

CYTOGEOGRAPHY AND REPRODUCTIVE BIOLOGY OF
ACHILLEA MILLEFOLIUM IN OKLAHOMA
AND ADJACENT STATES

by

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ACHILLEA MILLEFOLIUM IN OKLAHOMA
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PREFACE

In order to facilitate submission of this thesis for publication, the editorial policy of the taxonomic journal RHODORA was followed. The thesis comprises two manuscripts, each presented as a chapter. Collection data, which are inappropriate for publication, but necessary for future reference are presented in the appendix. Presentation of the thesis in this manner is based on the Graduate College's policy of accepting a thesis written in manuscript form and is subject to approval by the College of the thesis adviser's request for a waiver of the standard format.

No study is successful without help. A very special note of appreciation is extended to my major adviser, Dr. Ronald J. Tyrl, for his patience, guidance, and encouragement during the course of this study and the preparation of this manuscript.

I would like to express my appreciation also to the members of my committee, Dr. Glenn Todd, and Dr. Herbert Bruneau, for their assistance and advice. Special thanks are given to my brother, Dr. Youshia Pireh, for his understanding and support; to my sister, Daisy, for her valuable time on collecting trips and in preparing squashes in this investigation. Much appreciation and love are extended to my parents, Mr. and Mrs. Youash Y. Pireh, for their love and encouragement. I can not find the words to express sufficiently the pride and respect which I feel for these two exceptional people. Also thanks to Flora, Evlin, and Edward for their encouragement in this and all endeavors.

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CHAPTER I

CYTOGEOGRAPHY OF *ACHILLEA MILLEFOLIUM* IN OKLAHOMA AND ADJACENT STATES

The circumboreal *Achillea millefolium* L. (Asteraceae: Anthemideae) is perhaps one of the most extensively studied polyploid complexes. Comprising diploids, tetraploids, hexaploids, and octoploids on a base chromosome number of nine, the complex is cosmopolitan in the northern hemisphere with greatest diversity in southeastern Europe and southwestern to central Asia. Investigations by Schneider (1958) and Ehrendorfer (1952b, 1953, 1959a-d) indicate that the complex in Eurasia is composed of isolated diploid cytotypes and derived polyploid hybrids. Species names have been applied to these cytotypes; Ehrendorfer (1952b) recognized four diploids ($n = 9$): *A. asplenifolia* Vent., found in low moor vegetation; *A. roseo-alba* Ehrend., an introgressive hybrid of *A. setacea* and *A. asplenifolia*; and *A. tomentosa* L. *Achillea collina* Becker is a tetraploid ($n = 18$) found in dry grasslands and open oak forests; while *A. pannonica* Scheele is an octoploid ($n = 36$), distributed on dry slopes. Eurasian hexaploids ($n = 27$) are classified as *A. stricta* Schleicher and *A. millefolium* L. sensu stricto. The relationship of both *A. tomentosa* and *A. stricta* to the other taxa is questionable.

Studies of polyploidy and geographical distribution in western North America have also been extensive beginning with the work of Turesson (1939) and Clausen, Keck & Hiesey (1938, 1940, 1948). Their studies were carried further by Lawrence (1947), Ehrendorfer (1952, 1973)

and Tyrl (1969, 1975). Only tetraploids ($n = 18$), hexaploids ($n = 27$), and their pentaploid, septaploid, and octoploid hybrids occur. Hexaploid Achillea is believed to occupy principally coastal habitats from Alaska to Baja California, while the tetraploid is believed to occur throughout the interior of the continent except for the coastal areas of northwestern Washington and southwestern Oregon - northwestern California (Figure 1).

Although the distributions of Achillea cytotypes have been studied exclusively in the Pacific Coast states, relatively few counts have been made of populations in the central and eastern portion of the continent. Widely spaced counts by Turesson (1939), Ehrle (1958), Mulligan & Bassett (1959), Turner et al. (1961), DeJong & Longpre (1963), Love & Solbrig (1964), Love & Love (1966), Love & Ritchie (1966), Hedberg (1967), Smolinski et al., (1967), Jones (1968), Suda & Argus (1969) and Ehrendorfer (1973) indicate that the tetraploids dominate but with hexaploids being found occasionally, e. g. in Illinois (Smolinski et al., 1967) and Ontario, Canada (Mulligan & Bassett, 1959).

The studies by Tyrl (1969, 1975) have indicated that while a broad pattern of cytotype distribution in Achillea may be generalized, as is presented in Figure 1, the distribution of tetraploids and hexaploids is often much more complex at the populational level. Numerous disjuncts--hexaploid plants and populations in areas previously thought to contain only tetraploids and vice versa--and mixed populations comprising both 4x and 6x plants were discovered. In addition, the discovery of tetraploid plants producing unreduced gametes suggested active formation of hexaploids in North America. Thus the objective of this study was to determine the chromosome number of Achillea plants growing in Oklahoma and adjacent states.



Figure 1. General distribution of Achillea millefolium cytotypes in western North America. Unshaded area, tetraploid distribution; shaded area, hexaploid distribution.

MATERIALS AND METHODS

Chromosome counts were made of 218 populations in Oklahoma and adjacent states (Pireh, 1978). A population sample normally consisted of material from three or four plants growing in road right-of-ways and adjacent fields. Each locality was assigned an accession number and located by range, township, section as well as mileage from a permanent landmark.

Heads in various stages of flowering were fixed in a modified Carnoy's solution (chloroform, 95% ethanol, glacial acetic acid; 6: 3: 1) for a minimum of 24 hours, then washed and stored in 70% ethanol. Heads were stained in bulk, using Snow's alcoholic carmine stain for 24 hours at 60°C and then washed in 70% ethanol. Excised anthers were squashed and mounted in Hoyer's Medium and examined with phase-contrast optics. Metaphase chromosomes were counted, being easily observed in microspores undergoing the first post-meiotic mitosis. Counts were obtained from three or four microspores per plant.

Somatic cell counts were also made. Achenes were germinated on moist filter paper in petri dishes. The fresh root tips were pre-treated with a saturated aqueous solution of paradichlorobenzene for 3 hours at ca 6°C, fixed in 95% ethanol and glacial acetic acid (3: 1), washed in 70% ethanol, and then stained, squashed, and mounted in 1% aqueous acetocarmine. Three or four cells per root tip were analyzed.

RESULTS

The 293 midwestern counts obtained in this study are combined with those of earlier reports (cited above) in Figure 2. All plants examined, with one exception, were tetraploid, $2n = 36$. Meiotic divisions were

