# AN OVERVIEW OF THE GENUS CHRYSOTHAMNUS (ASTERACEAE)

Loran C. Anderson

ABSTRACT: The genus Chrysothamnus contains five sections, 16 species, and 41 subspecies. General comments, keys to the species and subspecies, and an atlas of distributional maps are given.

## INTRODUCTION

Chrysothamnus (commonly known as rabbitbrush) is a widespread genus over much of western North America. Some species are sub-dominants in sagebrush desert and desert grassland; others are truly montane. This overview is provided now in anticipation of my upcoming monograph, which will include much more detail. The early nomenclatural history of the genus was summarized by Hall and Clements (1923). They recognized four sections, 12 species, and 40 subspecies.

Subsequent work has resulted in additional resolution of the taxonomy. For example, C. pyramidatus was transferred to Haplopappus (Blake 1926) and finally to Baccharis (Rzedowski 1972). Chrysothamnus gramineus was reclassified as a Petradoria (Anderson 1963). New species include C. eremobius, C. molestus, and C. spathulatus (Anderson 1964, 1983). Chrysothamnus linifolius and C. humilis are recognized as distinct species again. One fossil species, C. pulchelloides, has been recorded for the genus (Anderson 1980c). In addition, several new subspecies have been described (Anderson 1978, 1980a, 1980b, 1981, 1984), and sectional composition within the genus has been modified.

The transfer of C. gramineus to Petradoria (as P. discoidea) was made with the knowledge available at that time. With the recent discovery of C. eremobius (Anderson 1983), it is apparent that C. gramineus should be retained in Chrysothamnus. A new section of the genus is formally described to accommodate the species C. eremobius and C. gramineus (type species of the section).

Chrysothamnus Gramini L. C. Anderson, sect. nov.

Caules recti annui e caudice lignoso crescentes; folia plana, rigida, chartaceae, manifeste venosa, plusminusve persistentia.

Sectional composition in Chrysothamnus is now perceived as follows:

Section Chrysothamnus
- C. albidus (Jones ex Gray) Greene
- C. greenei (Gray) Greene
- C. humilis Greene
- C. linifolius Greene
- C. spathulatus L. C. Anderson
- C. viscidiflorus (Hook.) Nutt.

Section Gramini
- C. eremobius L. C. Anderson
- C. gramineus Hall

Section Nauseosi
- C. parryi (Gray) Greene
- C. nauseosus (Pallas) Britt.

Section Pulchelli
- C. depressus Nutt.
- C. molestus (Blake) L. C. Anderson
- C. pulchellus (Gray) Greene
- C. vaseyi (Gray) Greene

Section Punctati
- C. paniculatus (Gray) Hall
- C. teretifolius (Dur. & Hilg.) Hall & Clem.

Characteristics of the sections are given in the key to the species. Presumed phylogenetic relationships of taxa within and among sections are given in Anderson and Fisher (1970) and Anderson (1983). Figure numbers precede taxon name in right-hand column.

Paper presented at the Symposium: Biology of Artemisia and Chrysothamnus, Provo, UT, July 9-13, 1984.

Loran C. Anderson is Professor and Curator of the Herbarium, Florida State University, Tallahassee, FL.

## KEY TO THE SPECIES

1. Stems tomentose, hairs often densely compacted (Section Nauseosi)

   2. Phyllaries attenuate, weakly keeled, rather membranous; inflorescences mostly racemose; heads 5-20 flowered . . . . . C. parryi (12 ssp.)

   2. Phyllaries obtuse to acute, if attenuate then strongly keeled, chartaceous; inflorescences mostly cymose; heads usually 5 flowered . . . . . C. nauseosus (22 ssp.)

1. Stems glabrous, puberulent, or resinous-punctate, never tomentose

3. Stems and leaves resinous-punctate; corollas yellow (Section Punctati)

4. Involucres 6-8 mm long, turbinate; phyllaries weakly aligned vertically . . 19. C. paniculatus

4. Involucres 7.6-9.5 mm long, cylindric; phyllaries strongly aligned vertically with swollen tips . . . . . 26. C. teretifolius

3. Stems not resinous-punctate, if leaves resinous-punctate then corollas white

5. Upright stems annual; leaves flat, rigid, strongly veined, more or less persistent (Section Gramini)

6. Involucres 11-17.5 mm long; phyllaries not keeled; achenes glabrous . . 3. C. gramineus

6. Involucres 6.5-9 mm long; phyllaries keeled; achenes pubescent . . . . . 3. C. eremobius

5. Upright stems perennial; leaves often twisted, not rigid, strongly veined if persistent

7. Achenes glabrous with few glands just below pappus or few hairs along ridges (Section Pulchelli)

8. Corollas less than 9 mm long, surpassing the pappus

9. Involucres 5-7 mm long; phyllaries weakly aligned and keeled . . . 27. C. vaseyi

9. Involucres 10-13 mm long; phyllaries strongly aligned and keeled

10. Leaves less than 2 mm wide, densely glandular-hispid . . . . . 6. C. molestus

10. Leaves more than 2 mm wide, hispid or glabrous, rarely sparsely glandular . . . . . 2. C. depressus

8. Corollas mostly over 9 mm long but surpassed by abundant pappus . . . C. pulchellus (2 ssp.)

7. Achenes densely pubescent, rarely sparsely so in C. humilis and C. spathulatus but then achenes not ridged (Section Chrysothamnus)

11. Corollas white; leaves resinous punctate . . . . . 1. C. albidus

11. Corollas yellow; leaves more or less resinous, never punctate

12. Heads often overtopped by leaves; flowers 2-3(4); style branches included or barely surpassing corolla lobes, appendages long . . 5. C. humulis

12. Heads not overtopped by leaves; flowers 3 or more; styles long exserted beyond spreading corolla lobes

13. Style appendages long (40-70% of style branch); leaves lanceolate or spatulate, never twisted; shrubs over 7 dm tall

14. Involucres less than 6 mm long, turbinate; leaves lanceolate; plants soboliferous; achenes densely pubescent . . . . . 6. C. linifolius

14. Involucres over 6 mm long, cylindric; leaves spatulate; plants never soboliferous; achenes sparsely pubescent . 26. C. spathulatus

13. Style appendages short (30-45% of style branch); leaves linear to oblong-lanceolate, frequently twisted or involute

15. Phyllaries acuminate-cuspidate; leaves 1-2 mm wide . . . 4. C. greenei

15. Phyllaries obtuse or acute; leaves 1-10 mm wide . . . . C. viscidiflorus (5 ssp.)

The species are fairly well defined, but a few of them have considerable intraspecific variability, which has resulted in differing taxonomic treatments as seen in table 1.

Table 1.--The complex taxa of Chrysothamnus

| Species | Total names as species | Subspecies number (Hall and Clements 1923) | Subspecies number (Anderson this paper) |
|---|---|---|---|
| C. nauseosus | 62 | 20 | 22 |
| C. parryi | 15 | 10 | 12 |
| C. viscidiflorus | 25 | 9 | 5 |

KEY TO THE SUBSPECIES

Chrysothamnus nauseosus

1. Involucres pubescent to tomentose, rarely nearly glabrous; stems mostly whitish with tomentum; leaves mostly dark green or grayish-white ("gray group")

  2. Achenes glabrous, at least on lower half

    3. Achenes with tuft of hairs just below pappus; phyllaries sparsely villous as well as tomentose . . . . . 18. ssp. washoensis

    3. Achenes totally glabrous; phyllaries tomentose to nearly glabrous

      4. Leaves linear; corollas over 9 mm long

        5. Pappus about equal to corolla in length; style appendages longer than stigmatic portion . . . . . 9. ssp. bigelovii

        5. Pappus much shorter than corolla; style appendages shorter than stigmatic portion . . . . . 17. ssp. texensis

      4. Leaves narrowly oblanceolate; corollas less than 9 mm long . . . . . 17. ssp. psilocarpus

  2. Achenes densely pubescent

    6. Leaves 3-10 mm wide; phyllaries mostly obtuse . . . . . 17. ssp. salicifolius

    6. Leaves 1-3 mm wide; phyllaries various, usually acute

      7. Outer phyllaries densely tomentose, inner ones glabrous

        8. Plants mostly 1-2 dm tall; corolla lobes 1-2.5 mm long

          9. Involucres 8-9 mm long; corolla lobes 1.6-2.5 mm long . . . . 15. ssp. nanus

          9. Involucres 11-13 mm long; corolla lobes 1-1.5 mm long . . . . 18. ssp. uintahensis

        8. Plants over 3 dm tall; corolla lobes 0.5-1 mm long . . . . . 14. ssp. latisquameus

      7. All phyllaries tomentose, sometimes sparsely so

        10. Involucres 7-10(11) mm tall

          11. Corolla lobes 1-2 mm long; style appendages longer than stigmatic portions

            12. Corollas 6-8.5 mm long; involucres 7-9.5 mm long; shrubs mostly 2-6 dm tall . . . . . 16. ssp. nauseosus

            12. Corollas (8)9-11 mm long; involucres mostly 9-11 mm long; shrubs 4-15 dm tall (lower in some alpine forms) . . . . 7. ssp. albicaulis

11. Corolla lobes 0.5-1 mm long; style appendages shorter than stigmatic portions . . . . . 12. ssp. hololeucus

10. Involucres 11-13 mm long

13. Corolla lobes 1.7-2.3 mm long, glabrous . . . . . 8. ssp. bernardinus

13. Corolla lobes 0.5-1 mm long, villous . . . . . 18. ssp. turbinatus

1. Involucres glabrous, outer phyllaries sometimes ciliate or scurfy; stems greenish, tomentum more compacted; leaves usually greenish-yellow or absent ("green group")

14. Achenes glabrous

15. Outer phyllaries scurfy tomentulose, obtuse; inner ones glabrous, weakly keeled; stems yellowish-green . . . . . 16. ssp. nitidus

