: Indian Creek, 17 Sept 1970, Stephens 45399 (KANU). Carson Co.: 8 mi. W McLaughlin, 13 Sept 1968, Stephens 29195 (KANU). Douglas Co.: W Corsica, 10 Sept 1972, Stephens 61044 (KANU). Fall River Co.: Cheyenne River, 20 Sept 1970, Stephens 45454 (KANU). Gregory Co.: 1 mi. SE Bonesteel on US 18, 13 July 1975, Dille 192 (KSC). Hand Co.: 12 mi. N. Miller, 12 Sept 1972, Stephens 61237 (KANU). Hanson Co.: Emery, 9 Sept 1970, Stephens 44905 (KANU). Harding Co.: 15 mi. S Camp Crook, 25 July 1966, Stephens 7869 (KANU). Haulk Co.: 2 mi. E Faulkton, 12 Sept 1972, Stephens 61273 (KANU). Hutchinson Co.: James River, 9 Sept 1970, Stephens 44891 (KANU). Hyde Co.: 14 mi. S Highmore, 16 Sept 1972, Stephens 61802 (KANU). Jackson Co.: Kadok Lane, 16 July 1966, Stephens 0 63 (KANU). Kingsbury Co.: Spirit Lake, 10 Sept 1970, Stephens 44937 (KANU). Lawrence Co.: Spearfish Canyon, 20 Aug 1975, Dille 279 (KSC). Lyman Co.: 5 mi. N. Oacoma, 14 July 1969, Stephens 34011 (KANU). Meade Co.: 22 mi. N Hawes, 27 July 1966, Stephens 8098 (KANU). Mellette Co.: 4 mi. E Wood, 13 July 1971, Stephens 49277 (KANU). Miner Co.: 2½ mi. E Roswell, 24 Aug 1971, Stephens 51537 (KANU). Mix Co.: W Platte, 1 Aug 1967, Stephens & Brooks 15409 (KANU). Sanborn Co.: E Forestburg, 24 Aug 1971, Stephens 51533 (KANU). Tripp Co.: 6 mi. NW Colome, 14 July 1969, Stephens 34127 (KANU).

TEXAS: Briscoe Co.: 7 mi. W Silverton, 27 July 1974, Stephens 81190 (KANU). Carson Co.: 4.5 mi. SE Skellytown, 8 July 1975, Dille 171 (KSC). Castro Co.: 3 mi. W Nazareth, 27 July 1974, Stephens 81293 (KANU). Childress Co.: 5 mi. S Childress, 24 July 1974, Stephens 80857 (KANU). Collingsworth Co.: 2 mi. NW Wellington, 25 July 1974, Stephens 80936 (KANU). Cottle Co.: E Paducah, 23 July 1974, Stephens 80703 (KANU). Dallam Co.: 8 mi. NW Dalhart, 5 Aug 1974, Stephens 82279 (KANU). Deaf Smith Co.: Tierra Blanca Creek, 10 Sept 1973, Stephens 73267 (KANU). Donley Co.: E Hedley, 25 July 1974, Stephens 81009 (KANU). Floyd Co.: 5 mi. SW Lockney, 21 July 1974, Stephens 80454 (KANU). Foard Co.: 21 mi. W Crowell, 23 July 1974, Stephens 80756 (KANU). Gray Co.: S Panpa, 27 Aug 1973, Stephens 71831 (KANU). Hale Co.: 14 mi. S, 7 mi. W Plainview, 20 July 1974, Stephens 80409 (KANU). Hall Co.: 4 mi E Lesley, 26 July 1974, Stephens 81084 (KANU). Hansford Co.: 4 mi. SW Gruver, 6 Aug 1974, Stephens 82424 (KANU). Hardeman Co.: S Quanah, 24 July 1974, Stephens 80845 (KANU). Hartley Co.: N Channing, 13 Sept 1973, Stephens 73551 (KANU); 8 mi. E Hartley, 4 Aug 1974, Stephens 82106 (KANU). Hutchinson Co.: NE Stinnett, 2 Aug 1974, Stephens 81928 (KANU). Kent Co.: 8 mi. W Clairemont, 3 Sept 1973, Stephens 72708 (KANU). King Co.: Guthrie, 2 Sept 1973, Stephens 72531 (KANU). Lamb Co.: S Fieldton, 20 July 1974, Stephens 80342 (KANU). Lipscomb Co.: 8 mi. NE Glasier, 8 July 1975, Dille 168 (KSC). Moore Co.: 4 mi. N Dumas on US 287, 9 July 1976, Dille 172 (KSC). Motley Co.: N Roaring Springs, 1 Sept 1973, Stephens 72426 (KANU). Ochiltree Co.: 5 mi. N Perryton, 25 Aug 1973, Stephens 71569

(KANU). Oldham Co.: Vega, 12 Sept 1973, Stephens 73386 (KANU).
 Parmer Co.: 15 mi. S Friona, 10 Sept 1973, Stephens 73190 (KANU).
 Roberts Co.: Miami, 1 Aug 1974, Stephens 81848 (KANU). Sherman Co.:
 Coldwater Creek Valley, 6 Aug 1974, Stephens 82346 (KANU). Swisher
 Co.: 12 mi. SE Tulia, 27 July 1974, Stephens 81208 (KANU). Wheeler
 Co.: E Wheeler, 31 July 1974, Stephens 81745 (KANU).

WYOMING: Campbell Co.: 7½ mi. E Gillette, 14 Aug 1970, Stephens 43766 (KANU). Converse Co.: 9 mi. SW Shawnee, 6 Aug 1973, Stephens 70268 (KANU). Crook Co.: 14 mi. NE Moorcroft, 14 Aug 1970, Stephens 43782 (KANU). Goshen Co.: 3 mi. N Lingle on US 85, 11 July 1975, Dille 188 (KSC). Johnson Co.: 13 mi. S Buffalo, 3 Aug 1973, Stephens 69961 (KANU). Laramie Co.: W Meriden, 12 Aug 1973, Stephens 70990 (KANU). Natrona Co.: W Casper, 7 Aug 1973, Stephens 70328 (KANU). Niobrara Co.: 3 mi. E Lance Creek, 6 Aug 1973, Stephens 70209 (KANU). Platte Co.: N Wheatland, 11 Aug 1973, Stephens 70798 (KANU). Sheridan Co.: W Leiter, 2 Aug 1973, Stephens 69876 (KANU).

The first North American collections of this European native were made near Cambridge, Mass. in 1863, and it quickly spread throughout North America (Dewey, 1905). This plant is by far the most 'weedy' of the North American lactucas.

Three phases of L. serriola based solely on variations in leaf morphology occur throughout the range and in mixed populations. The phase with unlobed obovate leaves does not appear to be as common as the phase with deeply pinnate-lobed leaves. The third very common phase has the lower cauline leaves variously sinuate to deeply pinnate-lobed and the upper cauline leaves variously unlobed to sinuate. This last phase may be an intermediate between the two more 'distinct' phases. The totally unlobed phase is the basis for the names var. integrata and var. integrifolia.

The leaves of this plant will often rotate 90° on their longitudinal axis when exposed to full sunlight throughout the day. The margins of the leaves will then be vertical instead of horizontal. This characteristic has earned the name 'compass plant' for this species as the leave apicies were believed to point north and south.

L. serriola or a closely related species is believed to have been the ancient progenitor of the cultivated lettuce, L. sativa (Lindquist, 1960), and those two species hybridize under artificial and natural conditions (Thompson et al., 1941; Anderson, 1949).

4. Lactuca saligna Linnaeus

Lactuca saligna Linn., Sp. Pl. 796. 1753. Type locality: "Habitat in Gallia, Lipsiae." (not seen).

Lactuca saligna Linn. f. ruppiana (Wallr.) G. Beck.

Herbaceous winter annual .5-1 m tall; stem whitish, glabrous; latex white. Basal and lower cauline leaves sessile, linear, entire to pinnate-lobed with 1-2 pair of linear lobes near base or pinnatifid, base sagittate, 15-25 cm long, .5-4 cm wide, abaxial midrib often hirsute; middle and upper cauline leaves linear, entire or pinnate-lobed with 1-2 pair of linear lobes. Inflorescence a virgate panicle of 50-100 heads. Heads cylindric; involucral bracts 17, 7 mm long at anthesis, 12 mm long in fruit; florets 10-15; ligule yellow with a dark blue stripe on the abaxial side, 4.5-5 mm long; corolla tube yellow, 3-3.5 mm long with a ring of hairs at the summit; anthers yellow, exerted 2-2.5 mm; style branches yellow, exerted ca. 1 mm beyond anther tube; pappus white, in 2-3 series, each bristle 4 mm long, 2 cells thick; beak filiform 4-4.5 mm long; achene body lt. brown, 3 mm long, 1 mm wide, dorsiventrally compressed with prominent lateral ridges and 5-7 conspicuous ridges on the abaxial and adaxial surfaces. Pollen tricolporate. n = 9.

Infrequent in disturbed habitats and waste areas from e. central Kansas to Ohio. It has also become established in central California. It flowers in July and August.

