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A Study Of The Genus Potentilla In New Mexico

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A STUDY OF THE GENUS *POTENTILLA* IN NEW MEXICO

By

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Submitted in Partial Fulfillment of the
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in the Graduate School of
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ABSTRACT OF THESIS

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ABSTRACT

Studies of collections of Potentilla which I made during the summer of 1969, and from collections in The University of New Mexico Herbarium indicate that there are 24 species of Potentilla in New Mexico. These are: P. fruticosa L., P. arguta Pursh, P. fissa Nutt., P. glandulosa Lindl., P. thurberi A. Gray (and 1 variety), P. anserina L. (and 1 variety), P. pennsylvanica L., P. plattensis Nutt., P. crinita A. Gray (and 1 variety), P. pulcherrima Lehm. (and 1 variety), P. ambigens Greene, P. hippiana Lehm. (and 1 variety), P. diversifolia Lehm., P. sierrae-blancae Wooton and Rydb., P. bicrenata Rydb., P. subviscosa Greene, P. concinnaeformis Rydb., P. grayi Wats., P. sibbaldii Hall, P. oblanceolata Rydb., P. concinna Richards, P. rivalis Nutt. (and 1 variety), P. norvegica L., and P. paradoxa Nutt.

These taxa are treated systematically and probable relationships among them are discussed. Variability within the genus is apparently very great. The distribution of each species is given and a taxonomic key for identification of New Mexico specimens is included. Chromosome counts are given for those species for which they are known. The existence of certain taxa as distinct entities is questioned.

Proposed methods for further study of the genus are mentioned as a means by which problem species and their questionable relationships might better be understood.

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INTRODUCTION AND REVIEW OF THE GENUS *POTENTILLA*

The genus *Potentilla* is a large complex group in the tribe Potentilleae of the family Rosaceae. It includes from 200-300 described species distributed in temperate to subarctic habitats throughout the world. The number of taxa is variable depending on the treatment of the various taxonomists who often disagree as to what should be included.

Certain segregates such as *Horkelia*, *Ivesia*, *Sibbaldia*, *Argentina*, *Dasiphora*, *Drymocallis*, *Comarum*, *Purpusia* and others have all been described as separate genera of the Rosaceae or as sections or subgenera of *Potentilla* and have been shifted in and out of the genus from time to time. The type upon which the genus is based is *Potentilla reptans* L. which in *Genera Plantarum* is based on Tournefort's genus *Quinquefolium*.

The genus has undergone several revisions since the 1800's beginning with a monograph by Nestler in 1816. Another by Lehman followed in 1820 and still another by Seringe in 1825. Lehman again revised his monograph in 1856. Other major contributors of the same period include Bentham and Hooker in 1833 with their *Flora Boreali Americana* and, in 1840, Torrey and Gray contributed their *Flora of North America*. Gray wrote a monograph of the genus in 1865, followed by another from Watson in 1873, and another by Rydberg in 1898 which he revised in 1908. In addition, Wolf again monographed the genus in 1908.

Many other individuals have worked with the genus either extensively or with certain sections or species, and have all contributed to the understanding of this genus.

Most of the studies to the 1930's have been of a classical nature with morphology as the major criterion used in species determination. Sometimes only a scant description of a rare or questionable species exists and nothing new has been done to verify its existence. Such descriptions have been repeated with slight modifications from one publication to the next. It is not uncommon for several descriptions to fit more than the species it was intended for or for one description to fit several species. It is also evident that the various authors see different characteristics as more or less important in species delimitation as well as observing differences in expression of the same characteristic in the same species. Even in recent taxonomic keys it is not unusual to find complete contradictions in specific characteristics or characters used in species separation. This well illustrates the variability which exists.

Among the most prolific authors of species of Potentilla was Rydberg who, in addition to his monograph, continued to write notes on Potentilla throughout his lifetime. He often changed his ideas on certain species to the extent that new synonyms were created for species which already had been treated under a variety of combinations.

Within the genus the synonomy of many species is often chaotic but this serves to illustrate the complexity of variability within the genus. Many of the described species possibly do not exist as distinct entities and many treated as such might better be treated as regional or ecological races or varieties, or at most subspecies.

Some cytological work has been done with various potentillas since the early 1900's and chromosome counts have been determined for many species. Although this has been helpful in distinguishing between certain taxa, it has been equally confusing in the delimitation of others. In some sections the 2n number is constant for all species throughout their range. Others are extremely variable even within the same species, particularly in apomictic types. Differences have been found where diploids and polyploids occur within the same species from different geographical areas yet they are morphologically similar, Bowden (1957). For at least some species differences in the 2n number are found in individuals from different elevations. Those members from lower elevations may have higher 2n counts than those from higher elevations. The converse has also been found to be true of other species. This again illustrates the extreme variability within the genus.