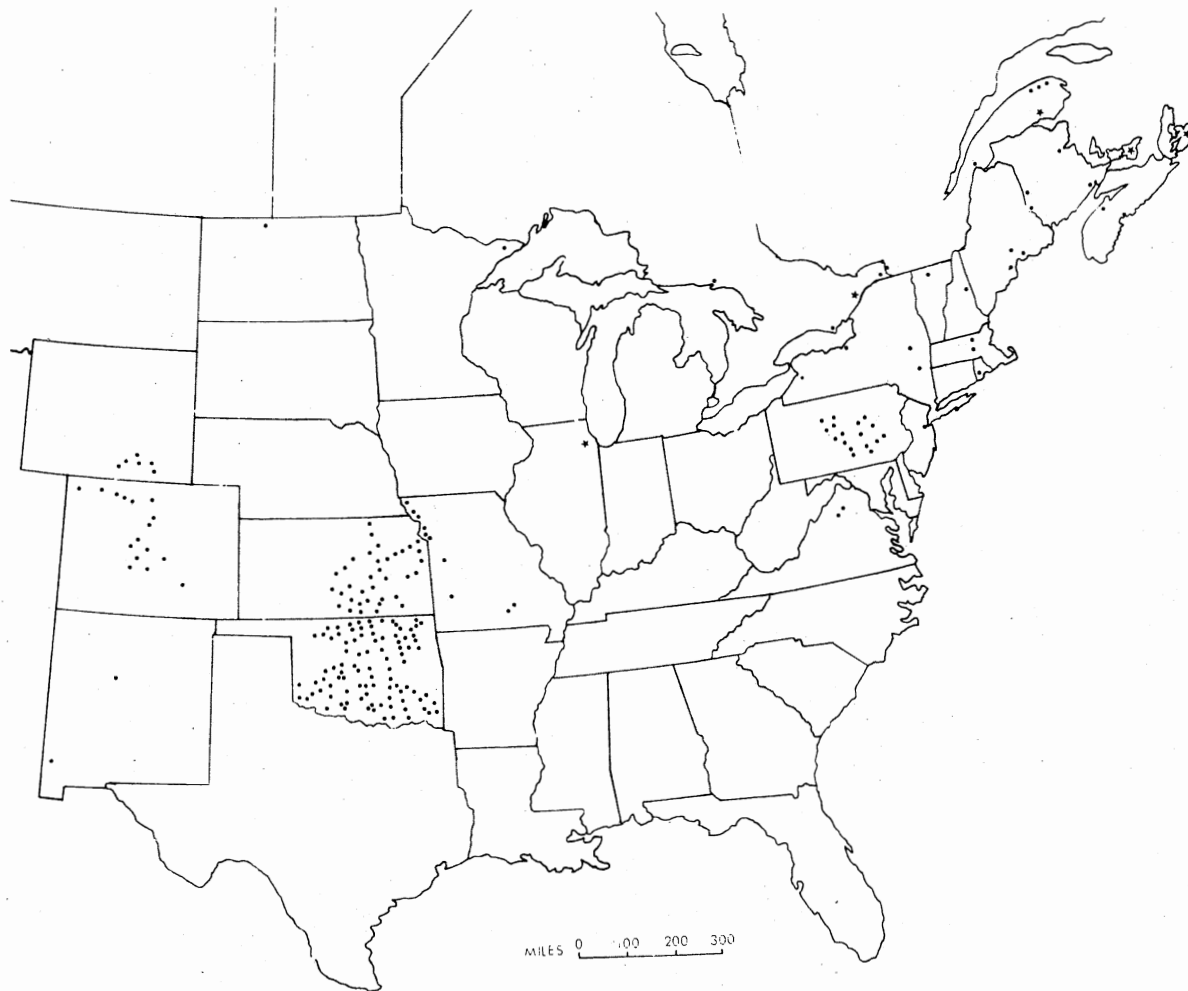


Figure 2. Distribution of *Achillea* cytotypes in the central and eastern United States and adjacent Canada.

Solid circles, tetraploid populations (n = 18); solid stars, hexaploid populations (n = 27).

regular, all microspores having 18 chromosomes and exhibiting uniform cytoplasmic staining and morphology. One plant from Caddo County in western Oklahoma was an aneuploid with a somatic chromosome number of 34. Meiosis was normal with spores having 17 chromosomes.

DISCUSSION

Tetraploid Achillea appears to dominate central and eastern North America; the additional chromosome counts reported here confirm the broad distributional pattern described by Ehrendorfer (1973). Additional evidence is available from herbarium collections. Determining ploidy level by measuring pollen grain diameters, Mulligan & Bassett (1959) reported tetraploids to occur throughout the interior of Canada, while hexaploids were present only along the northern coasts of Alaska, the Yukon, the Northwest Territories, Ontario, Quebec, and Newfoundland. Putative hexaploids found along the Atlantic Coast are believed to be recent introductions from Europe, being found near seaports or closely resembling commonly imported cultivars. Additional information, however, is needed regarding the occasional hexaploid plants reported from the interior of the continent (Mulligan & Bassett, 1959; Smolenski et al., 1967; Ehrendorfer, 1973). Their status as native plants or escaped ornamentals is yet unresolved; verification of their chromosome number is needed, as well as extensive sampling of adjacent populations.

The discovery of only 4x plants from diverse climatic and edaphic regimes, and the absence of meiotic irregularities support the hypothesis advanced by Ehrendorfer (1952b, 1973) and Tyrl (1969, 1975) that evolutionary activity in the genus is centered in the Pacific Northwest, especially the Klamath and Olympic Mountains. In these areas, the occurrence of numerous tetraploid plants producing both reduced ($n = 18$)

and unreduced ($n = 36$) microspores; the occurrence of solitary hexaploid plants among tetraploids having unreduced spores; and the occurrence of septaploids ($2n = 63$) and octoploids ($2n = 72$) among tetraploids and hexaploids producing unreduced spores suggests that functional unreduced gametes are responsible for increases in ploidy level in Achillea. For example, the union of $2x$ and $4x$ gametes results in the formation of a $6x$ zygote ($2n = 54$). The coastally restricted hexaploids appear to be indigenous to western North America and to arise from previously established tetraploid progenitors. The extensive observations of $4x$ - $6x$ intergradation in morphology, ecology, and environmental responses support this conclusion (Clausen et al., 1940, 1948; Hiesey, 1953; Hiesey & Nobs, 1952). In addition, the limited success in crossing Eurasian and North American hexaploids indicates a distant genetic relationship (Clausen et al., 1940; Ehrendorfer, 1952a; Hiesey & Nobs, 1970). In contrast, crosses between old and new world tetraploids are successful.

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CHAPTER II

THE REPRODUCTIVE BIOLOGY OF ACHILLEA MILLEFOLIUM

Achillea millefolium, a member of the Asteraceae, occurs throughout temperate North America. Commonly known as yarrow or western yarrow, it can be found growing along roadsides and in the prairies. Achillea is perhaps best known from the monumental work of Clausen, Keck & Hiesey in the late 1930's, 1940's and early 1950's. These men in their studies of the experimental nature of species studied Achillea in California and described a series of ecotypes based on climatic adaptations. Extensive studies of polyploidy and geographical distribution in western North America have also been made (Ehrendorfer, 1952, 1973; Tyrl, 1969, 1975). Although much is known about Achillea's morphology, physiology, and genetics, little was known about its pollination ecology. Thus the objective of our work has been to describe the pollination ecology of Achillea millefolium. The preliminary results of these studies are reported here.

METHODS

During the summers of 1977 and 1978, field studies were conducted on populations of Achillea near the University of Oklahoma Biological Station in Marshall County. Standard techniques employed in pollination ecology were used in these investigations.

To determine the time of pollen germination after deposition on the stigma, heads were bagged the night prior to opening. The next morning at 0900 hours C. D. T., the exposed stigmas of open florets were hand-pollinated with pollen from another plant. Stigmas were collected at one-hour intervals following pollination; fixed in a mixture of chloroform: ethanol: glacial acetic acid (6: 3: 1); and after staining with basic-fuchsin and lactophenol: aniline blue, observed with a compound microscope.

Stigma receptivity was also examined. Again heads were bagged the night before opening. Beginning at 0800 hours C. D. T. the following day, open florets were hand-pollinated with pollen from another plant. Stigmas were collected one hour after pollination and fixed in the manner described above. Thereafter, additional stigmas were collected and fixed at six-hour intervals for 54 hours, or throughout anthesis. The stigmas were stained in basic-fuchsin and lactophenol: aniline blue and examined for germinated pollen.

Pollen fertility was also examined. Five flowers from five different plants from each population were collected on the first day of anthesis. Pollen from each flower was scraped onto two slides. The grains on one slide were immediately stained with lactophenol: aniline blue and the first 300 grains observed were scored as either fertile or infertile. Darkly stained spherical pollen was scored as fertile, while pollen irregular in shape or faintly stained was scored as infertile. Pollen on the second slide was placed in full sunlight on a tray for 48 hours, stained and observed as before.

To determine the number of grains per anther, buds from 15 populations were collected, killed and fixed in Carnoy's solution and then stained in Snow's alcoholic-carmin stain. Buds from three

different plants were selected from each population. Three counts were made of each anther by direct microscopic observation.

In order to determine the nature of the breeding system in Achillea millefolium, different modes of reproduction were tested. Fifteen plants in approximately the same stage of flowering were studied. Experimental procedures were such that two plants were observed through their flowering period but not disturbed. Following maturation a single head was taken from each plant and the mature achenes counted. Simultaneously, eight plants were bagged prior to head opening and the bags left in place for three weeks. A single head was taken from each plant and the mature achenes counted. Insect visitors to Achillea were observed during the months of June and July for a total of 930 hours. Times of observation were first throughout the day, and then after the time of anther dehiscence was determined, only from 1300 to 1700 hours C. D. T.