15. Outer phyllaries glabrous, obtuse to acute, keeled; stems brownish to grayish-green

16. Involucres 7.5-10.5 mm long; stems often leafless . . . . . 14. ssp. leiospermus

16. Involucres 12-16 mm long; stems very leafy . . . . . 13. ssp. iridis

14. Achenes pubescent

17. Involucres over 15 mm long; phyllaries strongly keeled and cuspidate 8. ssp. arenarius

17. Involucres less than 15 mm long; phyllaries not cuspidate

18. Leaves 1-3 mm wide, 1-5-nerved

19. Involucres 11-13 mm long; corolla lobes 1.7-2.3 mm long . . . 8. ssp. bernardinus

19. Involucres 6.7-9.5 mm long; corolla lobes 0.6-1.5 mm long . . 11. ssp. graveolens

18. Leaves 1 mm wide or less, 1-nerved

20. Phyllaries abruptly pointed, recurved . . . . . 9. ssp. ceruminosus

20. Phyllaries acute, erect

21. Involucres 7-8 mm long; stems usually leafy; corolla lobes glabrous (achenes sometimes glabrous in Idaho) . . . . . 10. ssp. consimilis

21. Involucres 9-10 mm tall, phyllaries strongly ranked; stems often leafless

22. Corolla lobes glabrous . . . . . 15. ssp. mohavensis

22. Corolla lobes villous (sometimes sparsely so) . . . . 13. ssp. junceus

Chrysothamnus parryi

1. Flowers mostly 8-20 per head or leaves over 5 mm wide (never with stalked glands)

2. Shrubs over 3 dm tall; leaves mostly over 3 cm long

3. Flowers 8-20 per head; leaves 2-3 mm wide . . . . . 24. ssp. parryi

3. Flowers 5-7 per head; leaves 5-14 mm wide . . . . . 22. ssp. latior

2. Shrubs 1-2 dm tall; leaves mostly less than 3 cm long

4. Leaves 2-3.5 cm long, overtopping the inflorescence; corollas 9-10 mm long . . . . . 23. ssp. montanus

4. Leaves 1-1.5 mm long, not overtopping inflorescence; corollas 10-12 mm long . . . . . 22. ssp. imulus

1. Flowers mostly 5-7 per head; leaves 1-3 mm wide (flowers up to 10 per head and leaves to 4 mm wide in ssp. asper, then leaves with stalked glands)

5. Leaves oblanceolate, with short stalked glands; corollas up to 9 mm long . 20. ssp. asper

5. Leaves linear to oblanceolate, without stalked glands

6. Inflorescences reduced to 1-2 heads, each with 8-11(13) phyllaries; corollas 8-9 mm long . . . . . 22. ssp. monocephalus

6. Inflorescences with many heads; corollas mostly over 9 mm long

7. Inflorescences lax and elongated; involucres 12.5-15 mm long with 9-13 straight, narrow phyllaries . . . . . 24. ssp. vulcanicus

7. Inflorescences more compact; involucres shorter or with more phyllaries, often broader, spreading or recurved

8. Upper leaves overtopping inflorescence; corollas pale yellow, mostly 8-10 mm long

9. Inflorescences somewhat elongate, sparsely leafy; involucres 10-12 mm long; corolla lobes 1-1.5 mm long . . . . . 24. ssp. salmonensis

9. Inflorescences compact, very leafy; involucres 11.5-16 mm long; corolla lobes 1.5-1.7 mm long . . . . . 21. ssp. howardii

8. Upper leaves shorter than inflorescence; corollas often over 10 mm long

10. Corollas pale yellow, tubes abruptly dilated; corolla lobes 0.7-1 mm long, lanceolate . . . . . 20. ssp. affinis

10. Corollas clear yellow, tubes gradually flaring; corolla lobes 1.5-2 mm long, relatively broader

11. Phyllaries mostly straight tipped; involucres 11-15 mm long . . . . . 21. ssp. attenuatus

11. Phyllaries with recurved tips; involucres 14-19 mm long . 23. ssp. nevadensis

Chrysothamnus pulchellus

1. Shrubs 8-12 dm tall; leaves glabrous or puberulent, margins entire; corollas 11-13 mm long . . . . . 25. ssp. pulchellus

1. Shrubs 0.5-5(7) dm tall; leaves with scabrous-ciliolate margins, otherwise glabrous; corollas 7-12 mm long . . . . . 25. ssp. baileyi

Chrysothamnus viscidiflorus

1. Leaves planate, glabrous; corollas 3.5-4(4.5) mm long . . . . . 30. ssp. planifolius

1. Leaves more or less twisted or pubescent or corollas longer

2. Upper stems, frequently leaves, hairy

3. Stems and leaves finely puberulent; leaves 1-2(4) mm wide . . . . . 30. ssp. puberulus

3. Stems hispid near inflorescence; leaves over 2 mm wide, hirsute or glabrous . . . . . 29. ssp. lanceolatus

2. Stems glabrous; leaves often with ciliate margins, otherwise glabrous

4. Leaves ± 1 mm wide; flowers 3-4(5) per head; involucres somewhat turbinate . . . . . 28. ssp. axillaris

4. Leaves 1-10 mm wide; if 1 mm then flowers 4 or more per head and involucres narrowly cylindric . . . . . 31. ssp. viscidiflorus

NAMES EXCLUDED FROM THE KEYS

Chrysothamnus nauseosus ssp. glareosus (Jones) Hall & Clem.: taxon described as having glabrous achenes and flowers a half inch long, from Marysvale, UT. No specimens have been located in the herbaria or in the field.

Chrysothamnus nauseosus ssp. viscosus Keck: taxon described as differing somewhat from ssp. hololeucus. Type collection is an intergeneric hybrid between ssp. hololeucus and Haplopappus cuneatus.

Chrysothamnus parryi ssp. bolanderi (Gray) Hall & Clem.: known only from type locality. It is an intergeneric hybrid between C. nauseosus ssp. albicaulis and Haplopappus marconema.

NOMENCLATURAL INFORMATION AND TRIVIA

Figure

1. C. albidus (Jones ex Gray) Greene. The only white-flowered and most resinous species in the genus. Its geographical range is extensive, but it is not particularly abundant anywhere.

2. C. depressus Nutt. Somewhat variable species with stouter forms in Nevada and California, but there are no correlated patterns of variability worthy of taxonomic recognition.

3. C. eremobius L. C. Anderson. This very distinctive species was only recently discovered and described. Vegetatively it looks somewhat like Petradoria pumila.

3. C. gramineus Hall. This species was transferred to Petradoria by me several years ago based on then current data. Morphology of C. eremobius warrants returning this species to Chrysothamnus.

4. C. greenei (Gray) Greene. The species is very closely related to C. viscidiflorus. Narrow-leaved forms have been called ssp. filifolius, but leaf width varies under garden culture. I choose not to recognize the subspecies. It could be recognized at the varietal level.

5. C. humilis Greene. The earliest blooming species in the genus, it is sometimes confused with C. viscidiflorus ssp. puberulus, from which it can be distinguished by its coarser vesture in addition to the key characters and more cryptic anatomical features.

6. C. linifolius Greene. The only species in the genus that is soboliferous, it also has some unique anatomy--clearly distinct from C. viscidiflorus.

6. C. molestus (Blake) L. C. Anderson. This rare species is distinctive in the genus with its glandular-hispid foliage.

C. nauseosus (Pallas) Britt. The most complex and wide-ranging species in the genus. I have merged some of the subspecies of Hall and Clements but have also described new ones. Names of varieties within the more complex subspecies will be given in the upcoming monograph for those who wish further details of interrelationships. Twenty-two subspecies are currently recognized; they are sometimes subdivided as the "gray group" and the "green group" based on density of tomentum of stems and leaves. That categorization is not very good because individual plants of ssp. bernardinus fit one group or the other, and considerable variation in tomentum density can occur within a given population in several subspecies.

7. ssp. albicaulis (Nutt.) Hall & Clem. Includes the names californicus, macrophyllus, and speciosus. Perhaps the most variable ssp. in C. nauseosus, it intergrades somewhat with ssp. consimilis, nauseosus, and especially hololeucus where their ranges overlap.

8. ssp. arenarius L. C. Anderson. Very distinctive with heads up to 20 mm long and phyllaries strongly keeled. Recently found in Mesa Co., CO (new to that state), but not shown on map.

8. ssp. bernardinus (Hall) Hall & Clem. Very close to ssp. albicaulis.

9. ssp. bigelovii (Gray) Hall & Clem. Very distinctive, but rarely mistaken for C. parryi spp. howardii.

9. ssp. cerminosus (Dur. & Hilg.) Hall & Clem. Looks like a ssp. consimilis or mohavensis but with prominently recurved phyllary tips.

10. ssp. consimilis (Greene) Hall & Clem. Includes names artus, oreophilus, petrophilus (a form with glabrous achenes), pinifolius, and viridulus. Several of these are worthy of varietal status within the subspecies.

11. ssp. graveolens (Nutt.) Piper. Includes names confinis, falcatus, glabrata, and nivecaulis. Intergrades with ssp. hololeucus in eastern Utah to give plants with white stems but glabrous involucres.

12. ssp. hololeucus (Gray) Hall & Clem. Includes the names gnaphalodes and zionis. Largely sympatric with ssp. consimilis, but intergradations between the two have not been observed.

13. ssp. iridis L. C. Anderson. Known from only two locations on barren gypsiferous shale.

13. ssp. junceus (Greene) Hall & Clem. Distinctive with fastigiate rushlike branches. Recently found in Mesa Co., CO (new for state), but not shown on map.

14. ssp. latisquameus (Gray) Hall & Clem. Very distinctive in southern part of range, but intergrades with ssp. graveolens in north-central New Mexico.

14. ssp. leiospermus (Gray) Hall & Clem. Includes names abbreviatus and oliganthus. Intergrades with ssp. mohavensis in Clark Co., NV.

15. ssp. mohavensis (Green) Hall & Clem. Includes name occidentalis. Closely related to ssp. consimilis.