Keck's Revision of Horkelia and Ivesia of 1939 removed a substantial number of species from the genus Potentilla, and subsequent work by Clausen, Keck and

Hiesey (1940) has reduced the number of species in the section Drymocallis and in the section Graciles by assigning some of them subspecific rank and by formation of new combinations of specific epithets. Although their work has not been of a purely taxonomic nature, it has shed some light on the effect of environment on morphology, on relationships between species within a section, and has shown that variability is often so extreme within a species to the extent that some characteristics used in species identification are too variable to be of any taxonomic value.

At present the genus Potentilla needs a revision based on long term studies and involving improved methods of evaluation of all characteristics which might be significant. Positive identification of closely related and questionable species needs to be made. Undoubtedly, combining techniques borrowed from biochemistry, physiology, genetics and ecology would help one to better understand the mechanisms involved in the variability of expression of a number of morphological characters. Also, through use of numerical analysis, a large number of characteristics could be used and a less biased comparison made to determine relationships which are significant.

Presently the genus Potentilla is of little interest to taxonomists, and no major taxonomic work has recently appeared in the literature. This study is purely systematic with the objectives of determining which

species of Potentilla occur in New Mexico, their distribution, their identification, and their relationships.

Final decisions regarding the identification of the specimens were made after consulting the available descriptions and taxonomic keys which might fit the specimens observed. Original descriptions were consulted whenever available.

Because so much of my reading included Rydberg's work, my ideas may show a bias toward his views, although I have tried to be objective and see contradictions which exist.

RANGE OF THE GENUS AND ITS ECONOMIC VALUE

Members of the genus Potentilla occupy varied habitats throughout their range but are principally montane. They are common to high mountains and alpine zones and are found throughout the temperate regions of the northern hemisphere, extending into arctic regions including Greenland, the Aleutian Islands, the islands of the Bering Sea, and north to the N slope of Brooks Range. Members are also known from high mountainous regions through Central America and into the tropical latitudes of South America. Few species are strictly lowland types and others are found from sea level to over 3,000 m. None are confined to strictly xeric habitats although some may occur through the southwestern United States and Mexico in relatively dry arid zones. Some forms are strictly confined to the high or colder regions of the world, being found on mountain peaks of Europe, Asia and North America.

The members of the genus Potentilla have relatively little economic value, although the roots of P. anserina have been used as an article of food in some parts of the world. The roots of P. palustre and P. tormentilla have been used for tanning and dying, and those of P. anserina and P. erecta have been used for their supposed medicinal powers, Rydberg (1898). In fact the genus name is derived from the supposed strong medicinal powers which some taxa were believed to possess. The leaves of P. fruticosa have been used as a substitute for tea, Harrington (1967).

MATERIALS AND METHODS

A total of 2,157 specimens were collected from early June, 1969, through late September, 1969, at locations in southwestern, central, and northern New Mexico. Another 238 specimens in The University of New Mexico Herbarium were also examined for this study. These include some specimens from Arizona, Colorado, and a few from California which were helpful in describing several species when only a few New Mexico specimens were available. Four New Mexico species were not available for study and their descriptions are based on those given in the literature.

Collection areas were chosen from known sites where collections previously had been made, as determined by specimens in The University of New Mexico Herbarium, as well as by localities given in Wooten and Standley (1915). Although it was not possible to cover all previously determined sites, several new ones were visited.

Specimens were collected at random in an attempt to obtain plants in different stages of development. These were examined in the field as well as in the herbarium. Observations and quantitative measurements of various structures were made and recorded. Characteristics were observed using a 10x and 20x hand lens as well as 10x and 20x binocular dissecting scope. Characteristics noted in the specimens were then compared to those given in the various taxonomic keys and descriptions consulted.

Final decisions were based on a combination of characters which appear most frequently in the keys used, although some are often contradictory or very skimpy.

The following structures were examined in various degrees of detail depending on the emphasis given to them in keys and descriptions. Their usefulness is annotated below:

Vegetative parts.