REPRESENTATIVE SPECIMENS:

KANSAS: Allen Co.: 1 mi. E Moran, 13 Sept 1974, Stephens 83024 (KANU). Anderson Co.: 3 mi. N Garnett, 13 Aug 1960, McGregor 15971 (KANU). Bourbon Co.: 7 Sept 1974, Stephens 82814 (KANU). Chase Co.: 2.9 mi. W Strong City on US-50, 7 July 1975, Dille 153 (KSC). Coffey Co.: K13, 2 mi. E Jct. 75-13, 11 Aug 1975, Dille 2171218 (KSC). Crawford Co.: 3 mi. N, 1 mi. E Farlington, 9 Oct 1974, Stephens 82897 (KANU). Douglas Co.: 13 Aug 1971, Magrath 6900 (OKL); Kansas Univ. Campus, 13 Sept 1971, Magrath 6901 (OKL). Franklin Co.: 31 July 1974, Brooks 7715 (KANU). Greenwood Co.: 1½ mi. N Hamilton, 22 Sept 1974, Stephens 83313 (KANU). Jackson Co.: 2 Aug 1974, Brooks 7751 (KANU). Jefferson Co.: 1 mi. W McLouth, 27 July 1974, McGregor 26238 (KANU). Johnson Co.: 1 mi. S Edgerton, 31 July 1974, Brooks 7712 (KANU). Labette Co.: 6 mi. N Edna, 8 Oct 1973, Stephens 74281 (KANU). Leavenworth Co.: 23 Oct 1956, Wagenknecht 3386 (KANU). Linn Co.: 31 Aug 1974, Stephens 82725 (KANU). Miami Co.: 2 mi. N Paola, 30 Aug 1974, Stephens 82667 (KANU). Morris Co.: 5½ mi. N Council Grove, 12 Oct 1974, Stephens 83374 (KANU). Neosho Co.: 7 mi. E, 2½ mi. N, 1 mi. E Chanute, 2 Sept 1971, Holland 2958 (KANU). Osage Co.: 2 mi. E Carbondale, 31 July 1974, Brooks 7743 (KANU). Saline Co.: 20 Sept 1974, McGregor 26281 (KANU). Wabaunsee Co.: Jct. 99 & 31, 11 Aug 1975, Dille 208 (KSC).

MISSOURI: Collaway Co.: NE Readsville, 19 Aug 1954, Steyermark 76672 (SMU). Stone Co.: 1½ mi. S Lampe, 3 Aug 1961, Richards 3425 (KANU).

NEBRASKA: Lancaster Co.: 8 Nov 1974, Stephens 83546 (KANU). Richardson Co.: 2 mi. SE Rulo, 6 Sept 1971, Magrath & Robinson 7156 (OKL).

OKLAHOMA: Oklahoma Co.: 3 mi. N I-44 & I-35, 5 Aug 1972, Magrath 7700 (OKL).

The first collections of this European native were made in Ohio in the 1870's (Radloff, 1961). It has spread very slowly and localized in the Midwest and California.

Three phases of L. saligna based totally on leaf morphology occur through its range and in mixed populations. The phase with all leaves linear and entire will often occur in the same population with the phase that has all leaves pinnatifid. The phase with lower cauline leaves pinnatifid and upper cauline leaves linear and entire may be found with one or both of the previous phases. The name f. ruppiana is based on the totally pinnatifid phase.

5. Lactuca oblongifolia Nuttall

Lactuca oblongifolia Nutt., A Cat. of New and Interesting Plants...

For Sale at Messrs. Fraser's Nursery (Reprinted by Greene, Pittonia 2:116-119). 1813. Lactuca integrifolia Nutt., Gen. 2:124. 1818. Not Lactuca integrifolia Bigel., Fl. Bost. ed. 2. 287. 1824. Type Locality: "Missouri" (not seen).

Sonchus pulchellus Pursh, Fl. Sept. Am. 502. 1814. Agathyrsus pulchellus (Pursh) D. Don, Edin. N. Phil. Jour. 6:310. 1828. Lactuca pulchella (Pursh) DC. Prod. 7:134. 1838. Mulgedium pulchellum (Pursh) G. Don, Sweet's Hort. Brit. 418. 1839. Lactuca tatarica (Linn.) C.A. Mey. subsp. pulchella (Pursh) Stebbins, Madrono 5:123. 1939. Lactuca tatarica (Linn.) C.A. Mey. var. pulchella (Pursh) Breitung, Can. Field Nat. 71:70. 1957. Type Locality: "On the Banks of the Missouri." (not seen).

Mulgedium heterophyllum Nutt., Trans. Am. Phil. Soc. N.S. 7:411. 1841. Lactuca pulchella (Pursh) DC. var. heterophyllum (Nutt.) Farwell, Mich. Acad. Sci. 6:214. 1904. Type Locality: "Hab. Lake Huron, and Canada, to Latitude 66°." (not seen).

Herbaceous perennial, .3-1 m tall; stem glabrous, arising singly or rarely loosely clustered from a deeply taprooted rhizomatous caudex; latex white. Lower cauline leaves sessile linear-ovate to oblong, variously pinnate-lobed to runcinate or entire, base sagittate to cuneate, 9-13 cm long, 1-3 cm wide, abaxial midrib glabrous; middle and upper cauline leaves linear or lanceolate to oblong, pinnate-lobed or entire. Inflorescence a corymbose panicle of 20-50 heads; involucre bracts 18, 12-13 (15) mm long at anthesis, 15-17 mm long in fruit; florets 19-21; ligule blue to violet (white), 9-10 mm long; corolla tube 6 mm long with a ring of hairs at the summit; anthers white, exerted ca. 5 mm; style branches blue, exerted ca. 2mm beyond anther tube; pappus white, in 3-4 series, each bristle 8-10mm long, 5-9 cells thick; beak whitish, stout, 1.5mm long; achene body reddish 4mm long, 1-1.5mm wide, dorsi-

ventrally compressed with prominent lateral ridges and 4-6 conspicuous ridges on the abaxial and adaxial surfaces. Pollen tricolporate or occasionally with tetracolporate grains. $n = 9$.

Locally common in low, moist open meadows from s. central Alaska and s. central California east to w. Ontario, e. central Kansas and w. Texas. It flowers in July and August.

REPRESENTATIVE SPECIMENS:

COLORADO: Archuleta Co.: 1 mi. SE Pagosa Springs, 16 Aug 1958, Waterfall 15134 (SMU). Boulder Co.: Foothills RES, 7 July 1949, Bougere 1376 (SMU). Chaffee Co.: NW Salida, 8 Sept 1953, Waterfall 11504 (OKL). Custer Co.: 2.5 mi. N San Isabel, 3 Aug 1968 Stephens 26812 (KANU). El Paso Co.: 12 mi. N Colorado Springs, 8 Aug 1970, Stephens 43135 (KANU). Huerfano Co.: 3.5 mi. W Gardner, 2 Aug 1968, Stephens 26646 (KANU). Kit Carson Co.: Flagler Recreation Area, 7 July 1972, Brooks 3822 (KANU). Las Animas Co.: 5 mi. W Gulnare, 5 Aug 1970, Stephens 42772 (KANU). Logan Co.: 1 mi. W Iliff on US-138, 10 July 1975, Dille 184 (KSC). Phillips Co.: 3 mi. W Holyoke on US-6, 10 July 1975, Dille 183 (KSC). Pueblo Co.: 6 mi. W Fowler, 17 Aug 1968, Tomb 337 (SMU). Yuma Co.: Rd. to Bonny Res., 10 July 1975, Dille 179 (KSC).

IOWA: Boone Co.: 15 July 1949, Wingo 222 (SMU). Clarke Co.: 26 June 1957, Van Bruggen 2365 (SD). Fremont Co.: 3.5 mi., 9 mi. S Jct. Ia. 2&Hy 239, 3 July 1971, Weedon 6974 (KANU). Harrison Co.: 3 mi. SE Modale, 17 Aug 1974, Brooks 8193 (KANU). Monona Co.: 3 mi. S Onawa, 17 Aug 1974, Brooks 8264 (KANU).

KANSAS: Barton Co.: Aug 1895, Hitchcock s.n. (KSC). Cheyenne Co.: 2 mi. N St. Francis, 27 June 1954, McGregor 9443 (KANU); 1.5 mi. W St. Francis 16 Aug 1960, Harms 1220 (KANU, SMU). Clay Co.: Clay Center, 1929, Weber 261 (KSC). Cloud Co.: 1930, Fraser 373 (KSC). Decatur Co.: Decatur Co. St. Lake #1, 12 Aug 1948, McGregor 2122 (KANU). Ellis Co.: July 1895, Hitchcock s.n. (KSC). Ellsworth Co.: 1896, Becker s.n. (KSC). Finney Co.: 12 Aug 1895, Hitchcock s.n. (KSC). Ford Co.: 1 mi. NW Ford, 25 June 1958, Hulbert 3206 (KSC, KANU, OKL). Hamilton Co.: 29 July 1893, Thompson 162 (KSC). Kearney Co.: 10 July 1912, Ludlow & Muller 4489 (KANU). Marshall Co.: 2 mi. N, 5 mi. W Marysville, 17 July 1953, Horr 4536 (KANU). Mitchell Co.: 26 July 1888, Carleton s.n. (KSC). Osborne Co.: 15 mi. NE Natoma, 13 July 1932, Neher 185 (KSC). Ottawa Co.: 1 mi. N, 1 mi. W Ada, 16 July 1965, Richardson & Robertson 741 (KANU). Phillips Co.: 2.5 mi. S. Agra, 14 Aug 1975, Dille 239 (KSC). Republic Co.: 4 mi. S, .3 mi. W Cuba, 8 July 1960, Morley 462 (SMU). Russell Co.: 1 July 1895, Hitchcock s.n. (KSC). Saline Co.: Saline R., N Saline 22 July 1931, Havlin 990 (KANU). Scott Co.: 14 mi. N, 1 mi W Scott City, 16 July 1972, Stephens 57094 (KANU). Sheridan Co.: 1931, Weber 362 (KSC). Thomas Co.: 27 June 1897, Hitchcock s.n. (KSC). Washington Co.: .5 mi. S, 1.5 mi. W Washington, 23 July 1953, Horr 4625 (KANU).

MISSOURI: Atchison Co.: 3 mi. E Tarkio, 9 July 1940, Gleason 9272 (SMU).