PHENOLOGICAL PATTERNS

Achillea is a rhizomatous perennial herb 2-6 dm high. The heads are born in a flat or slightly round topped, broad paniculate or corymbiform inflorescence. Flowering commences in late April and early May and is generally completed by the middle of June with the exception of occasional plants which produce small secondary inflorescences. The opening of all florets in a single head takes several days. Prior to the emergence of the ray florets, the head is ovoid, the phyllaries being imbricate with broad, scarious, fimbriate margins (Figure 1A). As flowering begins, the tips of the ray floret corollas emerge vertically from the apex of the involucre (Figure 1B). Each head has 3 to 5 ray florets which are pistillate, fertile and typically white, or occasionally pink. At this time of ray floret emergence, meiosis is

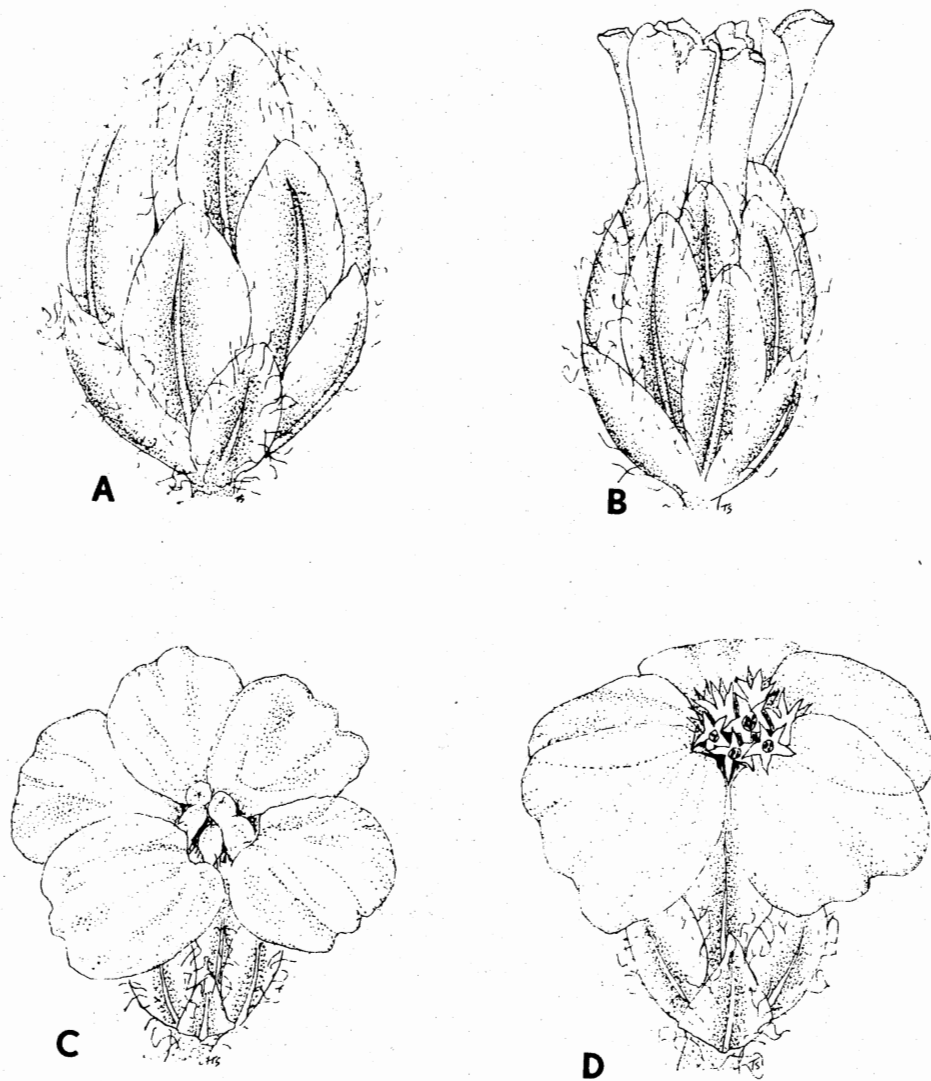


Figure 1. Head maturation in *Achillea millefolium*. A. Head prior to ray floret emergence. B. Ray florets emerging. C. Ray floret corollas reflexed. D. Disk florets open.

taking place in the anthers of the larger disk florets. One or two days after the initial emergence, the ray florets are completely exposed with the corolla limb reflexed at right angles to the head axis (Figure 1C).

At the same time, one, two, or three disk florets open. The disk florets number 10 to 30 per head and are perfect. As is characteristic of composites, maturation of florets is differential. Each day one, two, or three additional florets will open until all have opened (Figure 1D). This generally takes about 7 days. The stamen filaments are free and attached to the corolla 0.5 to 1 mm above their bases. The filaments are short prior to anthesis, at which time they elongate, the anthers thus emerging from between the corolla lobes (Figure 2A). The gaping disk floret and the bright yellow-orange anthers protruding from it is characteristic of this phenological stage. The time of anther emergence is usually before noon, but florets can be found opening in the afternoon as well. Each anther sac splits open first at the apex to release the pollen (Figure 2B). The rupture extends only one-quarter to one-third the length of the anther. Each anther contains approximately 500 pollen grains which are binucleate at the time of pollination. In each population examined, pollen fertility was about 97 percent with no significant differences between populations being discovered. As the anthers dehisce, they twist and often separate from each other. At this time, the tips of the style branches are visible as they extend slightly beyond the throat of the corolla; they are clasped or only slightly spread (Figure 3A). The style branches are tubular with a truncate to rounded apex; the stigmatic surface extends over the inner or adaxial surface. The style branches elongate and in doing so, separate from each other and curve outward (Figure 3B). This takes some 12 to 24 hours.

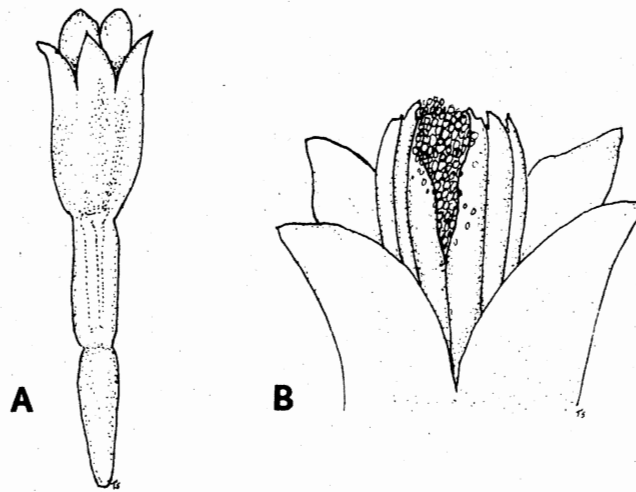


Figure 2. Disk floret anthesis in Achillea millefolium. A. Disk floret with open corolla lobes. B. Anther sacs splitting open.

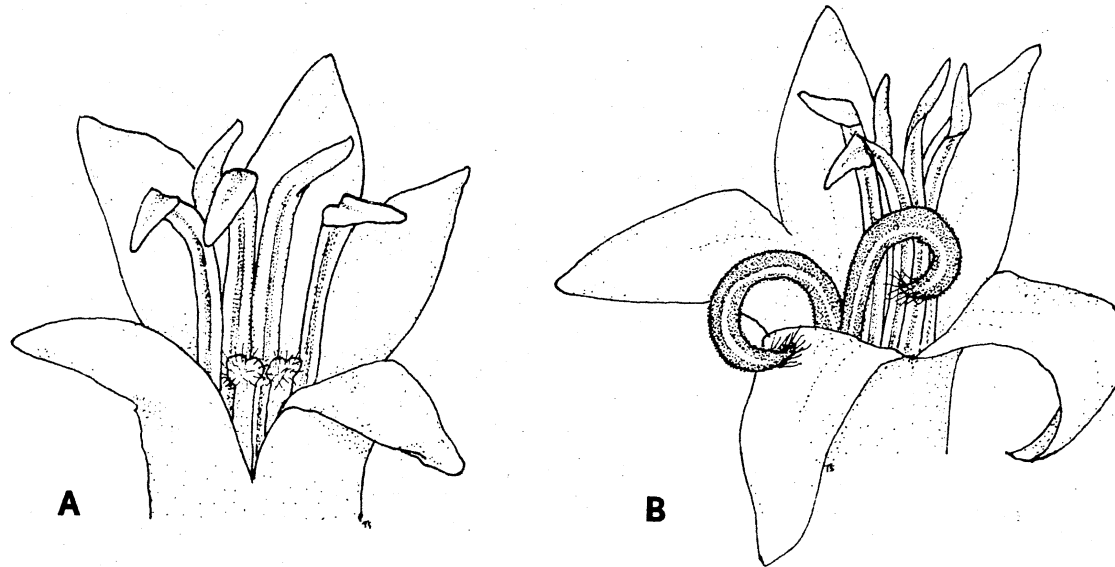


Figure 3. Mature disk floret of Achillea millefolium. A. Fully dehiscent anthers, style branches not elongated. B. Style branches elongated.