1. Roots - Useful in separating annuals and biennials from perennials. Perennials generally have thick, woody spreading roots giving rise to stems from the crown; annuals usually have a taproot which is seldom branched.
2. Stolons - The ability or lack of ability to produce roots at the nodes is a good means of separating several species of Potentilla. P. anserina always produces stolons in our types. P. glandulosa and some of its varieties as well as P. fissa lack stolons in our plants but have the potential to do so, as evident in descriptions of these species.
3. Leaf types - Primarily of value in separating large numbers of unrelated species in at least two groups, pinnate forms and digitate forms, although some are intermediate in this respect. Leaflet number, type and the degree of pubescence, type of margin, tooth pattern, shape, size of

leaflet, presence or absence of glands are all important characteristics and often are distinct in some members and quite variable in others.

4. Stems - The growth habit is constant in some, variable in most. Stem height does allow separation of types which are consistently tall from those that are consistently short, although some may be inconsistent in their height. Pigmentation, presence or absence of glands, type of pubescence, degree to which pubescence exists appear to be constant in few, variable in most.

Reproductive parts.

1. Calyx - Number of sepals and bractlets are constant at five in all potentillas, but their relative size to one another or when compared to petal length is often a good characteristic. Shape is variable sometimes within the same plant. A glandular condition of the calyx or the receptacle appears to be constant in some forms and is helpful in separating these from nonglandular types.
2. Corolla - Petal color is useful in separating several potentillas. Potentilla thurberi and its variety are the only potentillas in New Mexico with red petals, P. arguta is the only potentilla in New Mexico with white petals and P. fissa and P. glandulosa may have cream

colored petals. Petal shape is not a good characteristic for separating most potentillas, although with some forms it may be helpful when other characteristics are similar.

3. Pistils - Relative number, or abundance, is a good characteristic in separating forms with few pistils from forms with many.
4. Styles - Relative length as compared to the achene, whether filiform or thickened at the base and whether persistent or early deciduous, is often important in separating some types but variable in others.
5. Anthers - Shape is a good characteristic for separating certain taxa when other characteristics are similar. A few species have rounded or flat anthers. In other species they are ovate. Their size is similar in most but it is a good characteristic for separation of forms with either large or small anthers. Color is a good characteristic only in members with red anthers since all others are yellow.
6. Achenes - These are often very similar but their comparative size, abundance, and characteristic markings are useful. Pubescence or position of style attachment are often distinct characteristics at least for some members.

Because of the great degree of variability seen

within members of the genus, emphasis on the discussed structures as criteria for classification has been varied from one author to the next. The weight placed on the value of any one characteristic over another depends on the frequency with which it appears in different keys. When the same characteristic appeared regularly from one key to another it was considered important. I have attempted to consider all characteristics important either individually or when in combination with some that are more distinct.

The most useful references used in this study have been the following: Bulletin of the Torrey Botanical Club, mostly issues through 1922, publications of the Carnegie Institute (1940, 1958), contributions to the U. S. National Herbarium, mostly issues through 1925. The most useful keys are those by: Harrington (1964), Kearney and Peebles (1941-1964), Tidestrom (1941), Wooton and Standley (1915), Rydberg (1898, 1906, 1908, 1922), Jepson (1957), Coulter and Nelson (1909), Gray, A., Eighth Edition by M. L. Fernald (1950), and Munz (1959).

DESCRIPTION OF THE GENUS *POTENTILLA* IN NEW MEXICO

Potentilla L. Sp. Pl. 495. 1753.

Tormentilla L.; *Quinquefolium* (Tourn.); *Pentaphyllum* Gaertn.; *Dactophyllum* Spenn.; *Potentillopsis* Opiz.; *Chamaephyton* Fourr.; *Dynamidium* Fourr.; *Hypargyrium* Fourr.; *Callionia* Greene.

Plants principally herbaceous perennials, sometimes annuals or biennials, one species a shrub with shreddy bark; roots slender to thick, taproots or scaly branched rhizomes; the crown often covered with remnants of broad thin stipular portions of basal leaves; stems few to many, from almost nonexistent to 3 cm to 1.5 mm high, stout or slender, erect, ascending, decumbent or prostrate, sometimes stoloniferous, many or few-leaved, glabrous, glabrate, or variously pubescent, sometimes striate, occasionally glandular, green, brown or anthocyanose, branched above or below, sometimes diffuse, occasionally scapose or sub-scapose; basal and cauline leaves usually present, the former larger, more numerous and longer petioled, the latter often reduced, shorter petioled, both with stipular bases, three-to-many-foliolate, digitate, pinnate; leaflets usually short-stalked or sessile, sometimes decurrent or confluent, one member with a long-stalked terminal leaflet, variable in size, shape, pubescence, and with margins various; the inflorescence cymose, flowers seldom solitary; pedicels usually thin and long, sometimes short and thick; calyx persistent, of five