MONTANA: Big Horn Co.: 20 mi. N Hardin, 29 July 1973, Stephens 69438 (KANU). Blaine Co.: 6 mi. W Harlem, 21 July 1973, Stephens 68313 (KANU). Broadwater Co.: 16 Aug. 1945, Hitchcock & Muhlick 13639 (MO). Carter Co.: 38 mi. SE Ekalaka, 8 July 1973, Stephens 66731 (KANU). Chouteau Co.: 7 mi. N Big Sandy, 22 July 1973, Stephens 68503 (KANU). Custer Co.: 12 mi. E Locate, 10 July 1973, Stephens 67011 (KANU). Daniels Co.: 2 mi. E Flaxville, 17 July 1973, Stephens 67858 (KANU). Dawson Co.: 9 mi. NW Lindsay, 12 July 1973, Stephens 67340 (KANU). Fallon Co.: 3.5 mi. S Willard, 9 July 1973, Stephens 66840 (KANU). Fergus Co.: 13 mi. W Lewistown, 24 July 1973, Stephens 68781 (KANU). Garfield Co.: 15 mi. SW Jordon, 27 July 1973, Stephens 69130 (KANU). Judith Basin Co.: 9 mi. N Stanford, 23 July 1973, Stephens 68655 (KANU). McCone Co.: 2.5 mi. S, 1 mi. N Brockway, 12 July 1973, Stephens 67263 (KANU). Petroleum Co.: 8 mi. W Winnett, 26 July 1973, Stephens 68989 (KANU). Phillips Co.: .25 mi. E Malta, 20 July 1973, Stephens 68186 (KANU). Powder River Co.: 40 mi. W Broadus, 31 July 1973, Stephens 69615 (KANU). Prairie Co.: 23 mi. NW Terry, 11 July 1973, Stephens 67200 (KANU). Richland Co.: 25 mi. S Sidney, 14 July 1973 Stephens 67558 (KANU). Roosevelt Co.: 14 mi. W Culbertson, 29 June 1968, Stephens 23645 (KANU). Rosebud Co.: 1.5 mi. W Lame Deer, 30 July 1973, Stephens 69521 (KANU). Sheridan Co.: 17 mi. SW Westby, 5 July 1967, Stephens 13234 (KANU). Treasure Co.: 4 mi. E Sanders, 29 July 1973, Stephens 68256 (KANU). Valley Co.: 23 mi. S Opheim, 19 July 1973, Stephens 68116 (KANU). Wibaux Co.: 9 mi. N Wibaux, 14 July 1973, Stephens 67486 (KANU).

NEBRASKA: Adams Co.: 5 mi. E, .5 mi. N Heartwell, 29 June 1968, Birkholz 2354 (KANU). Arthur Co.: 10 mi. E Arthur, 19 July 1968, Stephens 24964 (KANU). Banner Co.: 11 mi. S, 6 mi. E Melbeta, 23 June 1966, Stephens 5512 (KANU).; 16 mi. N Kimball on Neb-71, 10 July 1975, Dille 185 (KSC). Box Butte Co.: 14 mi. N Alliance, 13 July 1968, Stephens 24498 (KANU). Cedar Co.: 7 mi. N, 2 mi. E Crofton, 19 July 1967, Stephens 14189 (KANU). Chase Co.: 1 mi. E Wanneta, 30 June 1970, Stephens 40941 (KANU). Custer Co.: 9 mi. S Broken Bow, 20 July 1968, Stephens 25941 (KANU). Dawes Co.: 13 mi. S, 10 mi. W Chadron, 22 Aug 1967, Stephens 16997 (KANU). Douglas Co.: 21 Aug 1898, Williamson s.n. (SMU). Furnas Co.: 1 mi. N, 2.5 mi. W Jct. N-46 & US-136, 28 June 1970, Magrath & Hays 5596 (KANU). Garden Co.: 2 mi. S Lewellen, 13 July 1967, Stephens 13929 (KANU); 1 mi. S, .5 mi. E Lewellen, 13 July 1968, Bare & McGregor 1476 (KANU). Garfield Co.: 10 mi. E Burwell, 11 July 1968, Stephens 24306 (KANU). Greeley Co.: 2 mi. S Scotia, 2 Aug 1967, Stephens 15725 (KANU). Harlan Co.: 4 mi. E, 3 mi. N Oxford, 21 July 1968, Stephens 25337 (KANU). Hayes Co.: 14 mi. W Hayes Center, 13 July 1967, Stephens 13955 (KANU). Keya Paha Co.: 6 mi. S Springview, 15 July 1969, Stephens 34344 (KANU). Knox Co.: S side of Lewis & Clark Lake, 29 June 1966, Croat 2149 (KANU). Lancaster Co.: 1.5 mi. E Davey, 3 Aug 1972, Stephens 58460 (KANU). Logan Co.: 4 mi. S, 1.5 mi. E Stapleton, 4 July 1968, Stephens 66428 (KANU). McPherson Co.: 22 mi. N Tryon, 19 July 1968, Stephens 24974 (KANU). Morrill Co.: 2 mi. W, 14 mi. S Bridgeport, 11 Aug 1967, Stephens 16089 (KANU). Nemaha Co.: 2 mi. N, 1 mi. W Peru, 1 Aug 1972, Stephens 58171 (KANU). Red Willow Co.: 1 mi. W McCook, 29 July 1966, Stephens 8367 (KANU). Sarpy Co.: Between Greenwood & Ashland, 29 June 1968, Sutherland 1815 (KANU). Scotts Bluff Co.: 1 mi. E Scotts Bluff N.M., 22 June 1966, Stephens 5362 (KANU). Sherman Co.: 1.5 mi. SE Litchfield on N-2, 13 July

1966, Stephens 6787 (KANU); 1 mi. E Hazard, 13 July 1966, Backer 2867 (KANU). Sioux Co.: 12 mi. S Agate, 11 Aug 1967, Stephens 16188 (KANU). Stanton Co.: 8.5 mi. S Pilger, 19 July 1967, Stephens 14098a (KANU). Webster Co.: 2 mi. S, 3 mi. W Red Cloud, 4 July 1973, McGregor 25595 (KANU).

NORTH DAKOTA: Billings Co.: 11 mi. E Medora, 1 July 1966, Croat 2335 (KANU). Bowman Co.: 6 mi. W, 1.5 mi. S Bowman, 8 July 1967, Stephens 13603 (KANU). Cavalier Co.: 9 mi. N, 6 mi. E Langton, 8 Sept 1968, Stephens 28900 (KANU). Dickey Co.: 4.5 mi. N Ellendale, 13 Sept 1972, Stephens 61393 (KANU). Divide Co.: 16 mi. SW Fortuna, 5 July 1967, Stephens 13172 (KANU). Emmons Co.: 14 mi. W, 13 mi. N Linton, 4 July 1969, Stephens 33233 (KANU). Faulk Co.: 6 mi. E, 6 mi. N Faulkton, 30 July 1967, Stephens 15276 (KANU). Foster Co.: 18 mi. E, 6 mi. S Carrington, 14 Sept 1972, Stephens 61542 (KANU). Golden Valley Co.: 6.5 mi N Sentinal Butte, 23 July 1971, Stephens 49973 (KANU). Grant Co.: 15 mi. S Raleigh, 18 July 1971, Stephens 49561 (KANU). Hettinger Co.: 10.5 mi. W Regent, 24 July 1971, Stephens 50075 (KANU). Kidder Co.: 5 mi. W Tuttle, 28 July 1967, Stephens 15057 (KANU). Logan Co.: 8 mi. S Napoleon, 29 July 1967, Stephens 15114 (KANU). McKenzie Co.: 15.5 mi N Alexander, 6 July 1967, Stephens 13349 (KANU); 8 July 1969, Ward 660 (MO). McLean Co.: Ory Prairie, 13 July 1972, Stanley 788 (SD). Mercer Co.: 10 mi. N Zap, 14 July 1969, Ward 809 (KANU). Morton Co.: 20 mi. E, 5 mi. N Flasher, 18 July 1971, Stephens 41610 (KANU). Mountaintrail Co.: 1 mi. E New Town, 4 Sept 1968, Stephens 28714 (KANU). Oliver Co.: 11 mi. E, 1 mi. S Center, 11 July 1971, Stephens 49646 (KANU). Pembina Co.: 5 mi. N Mountain Tongue River, 25 July 1971, Stephens 14671 (KANU). Pierce Co.: 9 mi. S, 7.5 mi. E Orrin, 27 July 1967, Stephens 14960 (KANU). Ramsey Co.: 10 mi. W Garske, 9 Sept 1968, Stephens 29004 (KANU). Ransom Co.: 6 mi. NW Lisbon, 10 July 1970, Seiler 2141 (KANU). Richland Co.: 20 mi. N Wyndmere, 24 July 1967, Stephens 14584 (KANU). Sargent Co.: 10.5 mi. W Cogswell, 26 Aug 1971, Stephens 51729 (KANU). Stark Co.: 12 mi. S Belfield, 1 Sept 1968, Stephens 28587 (KANU). Traill Co.: 3.7 mi. N Grandin, 22 July 1970, Seiler 2380 (KANU). Ward Co.: 8 mi. W Berthold, 5 Sept 1968, Stephens 28745 (KANU). Williams Co.: 4 mi. W Grenora, 5 July 1967, Stephens 13247 (KANU).

OKLAHOMA: Washita Co.: 17 June 1913, G.W. Stevens 979 (OKL, MO).

SOUTH DAKOTA: Aurora Co.: 2 July 1972, Van Genderen 41 (SD). Beadle Co.: 17 Aug 1969, Croat 3599 (MO). Bon Homme Co.: 7 mi. S Tabor, 23 June 1965, McGregor 19419 (KANU). Brookings Co.: 11 mi. N Arlington, 7 Sept 1969, Stephens 36504 (KANU). Brule Co.: 16 mi. S, 3 mi. E Pukwana, 1 July 1969, Stephens 32820 (KANU). Buffalo Co.: 8.5 mi. SE Ft. Thompson, 2 July 1969, Stephens 32940 (KANU). Butte Co.: Belle Fourche 2 July 1924, McIntosh 445 (SD); 17 mi. N Belle Fourche, 25 July 1966, Stephens 7787 (KANU, SMU). Campbell Co.: 5 mi. W, 2 mi. N. Mound City, 4 July 1969, Stephens 33174 (KANU). Chas Mix Co.: 2 mi. W Ft. Randall Res. Dam, 14 July 1966, Barker 3086 (KANU). Clark Co.: 6 mi. E, 4 mi. N Bradley, 27 July 1970, Stephens 42346 (KANU). Clay Co.: 6 mi. NW Vermillion, 27 June 1950, Johnson s.n. (SD). Codington Co.: Lake Kampeska, 3 Aug 1958, Dugle 738 (SD). Corson Co.: 9 mi. N, 3 mi. W Custer, 9 Aug 1969, Tomb & Tomb 571 (SMU). Day Co.: 6 Aug 1950, Machmiller 93 (SD). Dewey Co.: 20 mi. NE Whitehorse, 12 July 1969, Stephens 33780 (KANU). Fall River Co.: 9 mi. SW Hot Springs, 12 July