Deposition of pollen on the stigmas may or may not occur as the style branches elongate. The test for stigma receptivity revealed that the stigmas are receptive throughout anthesis. Pollen deposited on the stigma germinates within one hour. As the last disk florets open, the ray floret corollas fade and eventually drop off. The previously opened disk floret style branches turn light brown; and the phyllaries become straw-colored. The head does not close as fruit development begins. Full sized achenes are present by the end of two weeks after completion of head flowering. The mature achene is gray-black in color. The heads and pedicels continue to darken and dry out. The inflorescence borne on its stem persists through the summer, fall, and often until the late winter. The achenes are released as the heads gradually shatter.

INSECT VISITORS

In conjunction with these observations of head maturation, observations and collections were made of the insects visiting Achillea. A variety of insects, including lightning bugs, blister beetles, grasshoppers, and dipterans, visit the heads but do not appear to effect pollination as pollen was not found on their bodies following capture.

A wasp, in the family Pteromalidae is believed to be a pollinator. These wasps approach the heads; land; and probe disk florets. The wasp moves into a disk floret and in doing so, comes in contact with the anthers or stigmas depending upon the age of the floret. Pollen of Achillea was found on the legs and abdomens of these wasps.

Cross-pollination characterizes Achillea as the extensive studies of its breeding system have revealed (Clausen, Keck, & Hiesey 1940, Schneider 1958, Hiesey & Nobs 1952, and Ehrendorfer 1959). It is highly

self-incompatible and is not apomictic. The results of our limited bagging experiments agreed with these earlier studies.

SUMMARY

Achillea millefolium is a cosmopolitan species with a multitude of ecotypes and races occurring in diverse ecological conditions throughout the world. Its genetic, reproductive, and vegetative characteristics favor movement of plants throughout a region. High chromosome number, good chromosome pairing and obligate outcrossing promote genetic variability and thus ecological diversity. The prolonged flowering period, the large numbers of achenes that a single plant produces and the simple germination requirements of the seeds contribute to its dispersibility. Establishment and survival are aided by vigorous rhizomatous vegetative growth and perenniality. Continued investigations of Achillea's pollination ecology will enhance our understanding of the role and the significance of insect visitors in its reproductive biology.

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APPENDIX

COLLECTION DATA AND CHROMOSOME NUMBERS
OF ACHILLEA ACCESSIONS

TABLE I. COLLECTION DATA AND CHROMOSOME NUMBERS OF ACHILLEA ACCESSIONS.