sepals alternating with five bractlets; the receptacle generally hairy; petals usually five, yellow, red, purple, or white, from longer than to shorter than the sepals, variable in size and shape; stamens 10-30, seldom fewer or more, on filiform filaments, 1-3 mm long, inserted at the margin of the hypanthium or at the base of the receptacle; anthers yellow or red, usually ovoid, sometimes round flattened-ovoid or cordate, usually not exceeding 1 mm in largest dimensions; carpels few to many; styles terminal or nearly so, or basal, thin-filiform, conical, fusiform or short-filiform, sometimes thickened at the base, seldom longer than 2 mm, usually deciduous but somewhat persistent in some; achenes few to many, smooth, mostly glabrous occasionally silky-villous or lightly ciliate along the ventral margin, rugose, striate or at least with noticeable reticulate venation, 0.2-2.0 mm long.

KEY TO THE NEW MEXICO SPECIES OF *POTENTILLA*

1. Plants shrubby; stems woody with shredding bark; flowers yellow; achenes hairy; leaves pinnate..... *P. fruticosa*.
1. Plants herbaceous; stems not woody; flowers yellow, white or red; achenes usually glabrous, occasionally ciliate; leaves digitate or pinnate..... 2.
2. Plants perennial; stems not usually leafy..... 3.
2. Plants annual or biennial or short-lived perennials; stems usually leafy..... 29.
3. Basal leaves pinnate; petals yellow or white..... 4.
3. Basal leaves digitate; petals yellow or red..... 7.
4. Style attached near the base of the achene..... 5.
4. Style attached from near the apex, or laterally on the achene..... 9.
5. Petals white; stems never bearing stolons... *P. arguta*.
5. Petals yellow or cream colored; stems sometimes bearing stolons..... 6.
6. Petals cream colored; leaflets usually 9-11 (occasionally 13); leaves shaggy-villous to hirsute..... *P. fissa*.
6. Petals yellow; leaflets 5-9 (occasionally 11); leaves sparingly villous..... *P. glandulosa*.
7. Petals red; leaves digitately 5-to 7-foliolate..... 8.
7. Petals yellow; leaves digitately 3-to 7-foliolate, sometimes sub-pinnate..... 18.

8. Leaflets green-glabrate above, sometimes sericeous below..... P. thurberi.

8. Leaflets silvery-sericeous above, silky to tomentose below..... P. thurberi var. atrorubens.

9. Plants prostrate, stoloniferous; flowers solitary; achenes corky, grooved..... 10.

9. Plants erect to ascending, not stoloniferous; flowers usually cymose; achenes not corky or grooved..... 11.

10. Leaves green glabrate to silky above, white to silvery-silky below..... P. anserina.

10. Leaves about equally white or silvery on both surfaces..... P. anserina var. concolor.

11. Leaves deeply cleft to pinnatifid, the divisions linear to linear-oblong..... 12.

11. Leaves not as above, variously toothed..... 13.

12. Styles thickened at their base, usually smaller than the mature achene..... P. pennsylvanica.

12. Styles filiform, not thickened at their base, equal to or longer than the mature achene.... P. plattensis.

13. Achenes ciliate at their base; leaflets toothed from above the middle..... 14.

13. Achenes glabrous; leaflets usually toothed below the middle..... 15.

14. Leaflets conduplicate, toothed above the middle..... P. crinita.

14. Leaflets flat, toothed only at the apex, occasionally entire..... *P. crinita* var. *lemmonii*.
15. Basal leaves 5-to 9-foliolate, sometimes digitately sub-pinnate; anthers usually at least 1 mm long..... *P. pulcherrima*.
15. Leaves 7-to 15-foliolate, always definitely pinnate, at least (the upper pair of leaflets decurrent on the rachis); anthers usually less than 1 mm long..... 16.
16. Stems and the leaf rachis villous-hirsute; leaflets about equally green on both surfaces, but villous at least along the veins below..... *P. ambigens*.
16. Stems and the leaf rachis not as above; leaflets not equally green on both surfaces, silvery to white tomentose below..... 17.
17. Leaflets greener above, usually lightly silky, tomentose below..... *P. hippiana* var. *diffusa*.
17. Leaflets similar in color on both surfaces, silky above sometimes densely so, silky to tomentose below..... *P. hippiana*.
18. Stems at least 30 cm tall, usually 50-60 cm..... 19.
18. Stems short, seldom taller than 30 cm..... 23.
19. Glandular pubescence present at least on the calyx, or the herbage weakly glandular throughout..... *P. pulcherrima* var. *filipes*.
19. Glandular pubescence not present..... 20.