15. ssp. nanus (Cronq.) Keck. Local, montane variant close to ssp. albicaulis.

16. ssp. nauseosus. Includes the names frigidus, pallidus, plattensis, pulcherrimus, and wyomingensis. A variable subspecies that seemingly intergrades only with ssp. albicaulis.

16. ssp. nitidus L. C. Anderson. A few pubescent-achened plants found in some populations. Distinctive with its yellowish-green stems (chartreuse) and very pleasant odor.

17. ssp. psilocarpus (Blake) L. C. Anderson. Very local glabrous-achened subspecies.

17. ssp. salicifolius (Rydb.) Hall & Clem. Distinctive with wide leaves; close to ssp. albicaulis but seems to mix a little with ssp. graveolens near Soldier Summit, UT.

17. ssp. texensis L. C. Anderson. Endemic to Guadalupe Mtns. of New Mexico and Texas with unusually short pappus.

18. ssp. turbinatus (Jones) Hall & Clem. Rarely has glabrous achenes but then distinct from ssp. bigelovii in villous corolla lobes and involucral features.

18. ssp. uintahensis L. C. Anderson. Apparently a local, stabilized hybrid involving C. parryi.

18. ssp. washoensis L. C. Anderson. Close to ssp. albicaulis but unique with white villous hairs distally on otherwise glabrous achenes.

19. C. paniculatus (Gray) Hall. Often easily identified by black bands on stems from insect or fungal attack.

C. parryi (Gray) Greene. Variation hardly accounted for with just trinomials; 11 subspecies:

20. ssp. affinis (Nels.) L. C. Anderson. Close to ssp. attenuatus, but involucres more stramineous.

20. ssp. asper (Greene) Hall & Clem. Distinctive with stalked glands but stalks sometimes fairly short.

21. ssp. attenuatus (Jones) Hall & Clem. Intermediate in range and morphology between ssp. howardii and ssp. nevadensis.

21. ssp. howardii (Parry) Hall & Clem. Includes name collinus. Geographically variable in plant height.

22. ssp. imulus Hall & Clem. Very local, perhaps only an extreme form of ssp. asper.

22. ssp. latior Hall & Clem. Distinctive with broadly oblanceolate leaves, looks like certain Haplopappus.

22. ssp. monocephalus (Nels. & Kenn.) Hall & Clem. High alpine form probably derived from ssp. nevadensis.

23. ssp. montanus L. C. Anderson. Known only from type locality and remote from near relatives.

23. ssp. nevadensis (Gray) Hall & Clem. Variable in stature and leaf size.

24. ssp. parryi. Wide ranging, hybridizes with C. nauseosus only at its range limits in Nevada and Wyoming.

24. ssp. salmonensis L. C. Anderson. Plants look much like C. nauseosus ssp. consimilis, but possibly derived from ssp. attenuatus.

24. ssp. vulcanicus (Greene) Hall & Clem. Plant form suggests some influence from C. nauseosus ssp. albicaulis.

C. pulchellus (Gray) Greene. Distinctive desert species with prominently angled achenes; 2 subspecies:

25. ssp. baileyi (Woot. & Standl.) Hall & Clem. Wide ranging, somewhat variable in involucral features.

25. ssp. pulchellus. Includes name elatior, which was applied to puberulent form (which grows intermixed with standard subspecies).

26. C. spathulatus L. C. Anderson. Only species in genus that rarely has a few ray flowers, but only in two geographically peripheral populations.

26. C. teretifolius (Dur. & Hilg.) Hall & Clem. Sometimes confused with C. paniculatus, this grows mostly on rocky slopes, whereas paniculatus grows in sandy washes.

27. C. vaseyi (Gray) Greene. Includes name bakeri. Looks somewhat like C. viscidiflorus but more closely related to C. depressus.

C. viscidiflorus (Hook.) Nutt. Most wide ranging and complex after C. nauseosus; five subspecies:

28. ssp. axillaris (Keck) L. C. Anderson. Confused with stenophyllus form of ssp. viscidiflorus but distinct.

29. ssp. lanceolatus (Nutt.) Hall & Clem. Includes names elegans, glaucus, latus, and spathulata; intergrades extensively with ssp. viscidiflorus.

30. ssp. planifolius L. C. Anderson. Local form with small heads and flat leaves.

30. ssp. puberulus (D. C. Eat.) Hall & Clem. Often with ssp. viscidiflorus but not intergrading.

31. ssp. viscidiflorus. Includes names latifolius, pumilus, stenophyllus, tortifolius, and varus. The combination C. v. ssp. viscidiflorus var. stenophyllus has already been made (Anderson 1980b); others will be made in upcoming monograph.

## RANGE MAPS

The maps that follow (figures 1-31) depict the natural distribution of each taxon. More precise dot maps will be provided in the upcoming monograph. Ranges were determined from extensive field observations and from study of over 24,000 herbarium specimens.

## ACKNOWLEDGMENT

This work has been supported by a series of grants from the National Science Foundation, the most recent being DEB-8021776.

## REFERENCES

Anderson, L. C. Studies on Petradoria (Compositae): anatomy, cytology, taxonomy. Trans. Kans. Acad. Sci. 66: 632-684; 1963.

Anderson, L. C. Taxonomic notes on the Chrysothamnus viscidiflorus complex (Astereae, Compositae). Madroño. 17: 222-227; 1964.

Anderson, L. C. New taxa in Chrysothamnus, section Nauseosi (Asteraceae). Phytologia. 38: 309-320; 1978.

Anderson, L. C. Morphology and biogeography of Chrysothamnus nauseosus ssp. texensis (Asteraceae): a new Guadalupe Mountains endemic. Southw. Nat. 25: 197-206; 1980a.

Anderson, L. C. Identity of narrow-leaved Chrysothamnus viscidiflorus (Asteraceae). Great Basin Nat. 40: 117-120; 1980b.

Anderson, L. C. A new species of fossil Chrysothamnus (Asteraceae) from New Mexico. Great Basin Nat. 40: 351-352; 1980c.

Anderson, L. C. Chrysothamnus nauseosus ssp. iridis (Asteraceae): a new endemic from Utah. Great Basin Nat. 41: 311-313; 1981.

Anderson, L. C. Chrysothamnus eremobius (Asteraceae): a new species from Nevada. Brittonia. 35: 23-27; 1983.

Anderson, L. C. Chrysothamnus nauseosus ssp. uintahensis: a stabilized hybrid. Great Basin Nat. 44: 416-420; 1984.

Anderson, L. C.; Fisher, P. S. Phylogenetic indicators from floral anatomy in Chrysothamnus (Astereae, Compositae). Phytomorphology. 20: 112-118; 1970.

Blake, S. F. Compositae. In: Standley, P. C. Trees and shrubs of Mexico. Contrib. U.S. Nat. Herb. 23: 1401-1641; 1926.

Hall, H. M.; Clements, F. E. The phylogenetic method in taxonomy: The North American species of Artemisia, Chrysothamnus, and Atriplex. Carnegie Inst. Publ. 326: 1-355; 1923.

Rzedowski, J. Tres adiciones al genero Baccharis (Compositae) en Mexico. Brittonia. 24: 398-402; 1972.

In: McArthur, E. Durant; Welch, Bruce L., compilers. Proceedings--symposium on the biology of Artemisia and Chrysothamnus; 1984 July 9-13; Provo, UT. General Technical Report INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1986. 401 p.

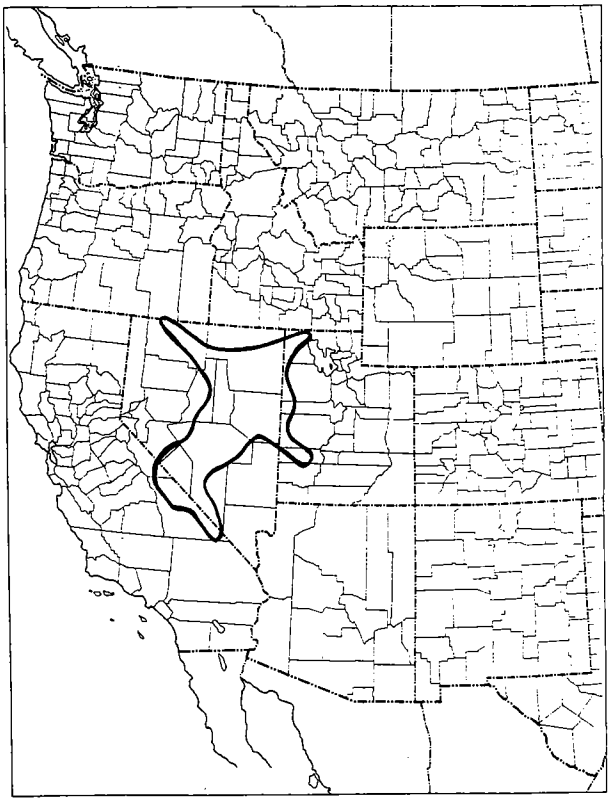

Figure 1.--Range of Chrysothamnus albidus.

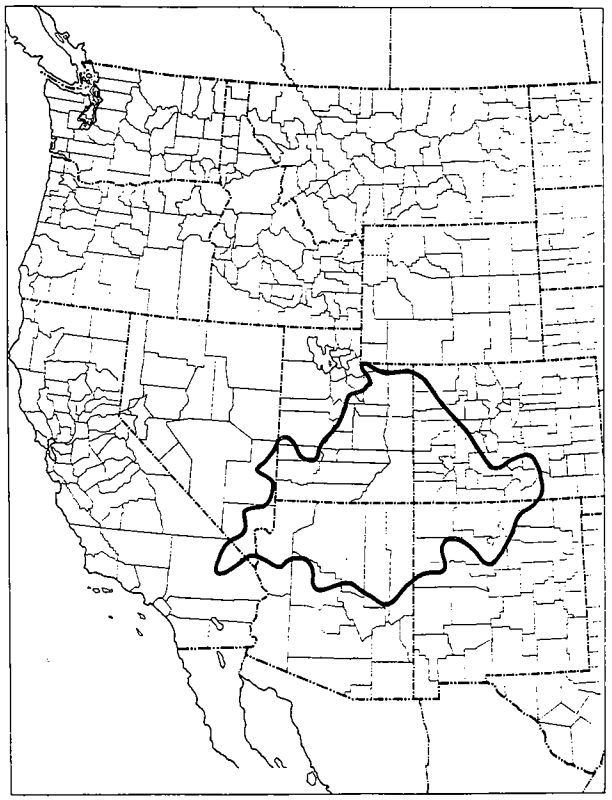

Figure 2.--Range of Chrysothamnus depressus.