1967, Stephens 13809 (KANU). Grant Co.: 14.5 mi. W Milbank, 27 June 1971, Stephens 48918 (KANU). Gregory Co.: 2 mi. W Picktown, 1 mi. S on Access Rd., 30 July 1965, Harms 3078 (KANU). Hanson Co.: Edge Rockport Colony, 19 July 1965, Harms 2805 (KANU). Harding Co.: 26 mi. S. Camp Cook, 25 July 1966, Stephens 7844 (KANU). Hughes Co.: 22.5 mi. SE Pierre, 2 July 1969, Stephens 33012 (KANU). Hutchinson Co.: 29 June 1969, Walz 131 (SD). Hyde Co.: 5 mi. N. Highmore, 31 July 1967, Stephens 15306 (KANU). Jackson Co.: Cedar Pass, 24 July 1913, Over 6194 (SD). Jerauld Co.: 2 mi. E Lane, 11 Sept 1972, Stephens 61180 (KANU). Jones Co.: 5 mi. E Murdo on US-16 - 83, 8 July 1964, Harms & Holsted 1471 (KANU). Kingsbury Co.: 2 mi. E Desmet, 21 July 1967, Stephens 14268 (KANU). Lake Co.: 3 mi. SE Madison, 29 June 1966, Croat 2176 (KANU). Lawrence Co.: N Black Hills, 26 July 1947, Bennett 646 (SD); 2 mi. S Cheyenne Crossing, 26 July 1966, Stephens 7501 (KANU); Spearfish Canyon, 19 Aug 1975, Dille 276 (KSC). Lincoln Co.: 29 June 1958, Messerli 168 (SD). Lyman Co.: 8 mi. S Lower Brule, 15 July 1966, Barker 3118 (KANU). Marshall Co.: 23 June 1959, Ailts 214 (SD). McPherson Co.: 4.5 mi. N Eureka, 29 July 1967, Stephens 15174 (KANU). Minnehala Co.: Ralisades State Park, 13 July 1959, Messerli 718 (SD). Pennington Co.: Rapid City, 19 July 1922, Lee B-191 (SD); 29 July 1957, Lindstrom 323 (SD); Badlands, 19 Aug 1967, Stockert 166-67 (SD). Perkins Co.: 7 mi. E Lemmon, 18 July 1971, Stephens 49549 (KANU). Potter Co.: 16 mi. W, 7 mi. S Gettysburg, 3 July 1969, Stephens 33098 (KANU). Roberts Co.: White Rock, 15 July 1897, Powell s.n. (SD); 14 mi. SE Wilmot, 22 July 1967, Stephens 14403 (KANU). Sanborn Co.: 13 July 1910, Visher 4416 (MO). Stanley Co.: 13 mi. SE Ft. Pierre, 23 June 1967, Stephens 12108 (KANU). Sully Co.: 18 mi. W, 10 mi. S Onida, 3 July 1969, Stephens 33058 (KANU). Todd Co.: 19 mi. S Mission, 5 July 1973, Stephens 66582 (KANU). Tripp Co.: 2 mi. E Colome, 14 July 1969, Stephens 43090 (KANU). Turner Co.: 6 mi. N, 8.25 mi. W Beresford, 1 July 1959, Messerli 529 (SD); 10 mi. S, 4 mi. W Marion, 25 June 1960, Harms 437 (KANU). Union Co.: 5 July 1961, Eslick s.n. (SD). Walworth Co.: Selby, 22 Aug 1950, Paul s.n. (SD). Wasabaugh Co.: 7 mi. E, 2 mi. N Wanblee, 29 June 1968, McGregor & Bare 1216 (KANU). Yankton Co.: Lewis & Clark Res., Gavins Pt. Rec. Area, 20 June 1965, Harms 2507 (KANU). Ziebach Co.: 2 mi. W, 5 mi. S Eagle Butte, 12 July 1969, Stephens 33855 (KANU).

WYOMING: Albany Co.: 28 July 1943, Porter 3301 (MO). Campbell Co.: 23 mi. NW Gillette, 2 Aug 1973, Stephens 69806 (KANU). Carbon Co.: .5 mi. N Medicine Bow, 8 Aug 1973, Stephens 70508 (KANU). Crook Co.: 2 mi. W Devils Tower Jct., 14 Aug 1970, Stephens 43809 (KANU). Goshen Co.: 3 mi. N Lingle on US-85, 11 July 1975, Dille 187 (KSC). Johnson Co.: 13 mi. S Buffalo, 3 Aug 1973, Stephens 69919 (KANU). Laramie Co.: .5 mi. S Meriden, 12 Aug 1973, Stephens 71002 (KANU). Lincoln Co.: 1 mi. W Kemmerer, 13 Aug 1963, Breedlove 5845 (SMU). Natrona Co.: 1 mi. W Casper, 7 Aug 1973, Stephens 70327 (KANU).

This plant was known as L. pulchella (Pursh) DC. until Reveal (1968) pointed out that the name L. oblongifolia Nutt. has one year priority over Sonchus pulchellus Pursh (see synonymy). However, this plant may be

a subspecies of the Asian taxon L. tatarica as proposed by Stebbins (1939). The name L. oblongifolia is retained in this treatment until more biosystematic data can be gathered on this problem.

The populations of L. oblongifolia are usually very uniform because of the rhisominous nature of this species. The flower color is almost always blue or lavender, but specimens have been collected from a population that had pure white flowers.

Three phases based on the leaf morphology have been identified, but little data on the distribution of them are available. The most common phase has oblong leaves with the lower cauline leaves possessing 1-3 pair of linear lobes close to the leaf base. Of the two less common phases, one has totally linear leaves and the other has ovate-runcinate leaves.

6. Lactuca floridana (Linn.) Gaertner

Sonchus floridanus Linn., Sp. Pl. p794. 1753. Lactuca floridana (Linn.) Gaertner, Fruct. 362. 1791. Cicerbita floridana (Linn.) Wallr. Sched. Crit. Fl. Hal 433. 1822. Agathyrus floridanus (Linn.) D. Don, Edin. N. Phil. Jour. 6:310. 1828. Mulgedium floridanum (Linn.) DC., Prod. 7:249. 1838. Galathenium floridanum (Linn.) Nutt. Trans. Am. Phil. Soc. N.S., 7:433. 1841. Wiestia floridana (Linn.) Sch. Bip., Herb. and Winckl. Jahrb. Pharm. 4:154. 1841. Type Locality: "Habitat in Virginia, Canada." (not seen).

Lactuca villosa Jacq., Hort. Schoenb. 3:62. 1798. Cicerbita villosa (Jacq.) Beauverd, Bull. Soc. Bot. Geneve. Ser. 2. 2:99-145. 1910. Mulgedium villosum (Jacq.) Small, Man. Se. Fl. p1498. 1933. Lactuca floridana (Linn.) Gaertn. var. villosa (Jacq.) Cronquist, Rhodora 50:31. 1948.

Sonchus acuminatis Willd., Sp. Pl. 3:1521. 1804. Cicerbita acuminata (Willd.) Wallr. Sched. Crit. Fl. Hal. p433. 1822. Mulgedium acuminatum (Willd.) Gray, Proc. Am. Acad. 19:73. 1883. Type Coll.: "Habitat in American Boreali." (not seen).

Mulgedium lyratum Cass., Dict. Sci. Nat. 33:297. 1824.

Mulgedium divaricatum Nutt., Trans. Am. Phil. Soc. N.S. 7:442. 1841.
Type Locality: "Habitat Louisiana." (not seen).

Lactuca floridana (Linn.) Gaertn. f. leucantha Fern., Rhodora 42:498.
1940. Type Coll.: Fernald and Long 11,484, Sussex Co., Virginia
(GH, -Holotype, PH, not seen).

Herbaceous biennial 1.5-2 (3) m tall; stem glabrous; latex white.
Basal and lower cauline leaves sessile, ovate, variously dentate to
deeply pinnate-lobed, apex broadly triangular, base attenuate and
sagittate, 17 (+) cm long, 9 (+) cm wide, abaxial veins hirsute; middle
and upper cauline leaves ovate to lanceolate, variously dentate to
pinnately lobed, apex broadly triangular to acute, base attenuate,
sagittate, glabrous throughout. Inflorescence a diffuse panicle of
50-100+ heads. Heads cylindric; involucral bracts 14-17, 8-9 mm long
at anthesis, 8-11 mm long in fruit; florets 11-16; ligule light blue
or rarely white, 5.5-6 mm long; corolla tube 5 mm long with a ring of
hairs at the summit; anthers dark blue exerted ca. 3 mm; style branches
light blue exerted ca. 1 mm beyond anther tube; pappus white, in 3-4
series, each bristle 5-6 mm long, 3-4 cells thick, short outer pappus
present; beak brown, stout or absent, 1 mm long if present; achene body
dark brown, 4-5 mm long, 1.5-2 mm wide, dorsiventrally compressed with
prominent lateral ridges and 4-5 conspicuous ridges on the abaxial and
adaxial surfaces. Pollen tetraporate. $n = 17$.

Common in forest clearings and along streams and lakes in rich
moist soil from e. North Dakota and e. Texas east to Maine and southern
Florida. It flowers from July to August.

REPRESENTATIVE SPECIMENS:

IOWA: Jasper Co.: 27 July 1956, Jan Bruggen 752 (SD). Louisa Co.: 29 Sept 1954, Davidson 4039 (SMU). Monona Co.: 4 mi. S, 3 mi. W Moorhead, 22 Aug 1974, Brooks 8530 (KANU). Washington Co.: 1 mi. NW Wellman, 7 Aug 1953, Wagenknecht 897 (KANU).