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1250	3	Oklahoma	Okmulgee	14E	15N	35 NE $\frac{1}{4}$	Right of way OK Hwy 16, 1.0 mi W of Muskogee County line. Scattered plants to 60 cm tall with <u>Malva</u> and festucoid grasses. April 16, 1977.
1251	1	Oklahoma	Logan	2W	19N	13	0.5 mi W of Payne County line, OK Hwy 51. Bank adjacent to Morris cemetery. April 23, 1977.
1252	1	Oklahoma	Blaine	12W	19N	15	Roadside OK Hwy 51, 2.5 mi W of OK Hwy 8. April 23, 1977.
1253	1	Oklahoma	Kingfisher	6W	19N	19 NE $\frac{1}{4}$	Roadside OK Hwy 51, 1 mi E of jct Hwy 81. April 23, 1977.
1254	1	Oklahoma	Kingfisher	5W	19N	21 NE $\frac{1}{4}$	2.7 mi W of Skeleton Creek bridge OK Hwy 51. April 23, 1977.
1255	1	Oklahoma	Logan	4W	19N	24	0.4 mi E of OK Hwy 74 on OK Hwy 51. April 23, 1977.
1256	1	Oklahoma	Logan	2W	19N	20 NE $\frac{1}{4}$	0.2 mi E of Wheanor Creek bridge OK Hwy 51. April 23, 1977.
1257	1	Kansas	Johnson	23E	14S	14 SE $\frac{1}{4}$	Roadside, jct of I-Hwy 35 and Kan Hwy 10; Scattered plants. May 15, 1977.
1258	1	Kansas	Johnson	23E	14S	14 SE $\frac{1}{4}$	Pasture W side of US Hwy 169, 2.0 mi S of I-Hwy 35 exit. May 15, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1259	1	Kansas	Miami	23E	17S	10	Embankment of US Hwy 169, 1.1 mi S of Kan Hwy 68 jct.; opposite Paola Lake. May 15, 1977.
1260	1	Kansas	Anderson	21E	19S	29 NW $\frac{1}{4}$	Creek bottom, county road to Lane, 1.1 mi S of Franklin Co. line on US Hwy 169. May 15, 1977.
1261	1	Kansas	Anderson	20E	21S	6	Creek banks adjacent to US Hwy 169, 0.5 mi S of jct with US Hwy 59, S of Garnett. May 15, 1977.
1262	1	Kansas	Anderson	18E	23S	11 NE $\frac{1}{4}$	Right-of-way jct of US Hwy 169 and Kan Hwy 57. May 15, 1977.
1263	1	Kansas	Allen	18E	24S	23 SW $\frac{1}{4}$	Banks of Neosho river at US Hwy 54 bridge 1.0 mi W of US Hwy 169 jct at Iola. May 15, 1977.
1264	1	Kansas	Woodson	16E	25S	11 SW $\frac{1}{4}$	Railroad embankment at Creek bridge adjacent to US Hwy 54. 6.6 mi E of US Hwy 75 jct. May 15, 1977.
1265	1	Kansas	Woodson	15E	25S	18	Roadside embankment adjacent to US Hwy 54, 4.4 mi W of US Hwy 75 jct; Flint Hills area. May 15, 1977.
1266	1	Kansas	Greenwood	13E	25S	27 SE $\frac{1}{4}$	Banks at Verdigris river at US Hwy 54 bridge. May 15, 1977.
1267	1	Kansas	Greenwood	11E	26S	5 NE $\frac{1}{4}$	Roadside US Hwy 54, 2.8 mi W of Kan Hwy 99 E jct; near Eureka. May 15, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1268	1	Kansas	Greenwood	9E	26S	3	Roadside US Hwy 54, 6.5 mi E of Butler Co. line; scattered plants. May 15, 1977.
1269	1	Kansas	Butler	7E	26S	3 SN $\frac{1}{4}$	Embankments of US Hwy 54 opposite Hwy-rest-area 2.0 mi W at Rosalia. May 15, 1977.
1270	1	Kansas	Butler	5E	26S	14 NE $\frac{1}{4}$	Roadside banks 1.1 mi S at Walnut river bridge on US Hwy 54; S of Eldorado. May 15, 1977.
1271	1	Kansas	Butler	5E	27S	23 SE $\frac{1}{4}$	0.5 mi N of Kan Hwy 96 on US Hwy 54, Pickerell corner. May 15, 1977.
1272	1	Kansas	Butler	4E	27S	23 SW $\frac{1}{4}$	Waste area, feed mill adjacent to railroad tracks; Augusta. May 15, 1977.
1273	1	Kansas	Butler	4E	27S	34 SW $\frac{1}{4}$	Embankment 1.1 mi S at Walnut river bridge on US Hwy 77. S of Augusta. May 15, 1977.
1274	1	Kansas	Butler	4E	29S	21 NW $\frac{1}{4}$	Waste area, jct of US Hwy 77 and county road M; Douglas. May 15, 1977.
1275	1	Kansas	Cowleg	4E	31S	4 NW $\frac{1}{4}$	100 mi S of jct of US Hwy 77 & Kan Hwy 15. May 15, 1977.
1276	1	Kansas	Cowleg	4E	32S	21 SE $\frac{1}{4}$	0.5 mi N of Timber Creek bridge on US Hwy 77; N of Winfield. May 15, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1277	1	Kansas	Cowleg	4E	34S	6	Roadside 2.5 mi N of Arkansas City & Fourlane panement on US Hwy 77. May 15, 1977.
1278	1	Kansas	Cowleg	3E	35S	1 NE $\frac{1}{4}$	Waste area. S end of Arkansas river bridge on US Hwy 77, S of Arkansas City. May 15, 1977.
1279	1	Oklahoma	Kay	2E	28N	11	Railroad right-of-way 1.8 mi N of Kay County court house in Newkirk. May 15, 1977.
1280	1	Oklahoma	Kay	2E	27N	3 NE $\frac{1}{4}$	Banks of Spring Creek culvert adjacent to US Hwy 77 3.2 mi S of Kay County court house in Newkirk. May 15, 1977.
1281	1	Oklahoma	Kay	2E	26N	34 SE $\frac{1}{4}$	Floodplain of Arkansas river, US Hwy 77 embankment at jct with US Hwy 6; Ponca City. May 15, 1977.
1282	1	Oklahoma	Noble	2E	24N	3	Banks of Salt Fork river at US Hwy 177 bridge. May 15, 1977.
1283	1	Oklahoma	Noble	2E	23N	15 SE $\frac{1}{4}$	Roadside ditch of US Hwy 177 at jct with OK Hwy 15 W. May 15, 1977.
1284	1	Oklahoma	Noble	2E	21N	3 SE $\frac{1}{4}$	US Hwy 177 embankment N end of Black Bear Creek bridge. May 15, 1977.
1285	1	Oklahoma	Noble	2E	21N	22	Barrow ditch 0.5 mi S of US Hwy 64 jct on US Hwy 177; large population. May 15, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1286	1	Oklahoma	Payne	2E	20N	3 NE $\frac{1}{4}$	Roadside US Hwy 177; 0.4 mi S of Noble county line. May 15, 1977.
1287	1	Oklahoma	Payne	2E	20N	27 NE $\frac{1}{4}$	Jct of US Hwy 177 & McCurdy Road, Stillwater. May 15, 1977.
1288	1	Oklahoma	Rogers	17E	20N	27	"Butler" pasture of McFarland--Ingersoll Ranch 3.2 km N of Inola on OK Hwy 88. May 15, 1977.
1289	1	Oklahoma	Rogers	17E	19N	32 SW $\frac{1}{4}$	Waste area behind gas station at jct of OK Hwys 88 & 33. May 15, 1977.
1290	1	Oklahoma	Rogers	15E	19N	31 SE $\frac{1}{4}$	Embankment at jct of I-Hwy 40 & OK Hwy 33; E-side of Tulsa. May 15, 1977.
1291	1	Oklahoma	Payne	2E	19N	16	Banks Stillwater Creek bridge, OK Hwy 51. May 17, 1977.
1292	1	Oklahoma	Payne	1W	19N	24	Roadside banks OK Hwy 51, 0.2 mi E of OK Hwy 86. May 17, 1977.
1293	2	Oklahoma	Payne	1W	19N	18	Jct of OK Hwy 51 & I-Hwy 35. May 17, 1977.
1294	1	Oklahoma	Logan	2W	19N	34 SW $\frac{1}{4}$	0.1 mi N of Mulhall, next to Santa Fe RR right-of-way. May 17, 1977.
1295	1	Oklahoma	Logan	2W	17N	5 NE $\frac{1}{4}$	Roadside bank OK Hwy 77 at Skeleton Creek. May 17, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Town-ship	Section	Notes
1296	2	Oklahoma	Logan	2W	17N	19 SW $\frac{1}{4}$	Roadside bank OK Hwy 74C; 2.0 mi W of US Hwy 77 jct. May 17, 1977.
1297	1	Oklahoma	Logan	4W	17N	12 SE $\frac{1}{4}$	Roadside OK Hwy 74C; 0.2 mi E OK Wolf Creek bridge. May 17, 1977.
1298	2	Oklahoma	Logan	4W	16N	11 NE $\frac{1}{4}$	Cimarron River bridge OK Hwy 74. May 17, 1977.
1299	2	Oklahoma	Kingfisher	5W	16N	25 NE $\frac{1}{4}$	Jct of OK Hwy 33 & OK Hwy 74F. May 17, 1977.
1300	2	Oklahoma	Kingfisher	6W	16N	18 SE $\frac{1}{4}$	Roadside OK Hwy 33, 3.0 mi E of Uncle John Creek bridge. May 17, 1977.
1301	1	Oklahoma	Kingfisher	7W	15N	21 NW $\frac{1}{4}$	3.0 mi N of the Canadian County line on US Hwy 81. May 17, 1977.
1302	2	Oklahoma	Canadian	7W	13N	20 SE $\frac{1}{4}$	Roadside US Hwy 81, 1 mi N of Canadian river bridge. May 17, 1977.
1303	2	Oklahoma	Canadian	7W	12N	21	Jct of US Hwy 81 & I-Hwy 40. May 17, 1977.
1304	1	Oklahoma	Grady	7W	10N	9 NW $\frac{1}{4}$	S-end of S Canadian River bridge on US Hwy 81. May 17, 1977.
1305	1	Oklahoma	Caddo	9W	10N	13 SE $\frac{1}{4}$	0.5 mi W of the Grady County line on OK Hwy 152. May 17, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1306	2	Oklahoma	Caddo	10W	10N	27 SW $\frac{1}{4}$	0.3 mi N of US Hwy 281 jct on OK Hwy 152. May 17, 1977.
1307	1	Oklahoma	Caddo	11W	10N	11 NW $\frac{1}{4}$	Roadside US Hwy 281, 0.1 mi S of Lookeha Water Tower. May 17, 1977.
1308	2	Oklahoma	Caddo	11W	12N	27	1.2 mi N of Hinton Main Street on US Hwy 281. May 17, 1977.
1309	2	Oklahoma	Canadian	10W	13N	18	1.7 mi S of Blaine County line on US Hwy 281. May 17, 1977.
1310	2	Oklahoma	Blaine	11W	14N	4 NE $\frac{1}{4}$	0.7 mi S of Greenfield on US Hwy 281. May 17, 1977.
1311	1	Oklahoma	Blaine	11W	16N	30 NE $\frac{1}{4}$	Jct of US Hwy 281 of OK Hwy 33; Watonga. May 17, 1977.
1312	2	Oklahoma	Blaine	11W	17N	34 NW $\frac{1}{4}$	On gypbluffs 0.4 mi W of Rock Island railroad tracks. May 17, 1977.
1313	2	Oklahoma	Blaine	10W	17N	7 NW $\frac{1}{4}$	Jct of OK Hwy 8 & Loyal Road. May 17, 1977.
1314	1	Oklahoma	Kingfisher	9W	17N	3 SE $\frac{1}{4}$	1 mi W Loyal on Loyal county road. May 17, 1977.
1315	1	Oklahoma	Blaine	7W	17N	18 NE $\frac{1}{4}$	$\frac{1}{4}$ mi S of Cimmarron River bridge on Loyal Co. Rd. May 17, 1977.
1316	2	Oklahoma	Kingfisher	7W	18N	13 NE $\frac{1}{4}$	4.7 mi N of Dover on US Hwy 81. May 17, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1317	2	Oklahoma	Payne	3E	19N	30 NW $\frac{1}{4}$	$\frac{1}{4}$ mi W of County Club Rd. on OK Hwy 51. May 20, 1977.