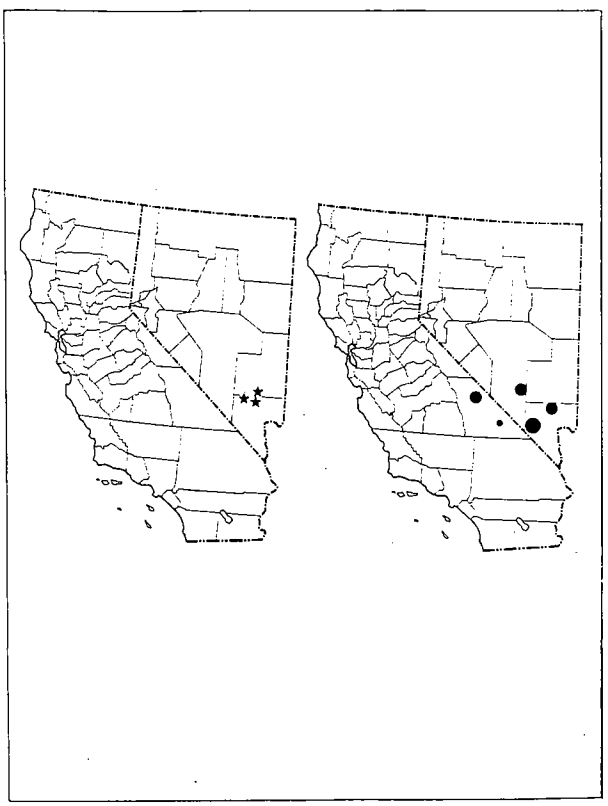

Figure 3.--Range of Chrysothamnus eremobius (stars); range of C. gramineus (dots).

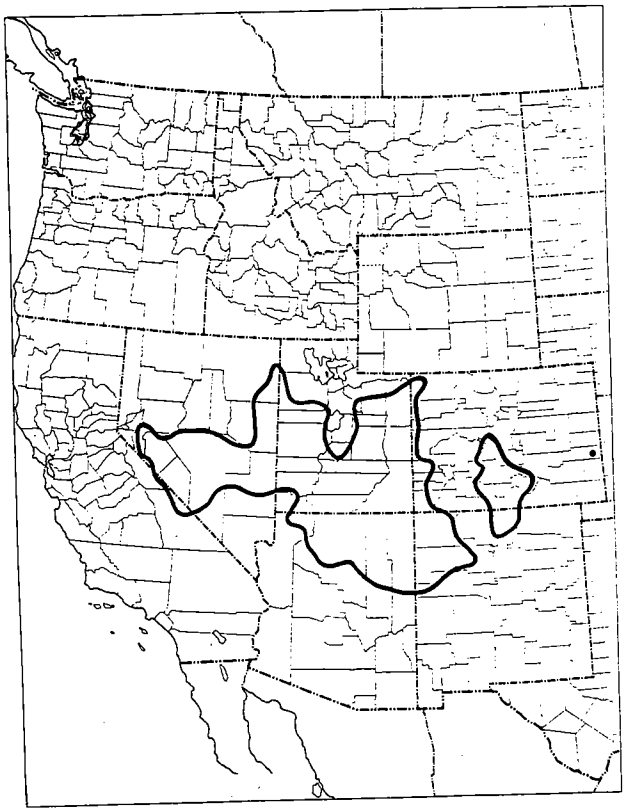

Figure 4.--Range of Chrysothamnus greenei.

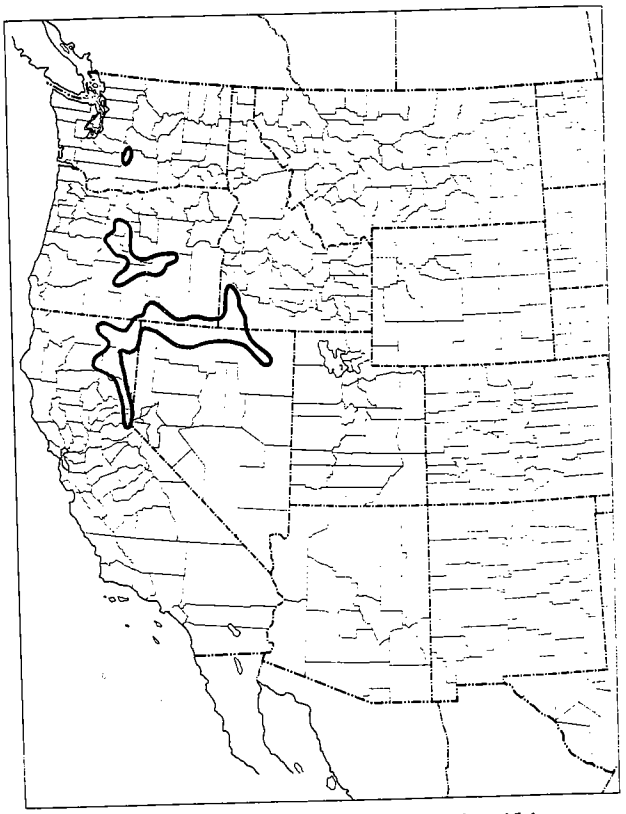

Figure 5.--Range of Chrysothamnus humilis.

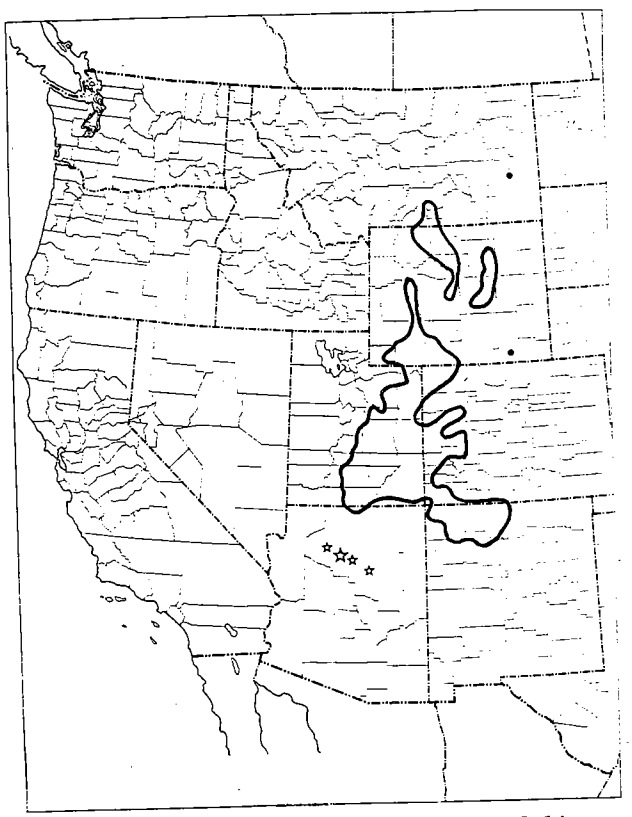

Figure 6.--Range of Chrysothamnus linifolius (dots and loops); range of C. molestus (stars).

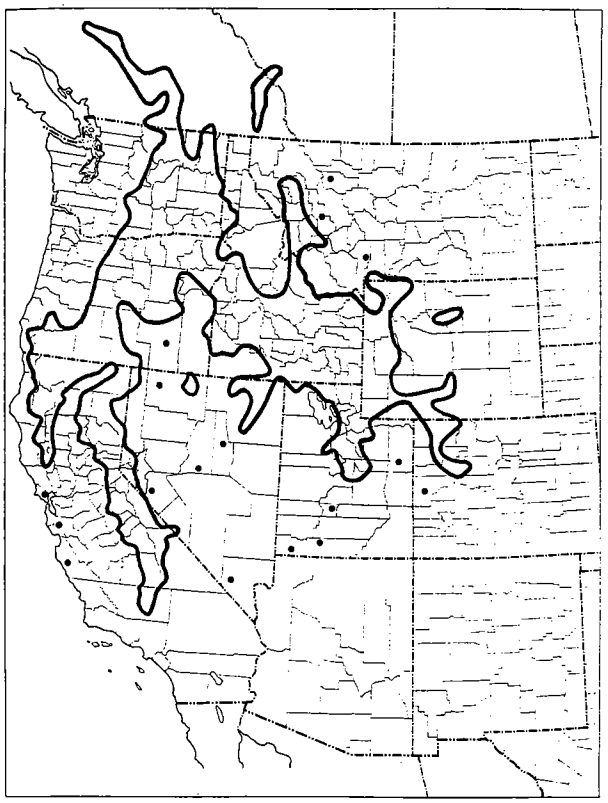

Figure 7.--Range of Chrysothamnus nauseosus ssp. albicaulis.