KANSAS: Anderson Co.: 3 mi. N Garnet, 13 Aug 1960, McGregor 15973 (KANU). Atchison Co.: State Lake, 18 Aug 1964, Kolstad 2033 (KANU). Bourbon Co.: 7 mi. S Bronson, 7 Sept 1974, Stephens 82860 (KANU). Chase Co.: .5 mi. W Strong City, 13 Oct 1974, Stephens 83430 (KANU). Cherokee Co.: 1 Sept 1934, Steller & Jacobs 318 (KSC). Clay Co.: 1929, Weber 263 (KSC). Cloud Co.: 1.5 mi. SE Clyde, 20 Sept 1945, Fraser 924 (KSC). Coffey Co.: k-31, 2 mi. E Jct. 75, 11 Aug 1975, Dille 215 (KSC). Cowley Co.: 1 mi. S, 2 mi. E. Arkansas City, 30 Sept 1967, Barker 5064 (KANU). Crawford Co.: 3 mi. N, 1 mi. E Farlington, 9 Sept 1974, Stephens 82898 (KANU). Doniphan Co.: 2 mi. N Troy, 5 Sept 1952, Horr 8287 (KANU); Hy. 7, 1 mi. N White Cloud, 17 Aug 1975, Dille 255 (KSC). Douglas Co.: 2 mi. N Baldwin, 9 Sept 1940, McGregor 358 (KANU); 5 mi. SW Lawrence, 13 Aug 1959, McGregor 15009 (KANU, SMU); S end Baldwin Lake, 25 Aug 1961, Richards 3619 (KANU). Franklin Co.: 2 mi. S, 5 mi. E Lane, 7 Sept 1968, Johnson 1566-a (KANU). Geary Co.: N Wreford, 19 Oct 1935, Gates 18887 (KSC). Greenwood Co.: 2 mi. E, 1.5 mi. S Neal, 17 Oct 1972, Stephens 63699 (KANU). Jackson Co.: 1 mi. E Denison, 17 Aug 1975, Dille 248 (KSC). Jefferson Co.: 2.2 mi. N, .3 mi. E Oskaloosa, 21 Sept 1968, Johnson 1661 (KANU). Johnson Co.: .5 mi. E Edgartown, 2 Oct 1973, Stephens 74012 (KANU). Labetter Co.: 4 mi. W Parsons, 8 Oct 1973, Stephens 74293 (KANU). Leavenworth Co.: Ft. Leavenworth, 23 Sept 1956, Wagenknecht 3370 (KANU). Linn Co.: 3 mi. N Trading Post, 31 Aug 1974, Stephens 82734 (KANU). McPherson Co.: 1940, Gustafson s.n. (KSC). Miami Co.: 2 mi. W, 2 mi. N Hillsdale, 24 Aug 1970, Stephens 44156 (KANU). Montgomery Co.: 3 mi. S, 1 mi. E Independence, 20 Sept 1974, Stephens 83134 (KANU). Neosha Co.: Neosha Co. St. Park, 10 Sept 1971, McGregor 24140 (KANU). Pottawatomie Co.: 5.5 mi. S Olsburg, 24 Aug 1967, Barker 4581 (KANU). Republic Co.: 1890, Thomas s.n. (KSC). Riley Co.: 17 Sept 1927, Gates 14968 (KSC). Rooks Co.: 28 July 1875, Popenoe s.n. (KSC). Sheridan Co.: 1931, Weber 362a (KSC). Washington Co.: 1940, Imhoff s.n. (KSC).

MISSOURI: Cedar Co.: 16 mi. SE El Dorado Springs, 6 Sept 1966, Stephens 9030 (KANU). Cape Girardeau Co.: 5 mi. W Delta, 31 Aug 1954, Steyermark 77001 (KANU). Dent Co.: 4 Aug 1936, Steyermark 12519 (MO). Franklin Co.: 7 Aug 1972, Shea 263 (MO). Henry Co.: 10 mi. E, 6 mi. N Clinton, 23 Aug 1969, Stephens 36263 (KANU). Jefferson Co.: 24 Sept 1967, Croat 3997 (MO). Montgomery Co.: 3 Oct 1934, Steyermark 15823 (MO). St. Louis Co.: 19 Aug 1930, Kellogg s.n. (MO). Wright Co.: 21 Aug 1937, Stephens 5183? (KANU). Nemaha Co.: 5 mi. NW Peru, 7 Sept 1967, Stephens 17715 (KANU). Richardson Co.: 1 mi. S, 2 mi. W Falls City, 29 Aug 1970, McGregor 23416 (KANU).

OKLAHOMA: Adair Co.: 4.5 mi. N Stilwell, 21 Aug 1968, Stephens 28055 (KANU). Bryan Co.: 2 mi. N Oberlin, 5 Sept 1962, J and C. Taylor 941 (OKL). Cherokee Co.: 8 mi. E Tahlequah, 28 Sept 1964, Lawson, Massey,

Goodman 180 (OKL). Cleveland Co.: .5 mi. N, .25 mi. NE Lexington, 27 Sept 1942, Hawk 80 (OKL). Mayes Co.: 4 mi. SE Locust Grove, 30 Aug 1903, Buck 637 (OKL). Murray Co.: 6 Nov 1936, Hopkins 1154 (OKL). Muskogee Co.: 4 Sept 1927, Little 2133 (OKL). Oklahoma Co.: Oklahoma City, 1 Sept 1941, Waterfall 3548 (OKL). Washington Co.: 15 mi. N Bartlesville, 30 Sept 1937, J. Engleman 5002 (OKL).

SOUTH DAKOTA: Clay Co.: SW Vermillion, 15 Sept 1969, Van Bruggen 5345 (SD).

This species has several phases based on variations in leaf morphology and flower color. The flower color is usually light blue, but occasionally the flowers are white. This latter phase has been referred to as f. leucantha. The lower leaves always have the broadly triangular apex but may either be pinnate-lobed below the apex or unlobed below the apex. The phase with the unlobed leaves is the basis for the name L. villosa.

7. Lactuca biennis (Moench) Fernald

Sonchus biennis Moench. Meth. 545. 1794. Lactuca biennis (Moench) Fern., Rhodora 42:302. 1940.

Sonchus racemosus Lam., Encycl. 3:400. 1789. Not Lactuca racemosus Willd., Sp. Pl. 3:1520. 1804.

Sonchus leucophaeus Willd., Sp. Pl. 3:1520. 1804. (Excl. Syn. Sonchus spicatus Lam. and Prenanthes autumnalis Walt.) Cicerbita leucophaea (Willd.) Wallr., Sched. Crit. Hal 434. 1822. Agathysus leucophaeus (Willd.) L. Beck, Bot. 170. 1833. Mulgedium leucophaeum (Willd.) DC., Prod. 7:250. 1838. Lactuca leucophaea Gray, Proc. Am. Acad. 19:73. 1883. Not Lactuca leucophaea Sibth., Fl. Graec. 4:794. 1833. Type Locality: "Habitat in America Boreali." (not seen).

Agathysus spicatus sensu D. Don, Edin. N. Phil. Jour. 6:310. 1829. Lactuca spicata sensu Hitch., Trans. St. Louis Acad. Sci. 5:506. 1891. Lactuca spicata sensu O. Ktze., Rev. Gen. 349. 1891. Cicerbita spicata sensu Beauverd, Bull. Soc. Bot. Geneve Ser 2. 2:99. 1910. Not Sonchus spicatus Lam., Encycl. 3:401. 1789.

Mulgedium leucophaeum (Willd.) DC. β integrifolium T. & G., Fl. N. Am. 2:499. 1843. Lactuca leucophaea (Willd.) Gray var. integrifolia (T. & G.) Gray, Syn. Fl. N. Am. 1. Pt 2.444. 1884. Lactuca spicata sensu Hitch. var. integrifolia (T. & G.) Britton,

Mem. Torr. Bot. Club 5:350. 1894. Lactuca spicata sensu Hitch.
var. aurea Jennings f. integrifolia (T. & G.) Jennings, Ann.
Carnegie Mus. 13:443. 1922. Lactuca biennis (Moench) Fern. f.
integrifolia (T. & G.) Fern., Rhodora 42:302. 1940.

Lactuca spicata sensu Hitch. var. aurea Jennings, Ann. Carnegie Mus.
13:440, Tab. 33. 1922. Lactuca biennis (Moench) Fern. f. aurea
(Jennings) Fern. Rhodora 42:302. 1940. Type Coll.: Jennings
and Kinzer, Forbes St. and Woodlawn Ave., Pittsburgh, Penn.,
Oct. 2, 1905. (CM, not seen).

Herbaceous biennial 1.5-2 m tall; stem glabrous; latex white.
Basal and lower cauline leaves sessile, variously pinnatifid to
deeply pinnate-lobed with a broadly triangular apex, dentate, base
atenuate, sagittate, often with trichomes on abaxial and adaxial
surfaces; middle and upper cauline leaves lanceolate, pinnate-lobed
to entire, base attenuate, sagittate, glabrous throughout. Inflorescence
a diffuse conical panicle of 50-100+ heads. Heads cylindric; involucre
bracts ca. 24, 8 mm long at anthesis, 11 mm long in fruit; florets 25-40;
ligule light blue with purple apex, 4 mm long; corolla tube 3 mm long
without a ring of hairs at the summit; anthers blue, exerted ca. 1 mm
beyond anther tube; pappus brown, in 3-4 series, each bristle 5-6 mm
long; 3-4 cells thick, short outer pappus present; beak brown, stout or
absent, 1 mm long if present; achene body light brown, 4-5 mm long,
1.5-2 mm wide, dorsiventrally compressed with prominent lateral ridges
and 4-5 conspicuous ridges on the abaxial and adaxial surfaces. Pollen
tetracolporate. $\underline{n} = 17$.

Found in forest clearings and along streams and lakes in rich,
moist soil from central British Columbia and northern California, east
to Newfoundland and North Carolina, and south to Wyoming, South Dakota,
and Iowa. It is rare in the Great Plains as it is found principally
in the northern portion of the Black Hills of South Dakota.

REPRESENTATIVE SPECIMENS:

MINNESOTA: Lake of the Woods Co.: 25 July 1939, Moore 11126 (KANU).

NORTH DAKOTA: Benson Co.: Lake Ibsen, 7 July 1909, Linnell s.n. (SD).

SOUTH DAKOTA: Custer Co.: Sylvan Lake, 13 Aug 1950, Brenckle & Petrack 50212 (SD). Lawrence Co.: Spearfish Canyon, 19 Aug 1975, Dille 275 (KSC). Marshall Co.: 2 Aug 1959, B Ailts 389 (SD). Pennington Co.: 6 mi. E Sheridan Lake, 18 July 1966, Stephens 7215 (KANU).