1318	2	Oklahoma	Noble	1W	21N	20 NW $\frac{1}{4}$	2.7 mi W of US Hwy 86 on OK Hwy 164. May 20, 1977.
1319	2	Oklahoma	Noble	1W	21N	14	Roadside bank of Hwy 86, 0.4 mi N of OK Hwy 164. May 20, 1977.
1320	3	Oklahoma	Noble	2W	21N	23	0.7 mi W of Warren Creek bridge on US Hwy 164. May 20, 1977.
1321	3	Oklahoma	Grafield	4W	23N	24	2.6 mi W of Black Bear Creek on OK Hwy 64 & OK Hwy 74. May 20, 1977.
1322	2	Oklahoma	Grafield	7W	23N	36	Jct US OK Hwy 60 0.1 mi N of Hwy 60. May 20, 1977.
1323	1	Oklahoma	Grafield	6W	23N	18	Roadside bank on US Hwy 60. May 20, 1977.
1324	1	Oklahoma	Grafield	7W	22N		Jct of OK Hwy 15 & US Hwy 60. 0.8 mi S of Indian Creek bridge. May 20, 1977.
1325	1	Oklahoma	Major	12W	22N	23	0.2 mi W of Cimarron River bridge on US Hwy 60. May 20, 1977.
1326	1	Oklahoma	Woodward	19W	22N	21	OK Hwy 15 & OK Hwy 50, 4.1 mi W of Main Creek bridge. May 20, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1327	2	Oklahoma	Woodward	19W	22N	28	OK Hwy 50, 2.7 mi from Cimarron River bridge. May 20, 1977.
1328	2	Oklahoma	Woods	18W	28N	35	3.2 N of OK Hwy 50 jct on US Hwy 64. May 20, 1977.
1329	2	Oklahoma	Woods	13W	27N	30	0.7 mi E from Cimarron River bridge on US Hwy 64. May 20, 1977.
1330	2	Oklahoma	Woods	13W	27N	30	1.3 mi from Little Ang on US Hwy 64. May 20, 1977.
1331	1	Oklahoma	Alfalfa	11W	27N	25	1.4 mi E on US Hwy 64 from railroad crossing. May 20, 1977.
1332	2	Oklahoma	Alfalfa	9W	27N	24	E on US Hwy 64, 2.1 mi E of roadside rest area. May 20, 1977.
1333	2	Oklahoma	Alfalfa	10W	27N	30	0.7 mi from railroad crossing on OK US Hwy 64. May 20, 1977.
1334	2	Oklahoma	Grant	6W	25N	11	1.5 mi from Wagon Creek bridge on US Hwy 64. May 20, 1977.
1335	1	Oklahoma	Grant	6W	25N	31	5 mi E of Pan Creek bridge on US Hwy 64. May 20, 1977.
1336	2	Oklahoma	Garfield	6W	26N	11	4.3 mi from Wild Horse Creek on US Hwy 74. May 20, 1977.
1337	1	Oklahoma	Garfield	3W	26N	8	2.7 mi E Skeleton Creek on OK Hwy 74. May 20, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1338	2	Oklahoma	Payne	2E	18N	9 NE $\frac{1}{4}$	4.2 mi S of OK Hwy 51 on Western Road; fence rows and fields. May 25, 1977.
1339	1	Oklahoma	Payne	2E	17N	7 SW $\frac{1}{4}$	Floodplain of Cimarron River at US Hwy 177 bridge. May 25, 1977.
1340	3	Oklahoma	Lincoln	3E	15W	6 SE $\frac{1}{4}$	Roadside US Hwy 177 0.9 mi S of Carney, OK. May 25, 1977.
1341	1	Oklahoma	Lincoln	3E	14N	19 NE $\frac{1}{4}$	Embankments of US Hwy 177 at jct with US Hwy 66; large population. May 25, 1977.
1342	2	Oklahoma	Lincoln	3E	12N	20 NE $\frac{1}{4}$	Roadside US Hwy 177 jct with US Hwy 62. May 25, 1977.
1343	3	Oklahoma	Pottawatomie	3E	10N	26 NE $\frac{1}{4}$	Banks at N-end of Canadian River at US Hwy 177 bridge. May 25, 1977.
1344	2	Oklahoma	Pottawatomie	3E	8N	13 NE $\frac{1}{4}$	Dance Creek at US Hwy 177 bridge. May 25, 1977.
1345	1	Oklahoma	Pontotoc	3E	6N	36 NE $\frac{1}{4}$	Floodplain of South Canadian River at US Hwy 177 bridge. May 25, 1977.
1346	2	Oklahoma	Garvin	3E	4N	14 NW $\frac{1}{4}$	Roadside US Hwy 177, at McGee Cemetery Road, Stratford. May 25, 1977.
1347	2	Oklahoma	Garvin	3E	2N	15 NE $\frac{1}{4}$	Roadside US Hwy 177 0.4 mi S of jct with OK Hwy 29. May 25, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1348	1	Oklahoma	Murray	3E	1S	2 NW $\frac{1}{4}$	Entrance to Platt National Park. On travertine limestone Arbuckle Mtns. single plant of edge of woods. May 25, 1977.
1349	1	Oklahoma	Murray	3E	2S	11 NE $\frac{1}{4}$	Top of limestone ridge on US Hwy 177 at Drake, OK. May 25, 1977.
1350	2	Oklahoma	Carter	3E	4S	3	Floodplain N-end of Washita bridge on US Hwy 177. May 25, 1977.
1351	2	Oklahoma	Johnston	4E	4S	26 SW $\frac{1}{4}$	Banks of Turkey Creek at US Hwy 70 bridge. May 25, 1977.
1352	1	Oklahoma	Marshall	5E	6S	5 NE $\frac{1}{4}$	Roadside jct of OK Hwys 99 & 99C. May 25, 1977.
1353	2	Oklahoma	Marshall	4E	8S	1 NE $\frac{1}{4}$	Red River floodplain at N-end of OK Hwy 99 bridge over Lake Texoma. May 25, 1977.
1354	2	Oklahoma	Marshall	4E	7S	10 SW $\frac{1}{4}$	Briar Creek at Powell Road bridge. May 25, 1977.
1355	1	Oklahoma	Love	3E	7S	5 SW $\frac{1}{4}$	Roadside OK Hwy 32; 4 mi W of Hickory Creek bridge. May 25, 1977.
1356	1	Oklahoma	Carter	1E	5S	12	Jct I-Hwy 35 & Aswalt Road; few scattered plants. May 25, 1977.
1357	1	Oklahoma	Carter	1E	4S	12 SW $\frac{1}{4}$	Right of way I-Hwy 35, 10.7 mi N of jct with OK Hwy 142 S-edge of Arbuckle Mtns. May 25, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1358	1	Oklahoma	Carter	2E	2S	7 NW $\frac{1}{4}$	1.1 mi N OK Hwy 53 on I-Hwy 35, base of limestone bluffs of Arbuckle Mtns. May 25, 1977.
1359	4	Oklahoma	Murray	2E	1N	30 SE $\frac{1}{4}$	Base of limestone bluffs I-Hwy 35 1.1 mi S of jct with US Hwy 77 D in Arbuckle Mtns. May 25, 1977.
1360	3	Oklahoma	Garvin	1E	2N	17 NE $\frac{1}{4}$	Creek banks I-Hwy 35 right-of-way. 0.1 mi S of OK Hwy 28 jct. May 25, 1977.
1361	2	Oklahoma	Garvin	1W	4N	34 NW $\frac{1}{4}$	Banks of Washita River at I-Hwy 35. May 25, 1977.
1362	3	Oklahoma	Cleveland	3W	9N	2	Roadside I-Hwy 35, 0.2 mi N of jct with US Hwy 77, Moore. May 25, 1977.
1363	2	Oklahoma	Oklahoma	2W	13N	16 NW $\frac{1}{4}$	0.2 mi N of I-Hwy 44 exit on I-Hwy 35; large population in field. May 25, 1977.
1364	1	Oklahoma	Tulsa	14E	22N	9	Floodplain of Caney River at US Hwy 169 bridge; numerous plants in right-of-way. May 25, 1977.
1365	1	Oklahoma	Nowata	16E	27N	7	Roadside of US Hwy 169, 0.5 mi S of OK Hwy 10 jct at Lenapah, OK. May 25, 1977.
1366	1	Oklahoma	Nowata	16E	29N	30	Railroad right-of-way adjacent to US Hwy 169 0.9 mi S of Watonga, OK. May 25, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1367	1	Kansas	Montgomery	17E	34S	31 NE $\frac{1}{4}$	Right-of-way 0.1 mi N of US Hwy 166 jct on US Hwy 169, N-edge of Coffeyville. May 25, 1977.
1368	1	Kansas	Montgomery	17E	32S	9 NW $\frac{1}{4}$	Waste area behind Kan Hwy weigh station, US Hwy 169, N-edge Cherryvale. May 25, 1977.
1369	1	Kansas	Allen	18E	26S	28	Limestone outcrop adjacent to US Hwy 169 2.5 mi S of Coal Creek bridge S edge of Humboldt. May 25, 1977.
1370	1	Kansas	Anderson	20E	23S	1 NW $\frac{1}{4}$	Small prairie 0.3 mi E of US Hwy 59 jct on Kan Hwy 52; W-edge of Kincaid, Kan. May 25, 1977.
1371	1	Kansas	Linn	22	22S	33 NW $\frac{1}{4}$	Waste area at jct of Kan Hwy 52 & paved county road N side Blue Mound, Kan. May 25, 1977.
1372	1	Kansas	Linn	24E	22S	8	Small prairie, 1.5 mi E of Main Street, Mound City on Kan Hwy 52; large population on creek terrace. May 25, 1977.
1373	1	Kansas	Linn	25E	20S	17	Roadside US Hwy 135; Scattered plants in barrow ditch, NE corner of Marais des Cygnes Wildlife Refuge. May 25, 1977.
1374	1	Kansas	Miami	25E	18S	5 NW $\frac{1}{4}$	Right-of-way US Hwy 69 3.6 mi S of Paola County Road jct & 7.1 mi S of Kan Hwy 68. May 25, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1375	1	Missouri	Platte	34N	52N	15 NE $\frac{1}{4}$	Right-of-way I-Hwy 29 1.0 mi N of Mo Hwy 291; NE-edge KCI airport. May 25, 1977.
1376	1	Missouri	Buchanan	35W	56N	14 SE $\frac{1}{4}$	Large population in barrow ditch adjacent to I-Hwy 29, 2.6 mi S of I-Hwy 229 exit. May 25, 1977.
1377	1	Missouri	Buchanan	35N	58N	27	Scattered plants, waste area at jct of US Hwy 71 & Cook Rd, N-edge St. Joseph. May 25, 1977.
1378	1	Missouri	Holt	37W	60N	35 NW $\frac{1}{4}$	Edge of woods adjacent to I-Hwy 29 0.7 mi W of US Hwy 59 exit, at Oregon, Mo, W-side Nodaway River Valley. May 25, 1977.
1379	1	Missouri	Holt	39W	62N	28	Isolated clone; barrow ditch of I-Hwy 29; 4.0 mi S of US Hwy 59 exit at Craig, Mo; just N of Square Creek bridge, Missouri River floodplain. May 25, 1977.
1380	1	Missouri	Atchison	40W	65N	23 NW $\frac{1}{4}$	Isolated clone in fence row adjacent to US Hwy 136 jct at Tarkio. May 25, 1977.
1381	1	Kansas	Jackson	15E	7S	9 NE $\frac{1}{4}$	Scattered plants in barrow ditches of US Hwy 75; S-side Holton; opposite Major Motel. May 25, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1382	1	Kansas	Shawnee	15E	12S	4 NW $\frac{1}{4}$	Roadside, jct US Hwy 75 Bypass & I-Hwy 470; W-side of Topeka; scattered plants. May 25, 1977.
1383	1	Kansas	Osage	14E	14S	19 SE $\frac{1}{4}$	Large population in prairie adjacent to I-Hwy 35 at mileage markers 158, 11 mi N of Admire exit. May 25, 1977.
1384	1	Kansas	Lyon	11E	18S	21 SE $\frac{1}{4}$	0.3 mi S of Emporia Service Center on I-Hwy 35, right-of-way; N-edge Flint Hills area. May 25, 1977.