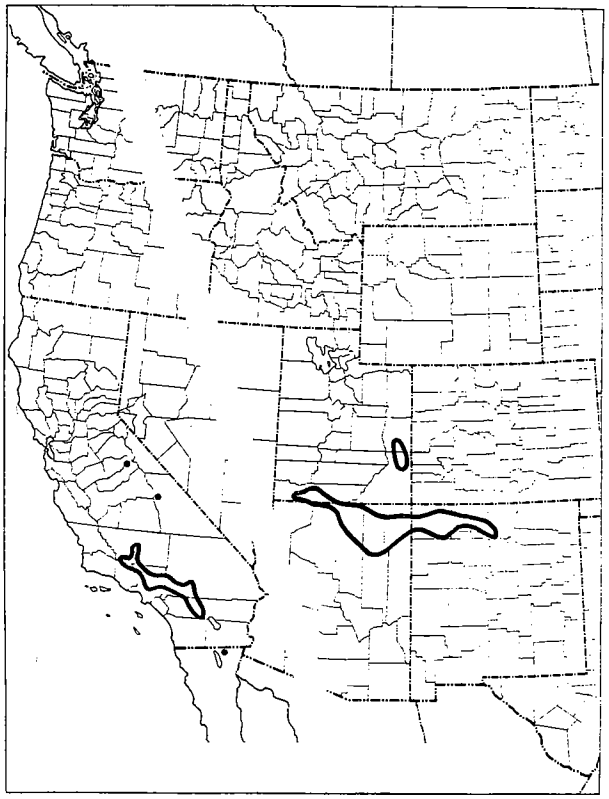

Figure 8.--Range of Chrysothamnus nauseosus ssp. arenarius (right map); range of C.n. ssp. bernardinus (left map).

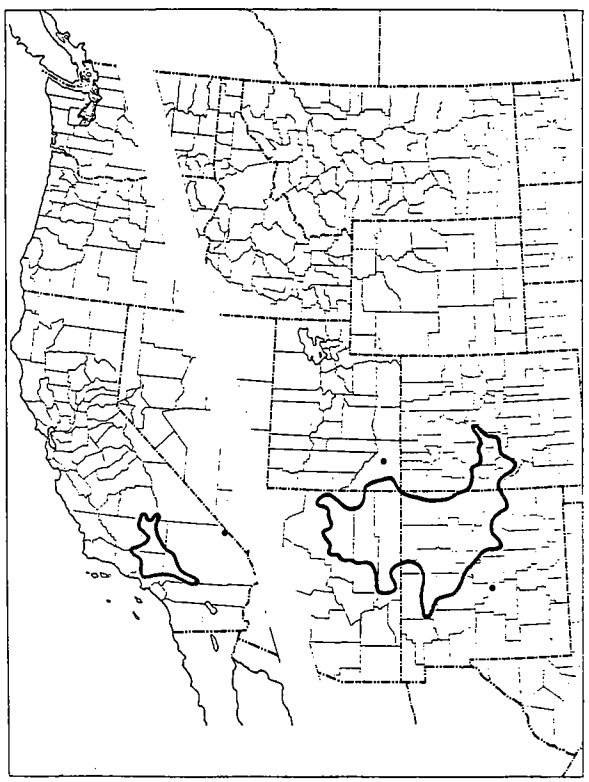

Figure 9.--Range of Chrysothamnus nauseosus ssp. bigelovii (right map); range of C.n. ssp. ceruminosus (left map).

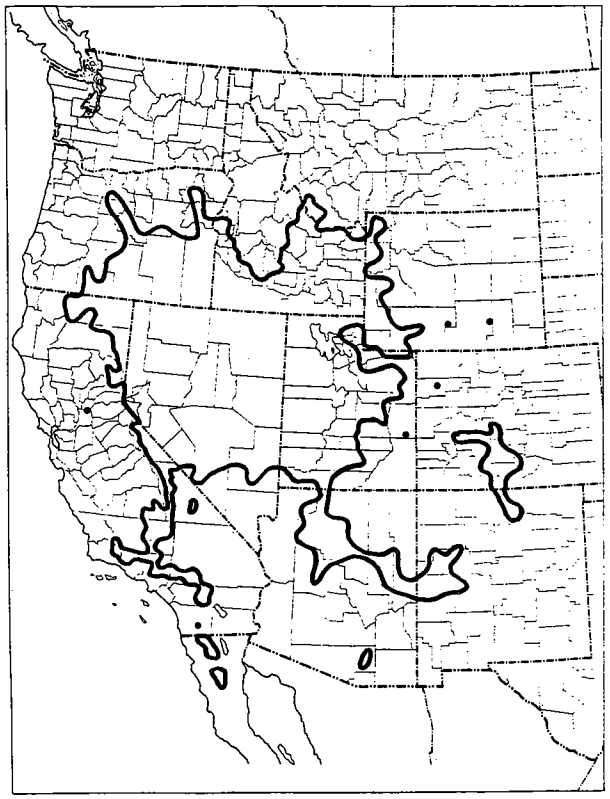

Figure 10.--Range of Chrysothamnus nauseosus ssp. consimilis.

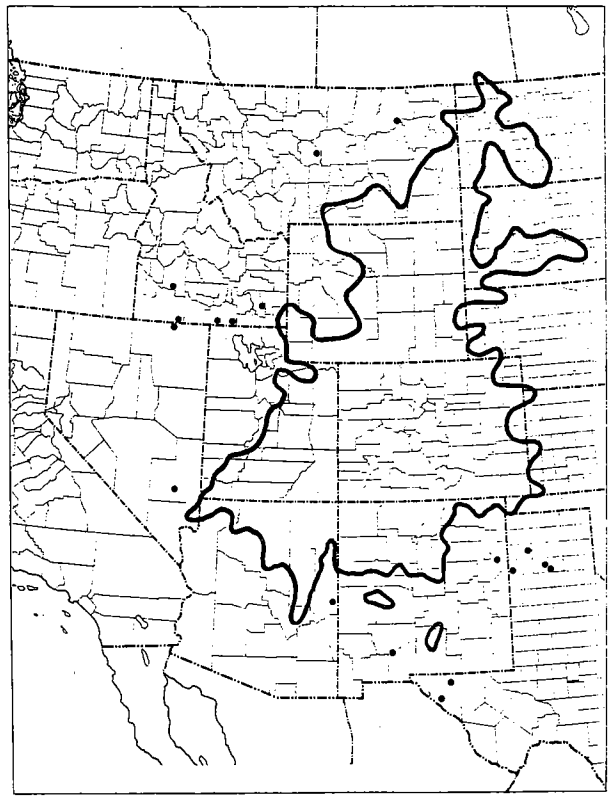

Figure 11.--Range of Chrysothamnus nauseosus ssp. graveolens.

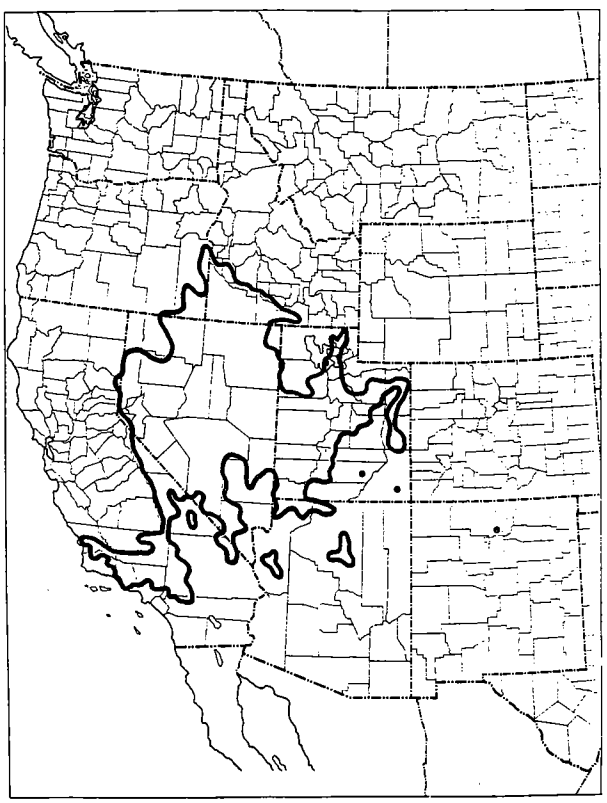

Figure 12.--Range of Chrysothamnus nauseosus ssp. hololeucus.

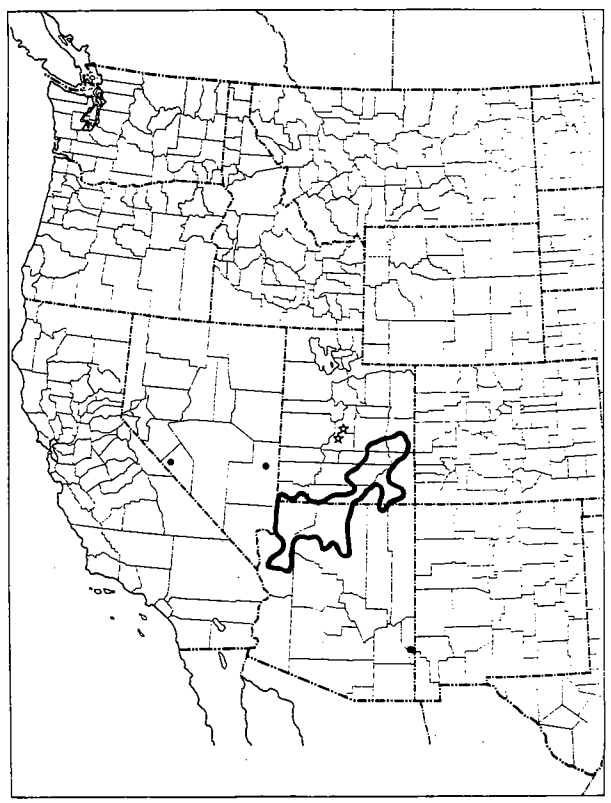

Figure 13.--Range of Chrysothamnus nauseosus ssp. iridis (stars); range of C.n. ssp. junceus (dots and loop).