The flower color is blue with purple tips, but a yellow phase is found in western Pennsylvania. Two phases may be defined based on variation in leaf morphology. One phase has pinnatifid leaves and the other phase has leaves with a broadly triangular apex and pinnate-lobed below the apex. No data have been gathered by this author on the distribution of these phases as the plant is rare in the Great Plains.

Doubtful and Excluded Names

Lactuca polyphylla Rydb., Bull. Torr. Bot. Club. 38:23. 1911. Type Coll.: E. L. Greene Lake Pend d'Oreille, Idaho, Aug. 5, 1885 (not seen). This may be L. canadensis upon examination of the type.

Lactuca sylvatica A. Nelson, Bull. Torr. Bot. Club. 26:486. 1899. Type Coll.: A. Nelson 4257, Elk Mtn., Medicine Bow R., Aug. 1897 (not seen). This may be L. oblongifolia upon examination of the type.

Sonchus multiflorus Desf., Cat. H. Par. 145. 1829. Mulgedium multiflorum (Desf.) DC. Prod. 7:249. 1838. Galethium multiflorum (Desf.) Nutt., Trans. Am. Phil. Soc. N.S. 7:443. 1841. This may be L. biennis upon examination of the type.

Sonchus acuminatus Bigel. Fl. Bost. ed 2. 290. 1824. This may be L. biennis upon examination of the type.

Lactuca multifida Rydb., Mem. N.Y. Bot. Gard. 1:484. 1900. Lactuca spicata Ssensu Hitch. var. multifida (Rydb.) Nelson & Macbr., Bot. Gaz. 62:152. 1916. Type Coll.: R. S. Williams, Columbia Falls, Montana, 1895 (NY, not seen). This may be L. biennis upon examination of the type.

Sonchus macrophyllus Willd., Sp. Pl. 3:1519. 1804. Cicerbita
macrophylla (Willd.) Wallr., Sched. Crit. Fl. Hal 433. 1822.
Agathyrus macrophyllus (Willd.) L. Beck, Bot. 170. 1833.
Mulgedium macrophyllum (Willd.) DC. Prod. 7:248. 1838.
Galathenium macrophyllum (Willd.) Nutt., Trans. Am. Phil. Soc.
N.S. 7:441. 1841. This may be either L. biennis or L. floridana
upon examination of the type.

Figure 63. Distribution of L. canadensis.

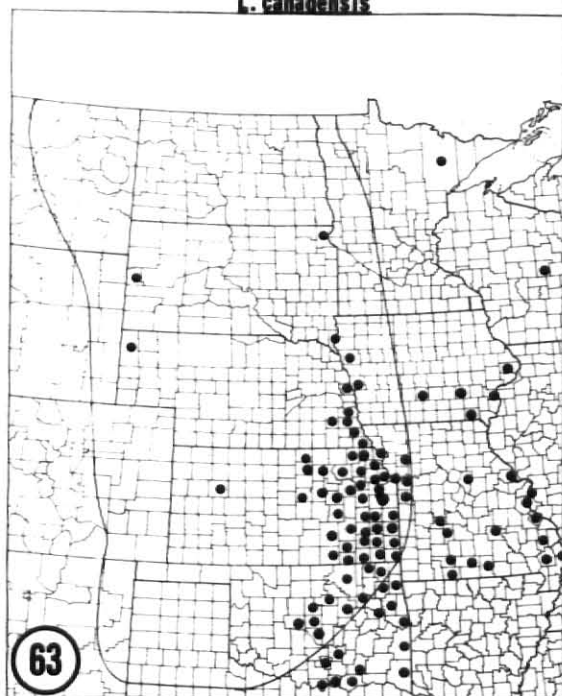
Figure 64. Specimen of L. canadensis, Stephens 59018 (KANU).

Figure 65. Specimen of L. canadensis, T.B. Croat 2487 (KANU).

Figure 66. Specimen of L. canadensis, C.S. Wallis 7649-1 (KANU).

Magnification of herbarium specimens is .26x.

L. canadensis



63



64



65

HERBARIUM OF KANSAS STATE UNIVERSITY
 L. canadensis L.
 Lawrence, Kansas

Plants of 1888
 L. canadensis L.
 Upper Co., Kansas
 1 mi. N. of 30th and 4th on 4th
 1888
 John H. Allen
 Thomas H. Allen



66

HERBARIUM OF KANSAS STATE UNIVERSITY
 L. canadensis L.
 Lawrence, Kansas

Plants of 1888
 L. canadensis L.
 Upper Co., Kansas
 1 mi. N. of 30th and 4th on 4th
 1888
 John H. Allen
 Thomas H. Allen

Figure 67. Specimen of L. canadensis, Stephens 60735 (KANU).

Figure 68. Distribution of L. ludoviciana.

Figure 69. Specimen of L. ludoviciana, Stephens 83026 (KANU).

Figure 70. Specimen of L. ludoviciana, Stephens 59162 (KANU).

Magnification of herbarium specimens is .26x.

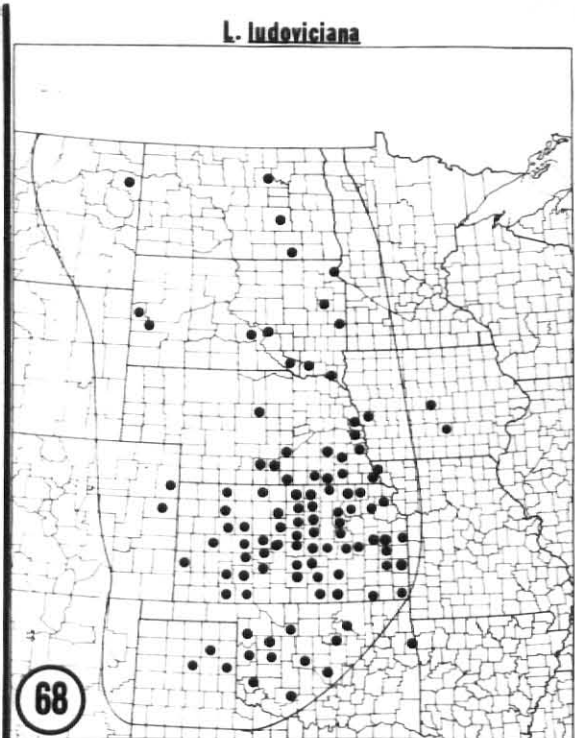


Figure 71. Distribution of L. serriola.

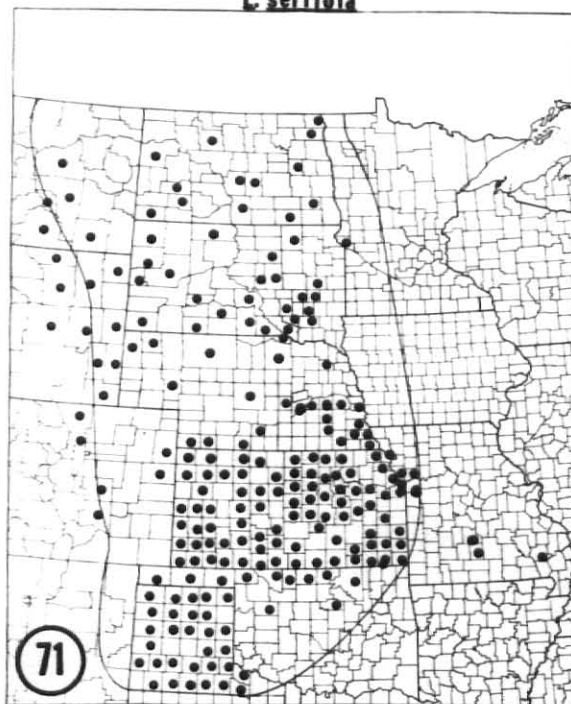
Figure 72. Specimen of L. serriola, Stephens 43421 (KANU).

Figure 73. Specimen of L. serriola, Stephens 44937 (KANU).

Figure 74. Distribution of L. saligna.

Magnification of herbarium specimens is .26x.

L. serriola



ANNOUATION LABEL

For Sample's Address

Colorado Plant

72

UNIVERSITY OF MINNESOTA
HERBARIUM, MINNEAPOLIS

1911
Herb. No. 10000
The University of Minnesota
Minneapolis, Minn.



South Dakota Plant

ANNOUATION LABEL

For Sample's Address

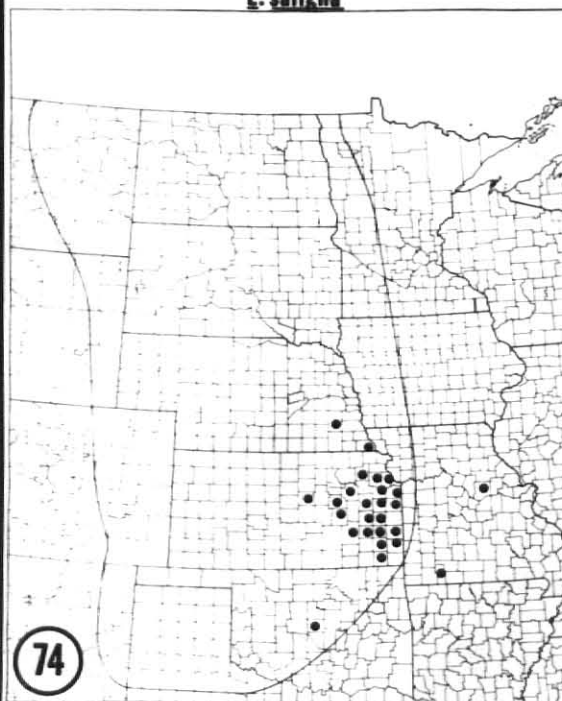
South Dakota

The University of Minnesota
Minneapolis, Minn.

73

UNIVERSITY OF MINNESOTA
HERBARIUM, MINNEAPOLIS

L. saligna



74

Figure 75. Specimen of L. saligna, Richards 3425 (KANU).

Figure 76. Specimen of L. saligna, Stephens 82814 (KANU).