1385	1	Kansas	Chase	10E	20S	19 SW $\frac{1}{4}$	Flint Hills prairie 5 mi N of Bazaar cattle pens exit on I-Hwy 35; opposite mileage marker 116. May 25, 1977.
1386	1	Kansas	Chase	9E	20S	35 SE $\frac{1}{4}$	Base of shale bluffs at I-Hwy 35 entrance 4.0 mi N of Mayfield-Green service area. May 25, 1977.
1387	1	Kansas	Butler	4E	26S	10 NE $\frac{1}{4}$	Waste area, jct Kan Hwy 254 & Augusta Co. Rd. May 27, 1977.
1388	1	Kansas	Cowleg	4E	34S	19 NW $\frac{1}{4}$	Waste area behind McDonald's. N-edge Arkansas City, Kan. May 27, 1977.
1389	3	Oklahoma	Grady	7W	7N	36 SW $\frac{1}{4}$	1 mi E of US Hwy 62 on OK Hwy I-35. May 27, 1977.
1390	3	Oklahoma	Grady	5W	7N	9	Roadside bank on US Hwy 62. May 29, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1391	2	Oklahoma	Grady	5W	8N	35	2.7 mi W on OK US Hwy 62. May 29, 1977.
1392	1	Oklahoma	Grady	3W	7N	1	½ mi S of US Hwy 62. May 29, 1977.
1393	2	Oklahoma	Caddo	9W	7N	21	3.6 mi from Washita River on Hwy US 62. May 29, 1977.
1394	1	Oklahoma	Caddo	11W	5N	20	Roadside bank on US Hwy 62. 0.2 mi S to Hrgce Creek. May 29, 1977.
1395	2	Oklahoma	Comanche	11W	3N	8	Roadside on Hwy 62. Scattered plants. May 29, 1977.
1396	1	Oklahoma	Comanche	12W	2N	24	Roadside on Hwy 62. Single plant. May 29, 1977.
1397	2	Oklahoma	Comanche	13W	2N	20	Right-of-way jct of US Hwy 62. May 29, 1977.
1398	2	Oklahoma	Kiowa	16W	2N	11	N on Hwy 54 on railroad embankment. May 29, 1977.
1399	1	Oklahoma	Kiowa	16W	2N	1	2.7 mi N of Hwy 54 on road side. May 29, 1977.
1400	1	Oklahoma	Kiowa	16W	7N	23	0.4 mi S of Rainy Mt. Creek on OK Hwy 54. May 29, 1977.
1401	3	Oklahoma	Kiowa	16W	7N	23	0.7 mi E of OK Hwy 9. May 29, 1977.
1402	1	Oklahoma	Caddo	13W	7N	8	1 mi E from Rainy Mt. Creek on Hwy 9. May 29, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1403	1	Oklahoma	Caddo	12W	7N	12	E of roadside on OK Hwy 9. May 29, 1977.
1404	1	Oklahoma	Caddo	10W	7N	10	E of OK Hwy 9 adjacent to railroad tracks. May 29, 1977.
1405	2	Oklahoma	Payne	2E	19N	20	0.4 mi E from Little Stillwater Creek bridge on OK Hwy 51. May 30, 1977.
1406	2	Oklahoma	Payne	6E	19N	30	Roadside 1.7 mi S of Council Creek bridge on OK Hwy 51. May 30, 1977.
1407	1	Oklahoma	Payne	6E	19N	13	0.9 mi W of Salt Creek bridge on OK Hwy 51. May 30, 1977.
1408	3	Oklahoma	Creek	8E	19N	24	0.9 mi from Deer Creek bridge on OK Hwy 51. May 30, 1977.
1409	1	Oklahoma	Creek	9E	19N	21	0.8 mi from Cotton Wood Creek, adjacent to railroad on OK Hwy 51. May 30, 1977.
1410	2	Oklahoma	Marshall	5E	6S	36 NE $\frac{1}{4}$	Waste area 0.1 mi W of US Hwy 70 jct on OK Hwy 32 W side of Kingston. June 6, 1977.
1411	2	Oklahoma	Bryan	7E	6S	34 NW $\frac{1}{4}$	Roadside US Hwy 70 2.5 mi E of Roosevelt bridge over Lake Texoma. June 6, 1977.
1412	2	Oklahoma	Bryan	9E	6S	35 NE $\frac{1}{4}$	Large population roadside US Hwy 70 2.2 mi E of US Hwy 69 jct. June 6, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1413	2	Oklahoma	Bryan	11E	6S	21 SW $\frac{1}{4}$	0.9 mi W of OK Hwy 22 on US Hwy 70. June 6, 1977.
1414	2	Oklahoma	Bryan	13E	6S	16 SE $\frac{1}{4}$	Large population US Hwy 70 right-of-way 0.2 mi W of Choctaw county line. June 6, 1977.
1415	2	Oklahoma	Choctaw	15E	6S	15	Roadside US Hwy 70 2.1 mi E of the Muddy River bridge. June 6, 1977.
1416	1	Oklahoma	Choctaw	17E	6S	21	Vacant lot behind Sonic Drive-In, Hugo. June 6, 1977.
1417	2	Oklahoma	Choctaw	19E	6S	15 SE $\frac{1}{4}$	Road right-of-way US Hwy 70, 2.1 mi W of Lake Raymond Gary bridge. June 6, 1977.
1418	1	Oklahoma	McCartain	22E	6S	32 SW $\frac{1}{4}$	Roadside US Hwy 70 bypass, 0.3 mi W of OK Hwy 98 jct W of Millerton, OK. June 6, 1977.
1419	1	Oklahoma	McCartain	23E	7S	36	Roadside US Hwy 70 bypass, 0.3 mi W of OK Hwy 37 jct. June 6, 1977.
1420	1	Oklahoma	McCartain	25E	6S	30 NW $\frac{1}{4}$	Roadside US Hwy 70 1.2 mi N of Yashow Creek bridge S-side Broken Bow. June 6, 1977.
1421	1	Oklahoma	McCartain	23E	5S	28 NE $\frac{1}{4}$	Floodplain of Glover River at OK Hwys 3 & 7 bridge. June 6, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1422	2	Oklahoma	McCartain	21E	4S	27 NW $\frac{1}{4}$	Barrow ditch OK Hwys 7 & 3 0.4 mi E of Ringold OK post office. June 6, 1977.
1423	1	Oklahoma	Pushmataha	19E	4S	18 SE $\frac{1}{4}$	Roadside bank OK Hwys 3 & 7, 0.3 mi W of OK Hwy 147 jct E of Frazer Creek. June 6, 1977.
1424	1	Oklahoma	Pushmataha	17E	4S	18 NW $\frac{1}{4}$	Roadside OK Hwy 3 & 7 0.6 mi E of creek bridge. June 6, 1977.
1425	2	Oklahoma	Atoka	14E	3S	28 NW $\frac{1}{4}$	Roadside OK Hwys 3 & 7 at Sandy Creek Bridge. June 6, 1977
1426	1	Oklahoma	Atoka	12E	2S	30	Barrow ditch OK Hwys 3 & 7, 0.2 mi E of Sand Creek bridge. June 6, 1977.
1427	1	Oklahoma	Atoka	9E	2S	24 NW $\frac{1}{4}$	Embankment OK Hwy 7 at Clear Boggy River bridge. June 6, 1977.
1428	1	Oklahoma	Johnston	8E	2S	19	Granite outcrop adjacent to OK Hwy 7; 0.5 mi S of OK Hwy 7Djct. June 6, 1977.
1429	1	Oklahoma	Johnston	6E	2S	25 NW $\frac{1}{4}$	Jct OK Hwy 7 at OK Hwy 99 roadside. June 6, 1977.
1430	1	Oklahoma	Johnston	6E	4S	8	Floodplain on Washita River at OK Hwy 99 bridge. June 6, 1977.
1431	1	Oklahoma	McClain	4W	9N	18	H.E. Bailey Turnpike at county line of McClain and Grady Cos.; roadside; few plants. June 6, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1432	1	Oklahoma	McClain	4W	9N	19	H. E. Bailey Turnpike & US Hwy 62; roadside; few plants. June 6, 1977.
1433	1	Oklahoma	Comanche	9W	4N	6	10.8 mi S of Chickasha on H. E. Bailey Turnpike; roadside. June 6, 1977.
1434	1	Oklahoma	Comanche	12W	3N	24	Jct of OK Hwy 58 & H. E. Bailey Turnpike; roadside. June 6, 1977.
1435	1	Oklahoma	Comanche	11W	3N	18	Jct of US Hwy 62 & H. E. Bailey; Lawton, OK. Roadside. June 6, 1977.
1436	1	Oklahoma	Comanche	14W	2N	22	Jct of OK Hwy 115 & US 62; roadside. June 6, 1977.
1437	1	Oklahoma	Comanche	15W	2N	21	8.2 mi W on US Hwy 62 from jct of OK Hwy 115. Roadside. June 6, 1977.
1438	1	Oklahoma	Kiowa	17W	2N	12	Jct of US 183 & US 62. Snyder, OK. Roadside. June 6, 1977.
1439	1	Oklahoma	Jackson	21W	9N	16	12.6 mi W on US 62 from jct 183. June 6, 1977.
1440	1	Oklahoma	Jackson	21W	2N	18	5.0 mi W of Altus on US Hwy 62; roadside, few plants. June 6, 1977.
1441	1	Oklahoma	Jackson	23W	2N	22	1.0 mi W of Duke on US Hwy 62; roadside; few plants. June 6, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1442	1	Oklahoma	Harmon	25W	3N	33	3.5 mi E of Hollis on US Hwy 62; roadside. June 6, 1977.
1443	1	Oklahoma	Greer	22W	5N	31	2.4 mi E of Magnum, OK on US Hwy 283. June 6, 1977.
1444	1	Oklahoma	Greer	20W	4N	6	Jct of US Hwy 283 & OK Hwy 44; roadside. June 6, 1977.
1445	1	Oklahoma	Kiowa	19W	6N	19	Jct of 44 & 9; Lonewolf, OK. June 6, 1977.
1446	1	Oklahoma	Kiowa	18W	6N	3	Jct of 9 & US 183; roadside. June 6, 1977.
1447	1	Oklahoma	Washita	18W	8N	1	2.9 mi N of Rocky, OK, on Hwy 183. June 6, 1977.
1448	1	Oklahoma	Washita	17W	9N	16	1.4 mi S of Cordell, OK on Hwy 183. June 6, 1977.
1449	1	Oklahoma	Custer	17W	12N	23	Jct of I-40 & US 183. Roadside; many plants. June 6, 1977.
1450	1	Oklahoma	Custer	16W	12N	17	1.0 mi E of Weatherford, OK on I-40; roadside abundant. June 6, 1977.
1451	1	Oklahoma	Caddo	13W	12N	10	Jct of I-40 & OK 58, Hydro, OK; roadside; abundant. June 6, 1977.
1452	1	Oklahoma	Caddo	11W	12N	10	Jct of I-40 & 281; roadside; abundant. June 6, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1453	1	Oklahoma	Canadian	9W	12N	11	Jct of I-40 & 270; roadside abundant. June 6, 1977.
1454	1	Oklahoma	Canadian	7W	12N	21	300 ft. W of jct of I-40 & 81; roadside; abundant. June 6, 1977.
1455	1	Oklahoma	Canadian	5W	12N	30	Jct of I-40 & 92; roadside; abundant. June 6, 1977.
1456	1	Oklahoma	Oklahoma	3W	11N	32	100 ft. jct of I-40 & I-24; roadside; abundant. June 6, 1977.
1457	1	Colorado	Douglas	67W	7S	35 SW $\frac{1}{4}$	Barrow ditch E side I-Hwy 25, 1.9 mi N of Colorado Hwy 86 exit, elev. 6200 ft. August 12, 1977.
1458	1	Colorado	Larimer	74W	9N	32 SW $\frac{1}{4}$	Waste area adjacent to state fish hatchery, Poudre River Valley, elev. 7650 ft. August 12, 1977.
1459	1	Colorado	Larimer	73W	9N	36 SW $\frac{1}{4}$	Open meadow adjacent to Colo. Hwy 14, 3.0 mi E of Rustic, Poudre River Canyon; elev. 7000 ft. August 12, 1977.
1460	1	Colorado	Jackson	80W	11N	13 SW $\frac{1}{4}$	Roadside of Colo. Hwy 125, 1.1 mi S of North Platte River bridge, elev. 8100 ft. August 12, 1977.
1461	1	Wyoming	Carbon	82W	16N	16 SW $\frac{1}{4}$	Barrow ditch 1.5 mi W of Uihlein Creek bridge on Wyo. Hwy 130; W shape of snowy mtns; elev. 7700 ft. August 19, 1977.