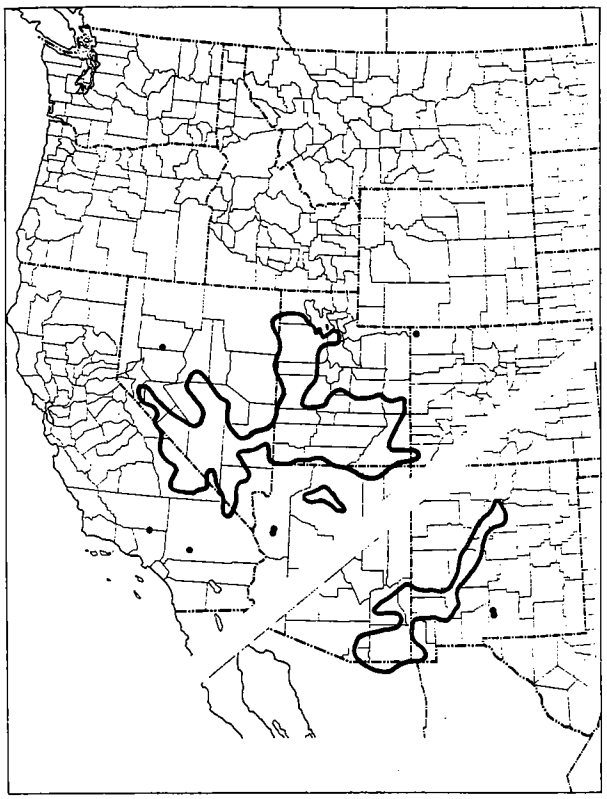

Figure 14.--Range of Chrysothamnus nauseosus ssp. latisquameus (lower right); range of C.n. ssp. leiospermus (upper left).

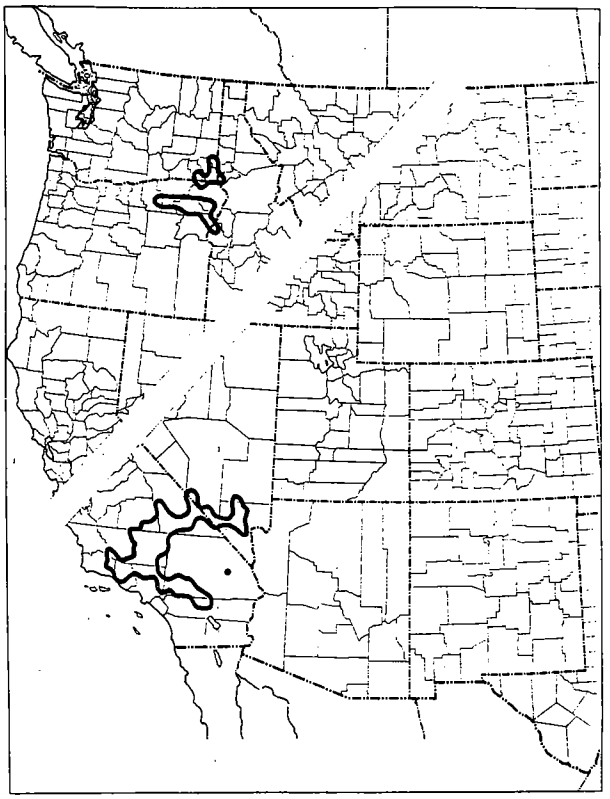

Figure 15.--Range of Chrysothamnus nauseosus ssp. mohavensis (lower map); range of C.n. ssp. nanus (upper map).

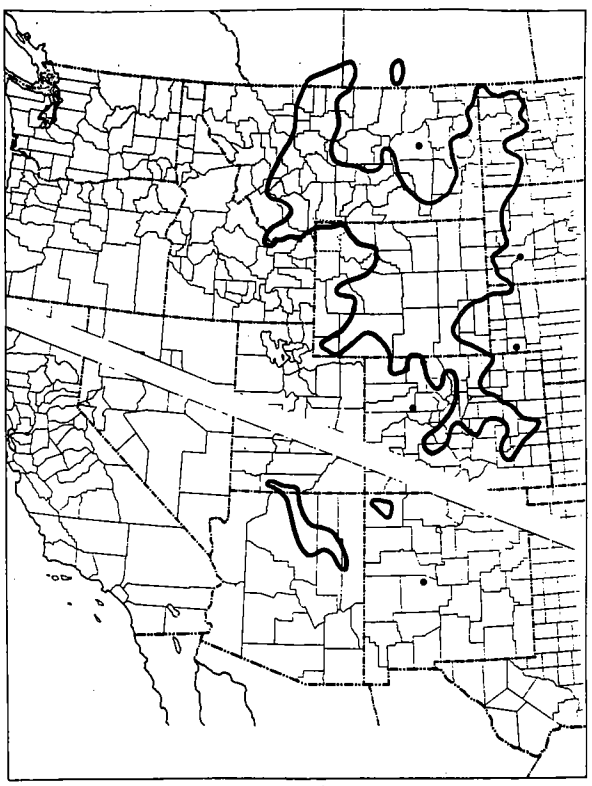

Figure 16.--Range of Chrysothamnus nauseosus ssp. nauseosus (upper right); range of C.n. ssp. nitidus (lower left).

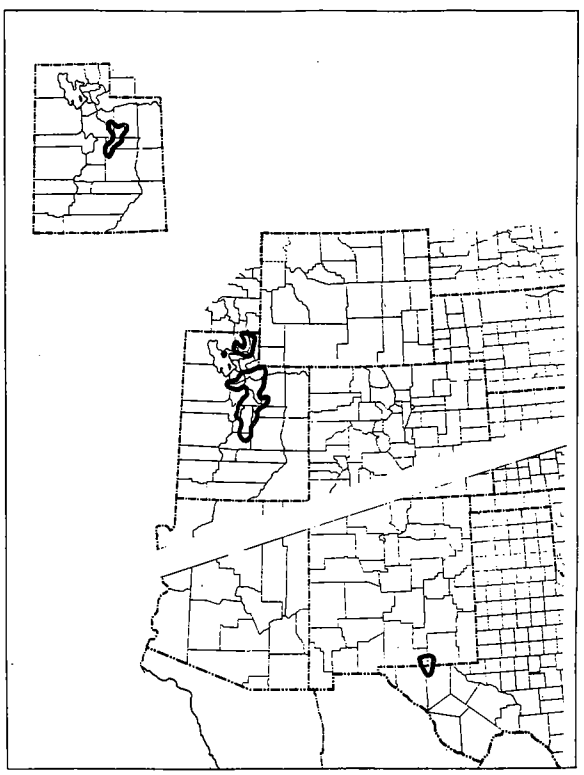

Figure 17.--Range of Chrysothamnus nauseosus ssp. psilocarpus (upper left); range of C.n. ssp. salicifolius (middle map); range of C.n. ssp. texensis (lower map).

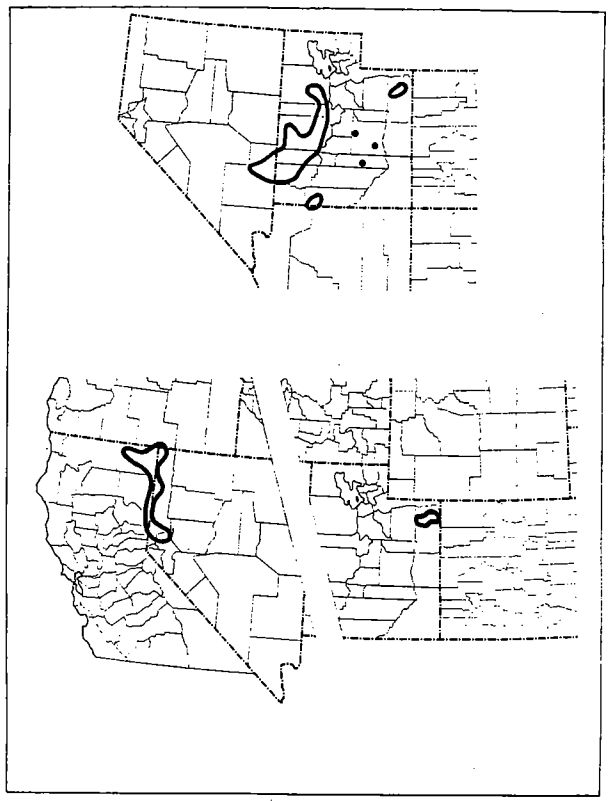

Figure 18.--Range of Chrysothamnus nauseosus ssp. turbinatus (upper map); range of C.n. ssp. uintahensis (lower right); range of C.n. ssp. washoensis (lower left).

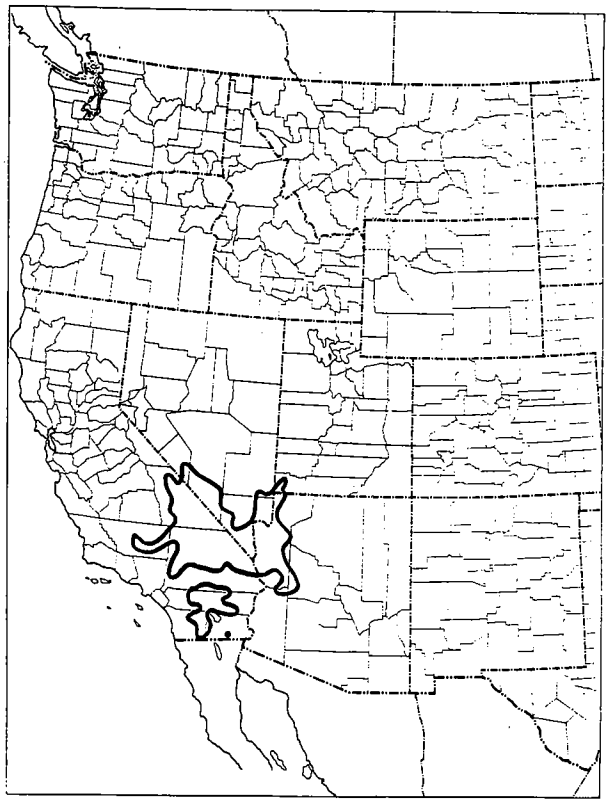

Figure 19.--Range of Chrysothamnus paniculatus.