Figure 77. Distribution of L. oblongifolia.

Figure 78. Specimen of L. oblongifolia, Stephens 55860 (KANU).

Magnification of herbarium specimens is .26x.



75

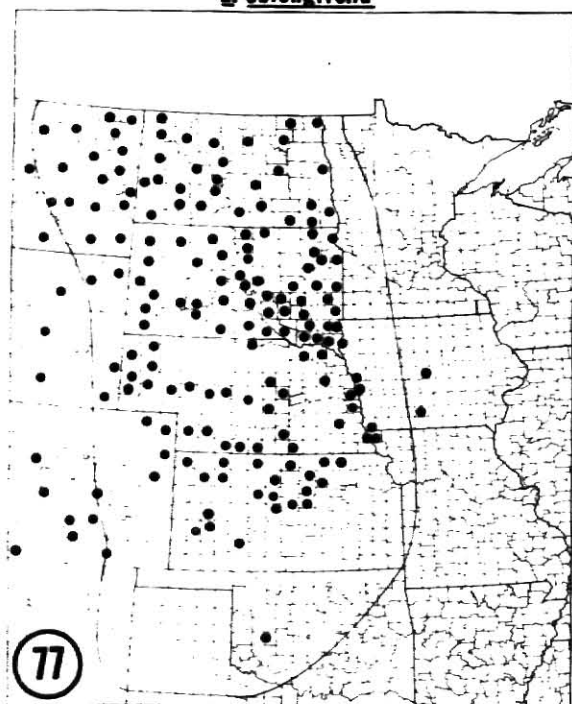
HERBARIUM OF THE
UNIVERSITY OF KANSAS
LABORATORY



76

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LABORATORY

L. oblongifolia



77



78

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LABORATORY

Figure 79. Specimen of L. oblongifolia, Stephens 33030 (KANU).

Figure 80. Distribution of L. floridana.

Figure 81. Specimen of L. floridana, Stephens 18731 (KANU).

Figure 82. Specimen of L. floridana, Stephens 17715 (KANU).

Magnification of herbarium specimens is .26x.

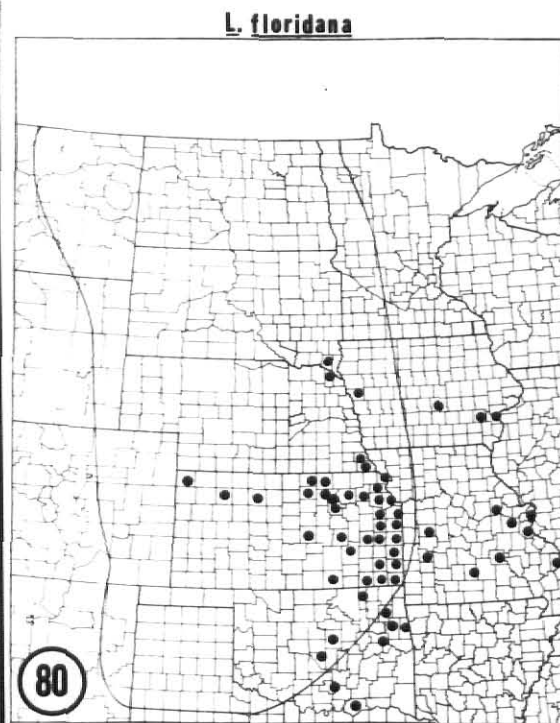


Figure 83. Distribution of L. biennis.

Figure 84. Specimen of L. biennis, Stephens 7215 (KANU).

Figure 85. Specimen of L. biennis, J.R. Churchill s.n. (MO).

Figure 86. Specimen of L. sativa, N.B. Jacobs s.n. (KSC).

Magnification of herbarium specimens is .26x.

L. biennis

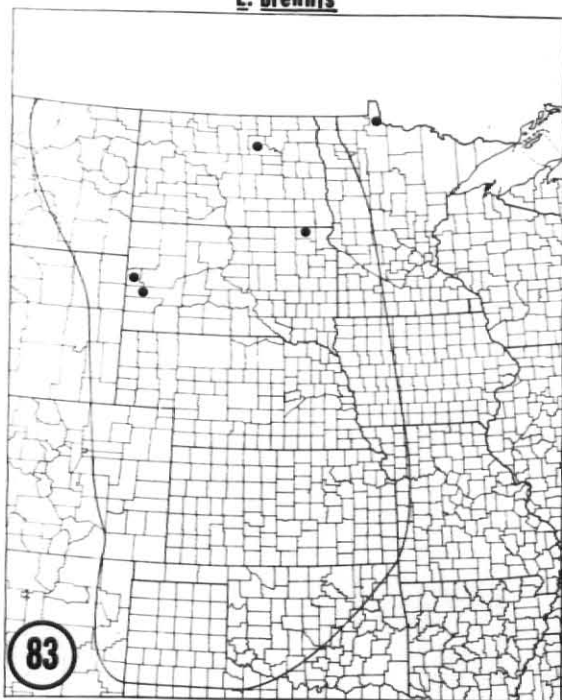


Figure 87. Specimen of L. virosa, J.T. Howell 19310 (MO).

Figure 88. Specimen of L. graminifolia, A.H. Curtiss 4504 (UC).

Figure 89. Specimen of L. hirsuta, O. Lakella 5120 (UC).

Figure 90. Specimen of L. tatarica, I. Schiraeovsky s.n. (MO).

Magnification of herbarium specimens is .26x.

APPENDIX I

A TENTATIVE INFRAGENERIC RECLASSIFICATION OF THE NORTH AMERICAN LACTUCAS AND RELATED SPECIES

This proposed infrageneric reclassification is only tentative and no formal changes are intended at this time. The formal reclassification must await a comprehensive study of the genus.

Present Classification:

Lactuca subg. Lactuca

L. sativa
L. serriola
L. saligna
L. virosa
L. canadensis
L. ludoviciana
L. hirsuta
L. graminifolia

Lactuca subg. Mulgedium

L. floridana
L. biennis
L. oblongifolia
L. tatarica

Proposed Reclassification:

Lactuca subg. Lactuca

L. sativa
L. serriola
L. saligna
L. virosa

Lactuca subg. Mulgedium

sect. Mulgedium
L. tatarica
L. oblongifolia
sect. Cicerbita
L. canadensis
L. ludoviciana
L. hirsuta
L. graminifolia
L. biennis
L. floridana

REFERENCES

- Anderson, E.A. 1949. Introgressive Hybridization. 1968 reprint
Hafner Publ. Co., New York. 102 pp.
- Babcock, E.B. and G.L. Stebbins. 1943. Systematic Studies in the
Cichorieae. Univ. Cal. Publ. Bot. 18:227-240.
- _____, G.L. Stebbins, and J.A. Jenkins. 1937. Chromosomes and
Phylogeny of Some Genera of the Crepidinae. Cytologia, Fujii
Jubl. Vol. 188-210.
- Beauverd, G. 1910. Contribution a L'etude des Composees. Bull. Soc.
Bot. Geneve, Ser 2, 2:99-145.
- Belzer, N.F. and M. Ownbey. 1971. Chromatographic Comparison of
Tragopogon Species Hybrids. Amer. Jour. Bot. 58:791-802.
- Bentham, G. 1873. Notes on the Classification, History, and Geographical
Distribution of Compositae. Jour. Linn. Soc. Bot. 13:489, 390:
475-480.
- Boulos, L. 1973. Revision Systematique du Genre Sonchus L. IV.
Sonchus-Genre.1. Sonchus. Bot. Not. 126:155-196.
- De Candole, A. 1838. Prodrum Systematis Naturalis Regni Vegetabilis,
Pars VII. Fortin, Masson and Co. Paris. 801 pp.
- Cassini, H. 1826. Ebauche De La Synantherologie. Huitieme Memorie
Le Tableau Methodique des Genres de la Tribu des Lactucees. Opusc.
Phytol. 1:378-426.
- Chatterjee, T. and K. Sharma. 1969. Cytotatonomy of Cichorieae. Genetica
40:577-590.
- Chuang, T. and L. Constance. 1969. A Systematic Study of Perideridia
(Umbelliferae-Apioideae). Univ. Cal. Publ. Bot. Vol. 35.
- Cooper, D.C. and K.L. Mahony. 1935. Cytological Observations in Certain
Compositae. Amer. Jour. Bot. 22:843-849.
- Correll, D.S. and M.C. Johnston. 1970. Manual of the Vascular Plants
of Texas. Texas Research Foundation, Renner, Texas. 1744 pp.
- Davis, P.H. and V.H. Heywood. 1963. Principles of Angiosperm Taxonomy.
1973 reprint Robt. E. Krieger Publ. Co. Huntington, New York. 488 pp.
- Dewey, L.H. 1905. Identity of Prickly Lettuce. Rhodora 7:9-12.
- Don, D. 1829. An Attempt at a New Classification of the Cicoraceae with
Some Observations on the Geographical Distribution of the Family.
Edinburgh New Philos. Jour. 6:305-311.