TABLE I. (CONTINUED)

Accession number	Plants counted	State	County	Range	Township	Section	Notes
1462	1	Wyoming	Carbon	81W	16N	16 SW $\frac{1}{4}$	Open Glade Ryan Park Campground, Medicine Bow Nat. For., Snowy Mtn. range; elev. 8400 ft. August 20, 1977.
1463	1	Colorado	Jackson	76W	6N	12 NE $\frac{1}{4}$	Roadside Colo. Hwy 14 at Nokhu Crags Overlook just below Cameron Pass; elev. 9866 ft. August 20, 1977.
1464	1	Wyoming	Albany	79W	16N	19 SW $\frac{1}{4}$	Open slopes above Mirror Lake adj to Wyo. Hwy 130; Medicine Bow Nat For Snowy Mtns; elev. 10600 ft. August 20, 1977.
1465	1	Wyoming	Albany	78W	15N	1	Roadside Wyo. Hwy 130, 2.5 mi E of Centennial Post Office; E slope of Snowy Mtns; elev. 8000 ft. August 23, 1977.
1466	1	Wyoming	Albany	72W	15N	35 NW $\frac{1}{4}$	Open pine woods behind I-Hwy 80, rest area at Summit Pass, elev. 8816 ft. August 23, 1977.
1467	1	Wyoming	Laramie	71W	13N	6 NW $\frac{1}{4}$	Grasslands at base of Amos Monument, 2 mi S of I-Hwy 80; elev. 8247 ft. August 23, 1977.

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