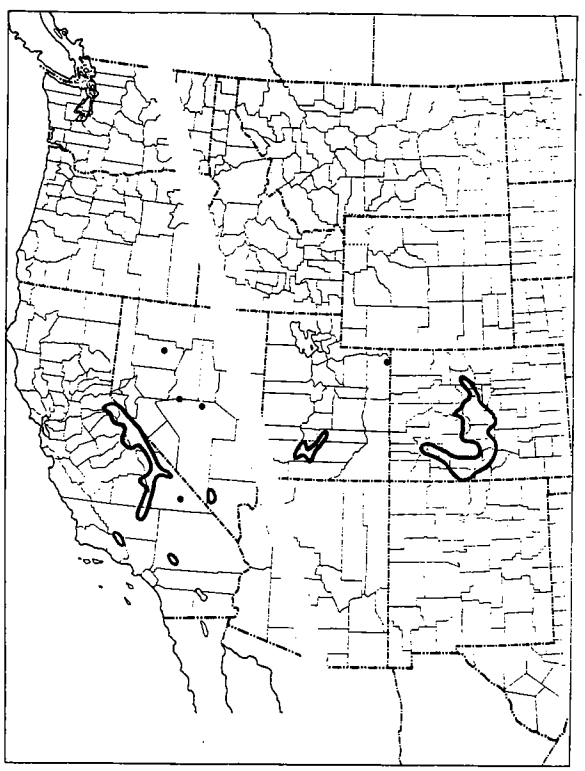

Figure 20.--Range of Chrysothamnus parryi ssp. affinis (right map); range of C.p. ssp. asper (left map).

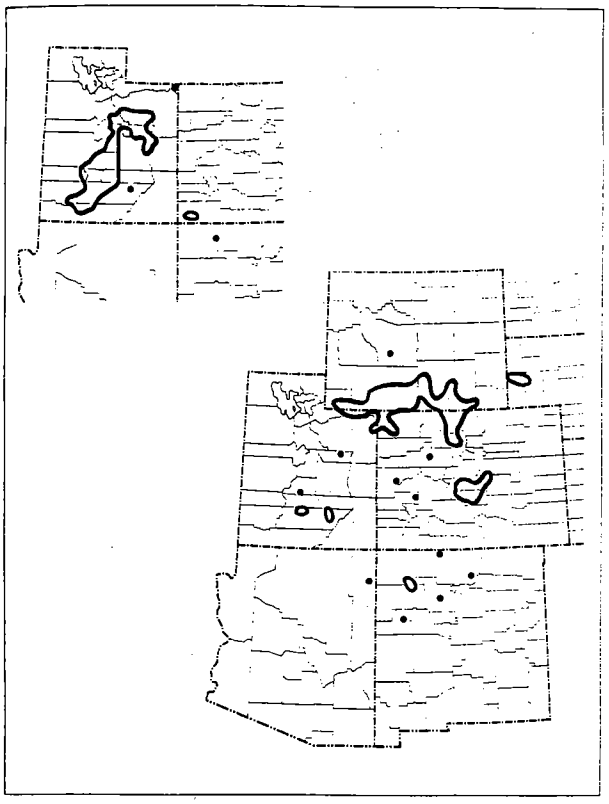

Figure 21.--Range of Chrysothamnus parryi ssp. attenuatus (upper left map); range of C.p. ssp. howardii (lower right map).

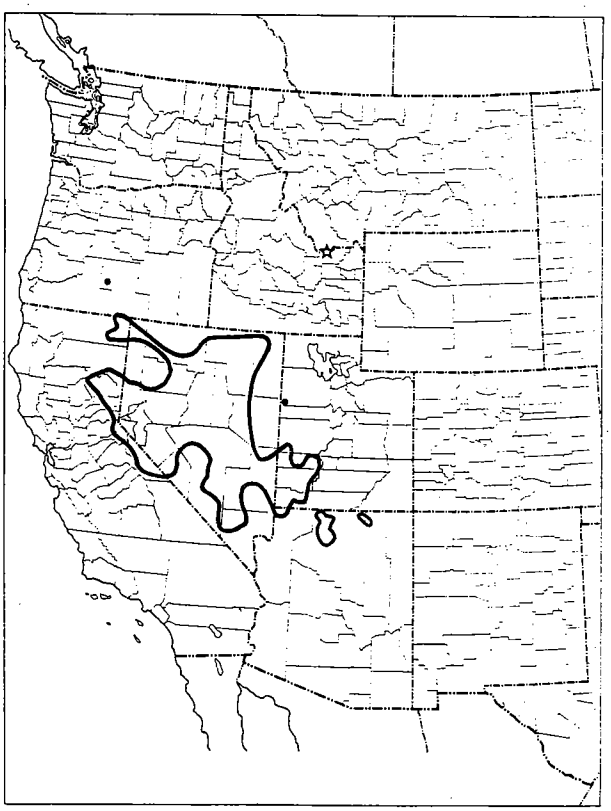

Figure 23.--Range of Chrysothamnus parryi ssp. montanus (star); range of C.p. ssp. nevadensis (dots and loops).

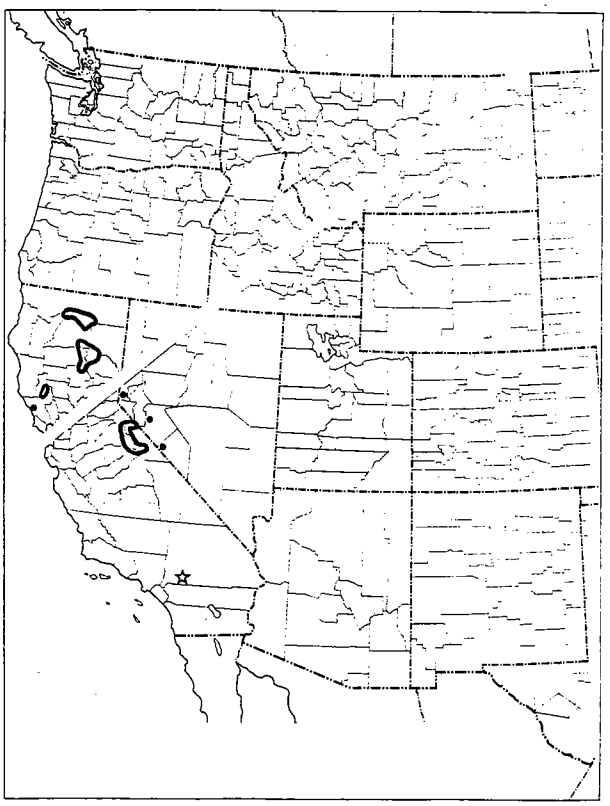

Figure 22.--Range of Chrysothamnus parryi ssp. imulus (star, lower map); range of C.p. ssp. latior (upper map); range of C.p. ssp. monocephalus (dots and loop, lower map).

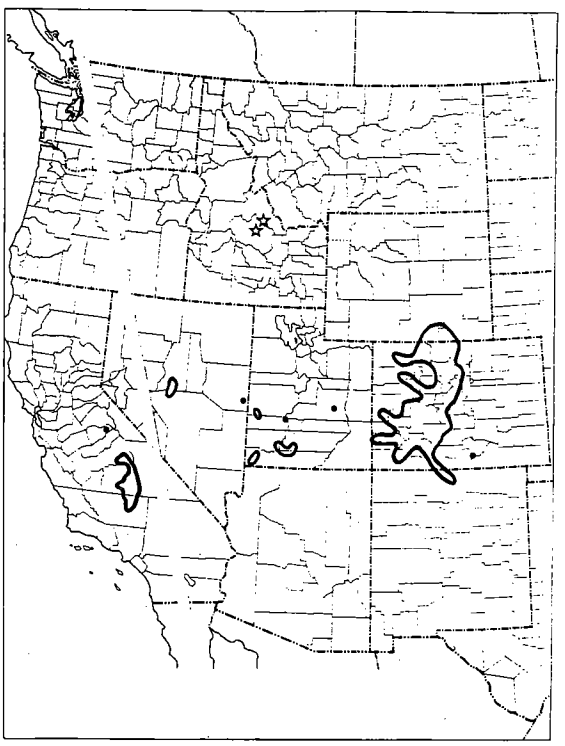

Figure 24.--Range of Chrysothamnus parryi ssp. parryi (dots and loops, right map); range of C.p. ssp. salmonensis (stars, right map); range of C.p. ssp. vulcanicus (left map).

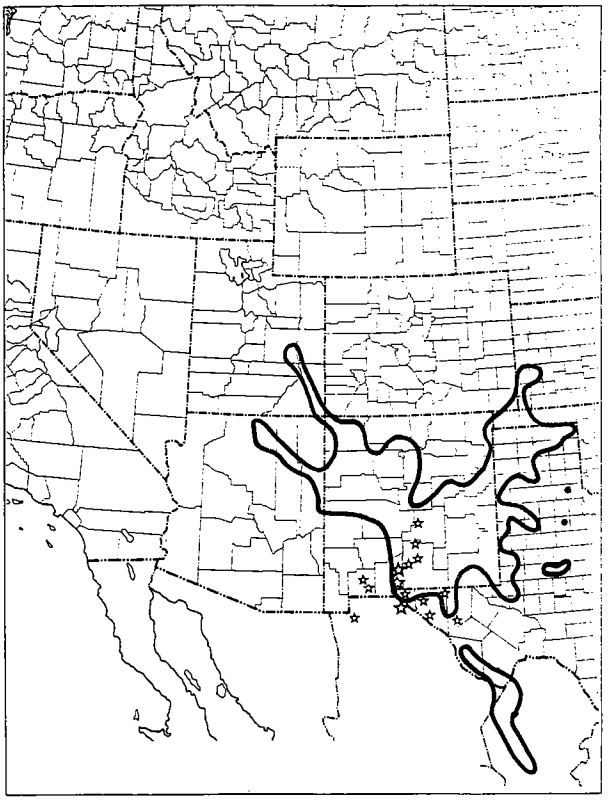

Figure 25.--Range of Chrysothamnus pulchellus ssp. baileyi (dots and loops); range of C.p. ssp. pulchellus (stars).