- Erdtman, G. 1960. The Acetolysis Method. *Svensk. Bot. Tidskr.* 54: 561-564.
- _____. 1966. Pollen Morphology and Plant Taxonomy, Angiosperms. Hafner Publ. Co. New York and London. 472 pp.
- Fægri, K. and J. Iverson. 1964. Textbook of Pollen Analysis. Munksgaard. Copenhagen. 202 pp.
- Farwell, O.A. 1923. Contributions to the Michigan Flora. *Mich. Acad. Sci.* 2:45.
- Fernald, M.L. 1927. Two Summers of Botanizing in Newfoundland. *Rhodora* 28:240.
- _____. 1950. Gray's Manual of Botany 8th ed. American Book Co. New York. 1567 pp.
- Gates, R.R. and E.M. Rees. 1921. A Cytological Study of Pollen Development in Lactuca. *Ann. Botany*, 35, 139:365-398.
- Gleason, H.A. and A. Cronquist. 1963. Manual of the Vascular Plants of the Northeastern United States and Adjacent Canada. Van Nostrand Co., Inc. New York. 767 pp.
- Graham, A. and A.S. Tomb. 1974. Palynology of Erythrina (Leguminosae: Papilionoideae): Preliminary Survey of the Subgenera. *Lloydia* 37: 465-481.
- Grant, V. 1971. Plant Speciation. Columbia Univ. Press. New York. 386 pp.
- Heiser, C.B. and T.W. Whitaker. 1948. Chromosome Number, Polyploidy and Growth Habit in California Weeds. *Amer. Jour. Bot.* 34:179-186.
- Ishikawa, M. 1916. A List of the Number of Chromosomes. *Bot. Mag. (Tokyo)*, 30, 360:404-448.
- _____. 1921. On the Chromosomes of Lactuca. *Bot. Mag. (Tokyo)*, 35, 415:153-158.
- Jeffrey, C. 1966. Notes on the Compositae I. The Cichorieae in the East Tropical Africa. *Kew Bull.* 18:427-486.
- Johnson, M.F. and H. Iltis. 1963. Preliminary Reports on the Flora of Wisconsin No. 48. Compositae I-Composite Family I. Wisconsin Academy of Sciences, Arts and Letters 52:325-331.
- Jones, S.B. 1968. Chromosome Numbers in Southeastern United States Compositae I. *Bull. Torrey Bot. Club* 95:393-395.
- De Jussieu, A.L. 1789. *Genera Plantarum*. Paris. 498 pp.
- Hoffman, O. 1891. Liguliflorae-Cichorieae. in A. Engler and K. Prantl, *Nat. Pflanzenfam.* IV. 5:350-387.

- Holmgren, P.K. and W. Keuken. 1974. Index Herbariorum; Part I, The Herbaria of the World. 6th ed. Regnum Vegetabile 92. Utrecht. 597 pp.
- Lessing, C.F. 1832. Synopsis Generum Compositarum. Berlin. 473 pp.
- Lewis, H. 1963. The Taxonomic Problem of Inbreeders. Regnum Vegetabile. 27:37-44.
- Lewis, W.H. 1964. Oldenlandia Corymbosa (Rubiaceae). Grana Paly. 5(3):330-341.
- Lindberg, H. 1936. Lactuca Tatarica (L.) C. A. Meyer I Norden. Svensk Botanisk Tidskrift 30:652-660.
- Lindquist, K. 1956. Reflexed and Erect Involucre in Lactuca. Hereditas 42:436-442.
- _____. 1958. Inheritance of Lobed Leaf Form in Lactuca. Hereditas 44:347-377.
- _____. 1960a. Cytogenetic Studies in Serriola Group of Lactuca. Hereditas 46:75-152.
- _____. 1960b. On the Origin of Cultivated Lettuce. Hereditas 46:319-350.
- _____. 1960c. Inheritance Studies in Lettuce. Hereditas 46:387-470.
- Linnaeus, C. 1753. Species Plantarum. Impensis Laurentii Salvii Holmiae.
- Mabry, T.J., K.R. Markham, M.B. Thomas. 1970. The Systematic Identification of Flavonoids. Springer-Verlag. New York. 343 pp.
- Mehra, P.N., B.S. Gill, J.K. Mehta. 1965. Cytological Investigations on the Indian Compositae I. North-Indian Taxa. Caryologia 18, 1:35-68.
- Milstead, W.L. 1964. A Revision of the North American Species of Prenanthes. Unpublished Ph.D. Dissertation. Purdue University, West Lafayette, Indiana.
- Mulligan, G.A. 1957. Chromosome Numbers of Canadian Weeds.I. Canadian Jour. Bot. 35, 5:779-789.
- _____. 1961. Chromosome Numbers of Canadian Weeds.III. Canadian Jour. Bot. 39, 5:1057-1066.
- _____. 1969. in IOPB Chromosome Number Reports XX. Taxon 18:213-221.
- Nazarova, N.A. 1968. The Caryology of the Subfam. Cichorioideae Kitam., Fam. Asteraceae. Bio. Zhurn. Arm. S.S.R. 21:93-98.
- Ono, H. 1943. Intergeneric Hybridization in Cicorieae.IV. A Hybrid of Paraixeris denticulata and Lactuca squarrosa. Cytologia 13:61-72.

- Packer, J.G. 1964. Chromosome Numbers and Taxonomic Notes on Western Canadian and Arctic Plants. *Canadian Jour. Bot.*, 42,4:473-494.
- Radford, A.E., W.C. Dickson, J.R. Massey, C.R. Bell. 1974. *Vascular Plant Systematics*. Harper and Row Publishers. New York. 875 pp.
- Radloff, H.W. 1961. The Taxonomy of Lactuca (Compositae) in North America North of Mexico. Unpublished Ph.D. Dissertation, University of Illinois, Urbana, Illinois.
- Reveal, J. 1968. On the Names in Fraser's 1813 Catalogue. *Rhodora* 70:40.
- Robinson. 1899. A New Wild Lettuce From Eastern Massachusetts. *Rhodora* 1:12.
- Skvarla, J.J. and B.L. Turner. 1966. Systematic Implications from Electron Microscopic Studies of Compositae Pollen - A Review. *Ann. Mo. Bot. Gard.* 53:220-244.
- Stebbins, G.L. 1937a. Critical Notes on Lactuca and Related Genera. *The Journal of Botany* 75:12-18.
- _____. 1937b. The Scandent Species of Prenanthes and Lactuca in Africa. *Bull. Jard. Bot. Bruxelles* 14:333-352.
- _____. 1939. Notes on Lactuca in Western North America. *Madrono* 5:123-126.
- _____. 1950. *Variation and Evolution in Higher Plants*. Columbia University Press. New York. 561 pp.
- _____. 1953. A New Classification of the Tribe Cichorieae, Family Compositae. *Madrono* 12:65-81.
- _____, G.C., J.A. Jenkins and M.S. Walters. 1953. Chromosomes and Phylogeny in the Compositae, Tribe Cichorieae. *Univ. Cal. Publ. Bot.* 26:401-429.
- Steyermark, J.A. 1963. *Flora of Missouri*. Iowa State Univ. Press. Ames. 1654 pp.
- Thompson, R.C. 1942. An Amphidiploid Lactuca. *J. Heredity* 33:253-264.
- _____. 1943. Further Studies on Interspecific Genetic Relationships in Lactuca. *J. Agr. Research* 66:41-48.
- _____, J.W. Haney, W.F. Kosar. 1948. Two New 26-Chromosome Forms of Lactuca. *Jour. Heredity* 39:263-267.
- _____, W.F. Kosar. 1938. Polyploidy in Lettuce Induced by Colchicine. *Proc. Amer. Soc. Hort. Sci.* 36:

- _____, T.W. Whitaker, G.W. Bohn. 1958. Natural Cross-Pollination in Lettuce. Proc. Amer. Soc. Hort. Sci. 72:
- _____, T.W. Whitaker, W.F. Kosar. 1941. Interspecific Genetic Relationships in Lactuca. Jour. Agr. Res. 63:91-107.
- Tijo, H.J. and A. Levan. 1950. The Use of Oxiquinoline in Chromosome Analysis. Anales Estacion Exper. Aula Dei. 2:21-64.
- Tomb, A.S. 1970. Novelties in Lygodesmia and Stephanomeria (Compositae: Cichorieae). Sida 3:530-532.
- _____. 1972. Taxonomy of Chaetadelpa (Compositae: Cichorieae). Madrono 21:459-462.
- _____, D.A. Larson, J.J. Skvarla. 1974. Pollen Morphology and Detailed Structure of the Family Compositae, Tribe Cichorieae. I. Subtribe Stephanomeriinae. Amer. Jour. Bot. 61:486-498.
- Tournefort, J.P. de. 1719. Institutions Rei Herbariae. 3 vols. Paris. 1:473-474.
- Turner, B.L. and M.C. Johnston. 1961. Chromosome Numbers in the Compositae III. Certain Mexican Species. Brittonia 13:64-69.
- _____, M. Powell, R.M. King. 1962. Chromosome Numbers in the Compositae VI. Additional Mexican and Guatemalan Species. Rhodora, 64:251-271.
- Vuilleumier, B.S. 1973. Generic Flora of the Southeastern U.S.: Lactuceae. Jour. of the Arnold Arb. 54:42-93.
- Whitaker, T.W. 1944. The Inheritance of Certain Characters in a Cross of Two American Species of Lactuca. Bull. Torrey Bot. Club 71:347-355.
- _____. 1950. The Genetics of Leaf Form in Cultivated Lettuce I. The Inheritance of Lobing. Proc. Am. Soc. Hort. Sci. 56:389-394.
- _____, I.C. Jagger. 1939. Cytogenetic Observations in Lactuca. Jour. Agr. Res. 58:297-306.
- _____, G.D. McCollum. 1954. Shattering in Lettuce - Its inheritance and Biological Significance. Bull. Torrey. Bot. Club 81:104-110.
- _____, R.C. Thompson. 1941. Cytological Studies in Lactuca. Bull. Torrey. Bot. Club 68:388-394.
- Wodehouse, R.P. 1935. Pollen Grains. McGraw-Hill. New York. 574 pp.

A REVISION OF THE GENUS LACTUCA
(COMPOSITAE: LACTUCEAE) IN THE GREAT PLAINS

by

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ABSTRACT

Seven species of Lactuca occurring in the Great Plains were revised using modern biosystematic techniques. These species are L. serriola and L. saligna (introduced) and L. canadensis, L. ludoviciana, L. biennis, and L. floridana (native).

Chromosome numbers of L. serriola, L. saligna, and L. oblongifolia are $n = 9$ and L. canadensis, L. ludoviciana, L. floridana, and L. biennis are $n = 17$. The $n = 17$ species are believed to be amphidiploids derived from a cross between an $n = 9$ species (L. oblongifolia or a closely related species) and an undetermined $n = 8$ species. Karyotypic studies, chromatographic studies, and pollen studies show close relationships among the $n = 17$ species and a close relationship between L. oblongifolia ($n = 9$) and the $n = 17$ species. L. serriola and L. saligna are distinct from the native species. SEM micrographs are provided for pollen and achene morphology.

A key is provided, and synonymies, descriptions, and distribution maps are presented for each species. No infraspecific taxa are recognized. The infraspecific variation is thought to be best treated as simple phases of highly polymorphic species.