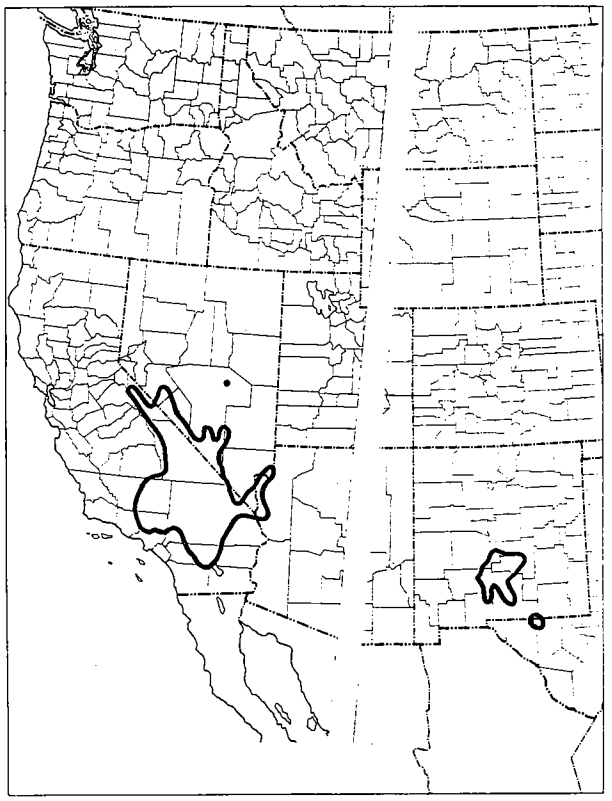

Figure 26.--Range of Chrysothamnus spathulatus (right map); range of C. teretifolius (left map).

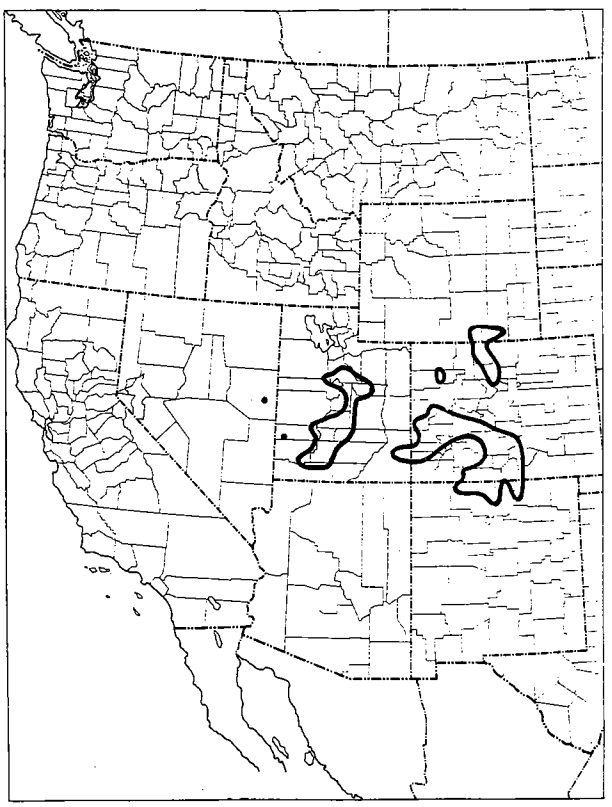

Figure 27.--Range of Chrysothamnus vaseyi.

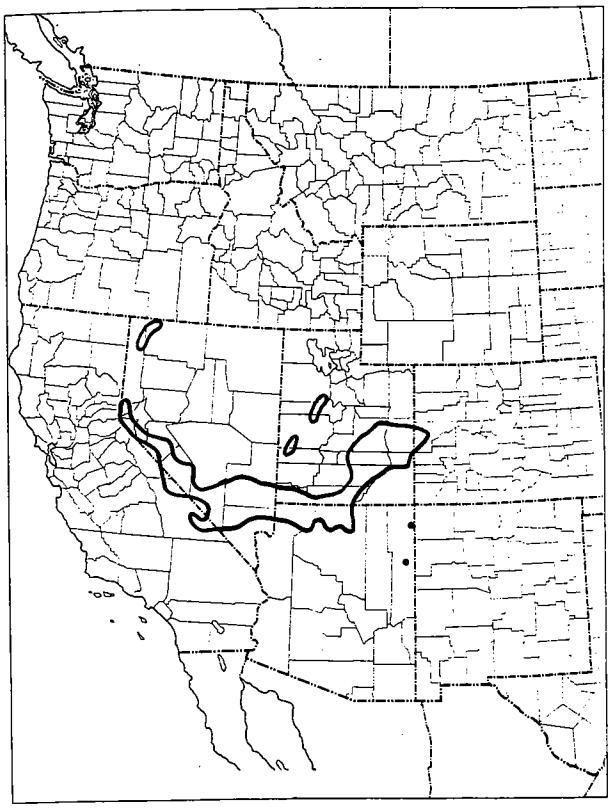

Figure 28.--Range of Chrysothamnus viscidiflorus ssp. axillaris.

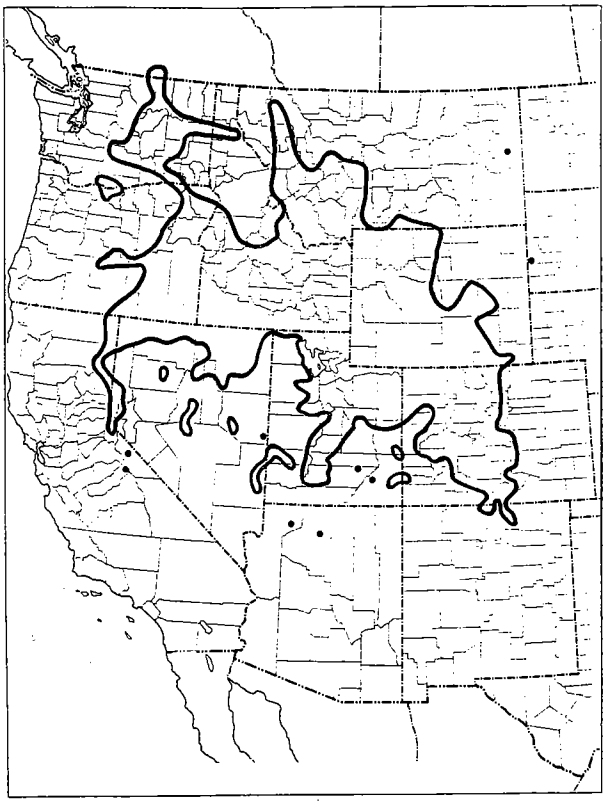

Figure 29.--Range of Chrysothamnus viscidiflorus ssp. lanceolatus.

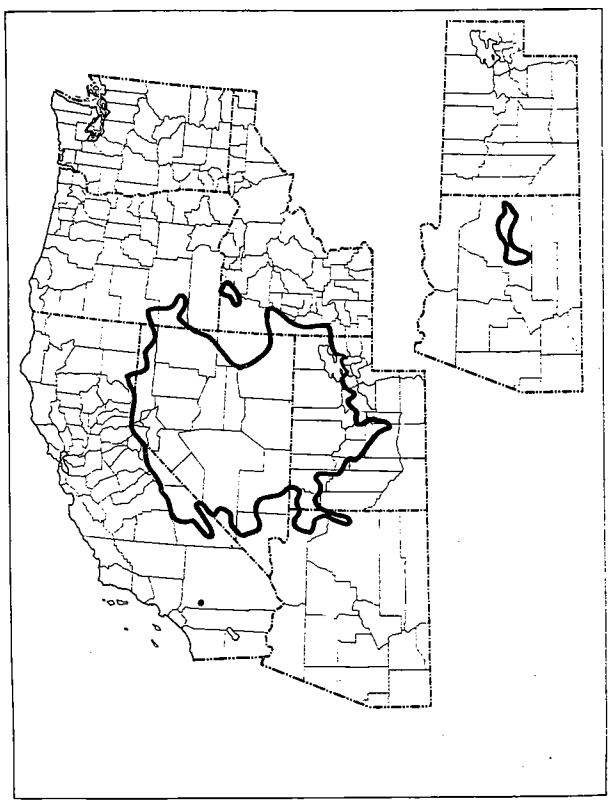

Figure 30.--Range of Chrysothamnus viscidiflorus ssp. planifolius (upper right map); range of C.v. ssp. puberulus (lower left map).

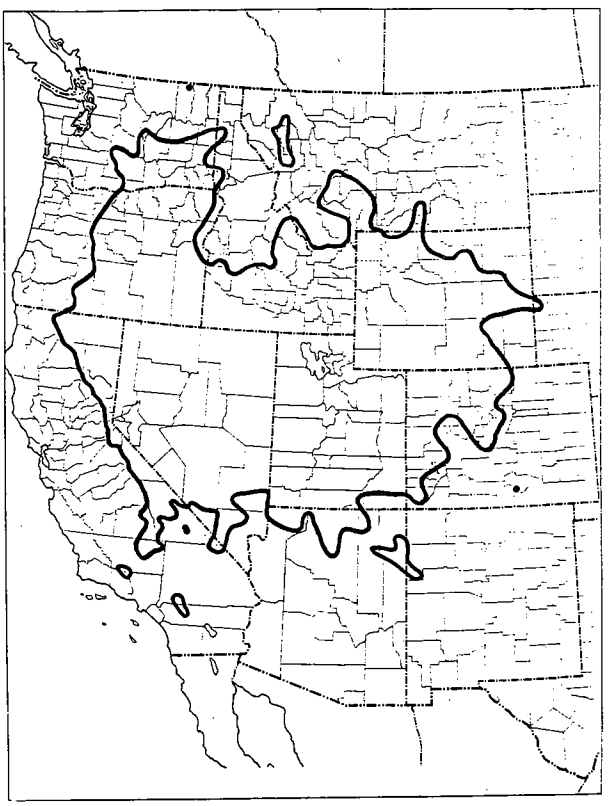

Figure 31.--Range of Chrysothamnus viscidiflorus ssp. viscidiflorus.