20. Anthers ovate, 1 mm long..... P. pulcherrima.
20. Anthers round, 0.5 mm..... P. diversifolia.
21. Plants glabrous throughout; leaflets toothed only at the apex..... P. sierrae-blancae.
21. Plants pubescent; leaflets usually toothed below the apex (except P. bicrenata and P. sibbaldii)... 24.
22. Leaflets narrowly oblong-cuneate to linear, few-toothed at their tips (achenes smooth, minute).... ..... P. bicrenata.
22. Leaflets not as above, not toothed at the tip, or if so, then the apex truncate..... 23.
23. Herbage, or at least at the receptacle, glandular..... 24.
23. Herbage not glandular..... 25.
24. Leaflets 5, obovate-cuneate, deeply cleft into oblong divisions..... P. subviscosa.
24. Leaflets 5-7, obovate to oblong-obovate, not cleft, serrate..... P. concinnaeformis.
25. Anthers round or nearly so, 0.5 mm long; styles filiform..... 26.
25. Anthers ovate; styles filiform or thickened at their base..... 27.
26. Styles about 2 mm long attached to the apex of the achene; leaves digitate, sub-pinnate, 5-to 7-foliolate..... P. diversifolia.

26. Styles about 1 mm long, attached below the apex of the achene; leaves 3-foliolate (leaflets fan-shaped; the middle leaflet long-stalked)..... ..... P. grayi.

27. Stamens fewer than 10; styles laterally attached to the achene; leaves three-toothed at their tips (truncate tips)..... P. sibbaldii.

27. Stamens more than 10; styles terminal on the achene, not toothed as above..... 28.

28. Leaflets usually 3-5, narrowly oblanceolate, with small narrow upwardly directed teeth..... ..... P. oblanceolata.

28. Leaflets usually 5, occasionally 7 obovate-cuneate, the teeth usually not directed upward..... ..... P. concinna.

29. Stems and foliage somewhat glandular pubescent.... 30.

29. Stems and foliage not glandular pubescent..... 31.

30. Basal leaves 3-to 5-foliolate..... P. rivalis.

30. Basal leaves all 3-foliolate..... ..... P. rivalis var. millegrana.

31. Basal leaves digitately 3-foliolate; leaflets obovate-serrate..... P. norvegica.

31. Basal leaves pinnate; leaflets not as above..... 32.

32. Achenes with a prominent enlargement along the ventral surface; leaves 8-to 10-foliolate..... ..... P. paradoxa.

32. Achenes not as above; leaves 3-foliolate (the middle leaflet long-stalked)..... *P. grayi*.

DESCRIPTION AND DISCUSSION OF THE SPECIES

Potentilla fruticosa L. Sp. Pl. 495. 1753.

Dasiphora fruticosa (L.) Rydb.

Plants shrubby, perennial; stems freely branched, woody, the younger stems slightly pubescent, the older ones with brown shredding bark; leaves pinnate, 3-to 7-foliolate, the petioles 0.5-2.0 cm long; leaflets linear to narrow-oblong, 1.2-3.5 cm long, 0.1-1.0 cm wide, entire, sometimes with ciliate margins, green-silky above, whitish-tomentose beneath, sometimes revolute in linear forms and with mucronate tips in broader forms; flowers solitary or in clusters; petals yellow, 5 or rarely 10, orbicular or nearly so, 0.5-1.4 cm long, 0.5-1.3 cm wide; receptacle hairy; sepals hairy, ovate, acute to acuminate, about one-half as long as the petals; bractlets linear, usually longer than the sepals; pistils numerous; styles thin-filiform; achenes numerous, small, densely hairy, 0.6 mm long, 0.2 mm wide.

Type locality: England; exact locality unknown.

Distribution: From Labrador to Alaska ranging southward to New Jersey, California, New Mexico, Colorado, Arizona, Utah, and Nevada. Also in Siberia and Western Europe.

New Mexico: Mountains; southwestern to northeastern and northwestern 6,000-11,500 ft., Chama, Cimarron Canyon, Eagle Nest, Wheeler Peak, Mt. Taylor, Catskill, Santa Fe, Las Vegas, Mogollon, Sandia, Jemez, Chuska, San Pedro, and

Magdalena Mountains.

This species is commonly known as shrubby cinquefoil and is remarkably constant in its characteristics. In higher or more northerly, drier areas it is often stunted throughout in contrast to its condition when found in lower areas near streams. The differences are so few that varietal distinctions, in the taxonomic sense, may not be warranted. Descriptions of known varieties, P. fruticosa var. tenuifolia (Wild) and P. fruticosa var. monticola (Rydberg, 1897) resemble at least in part those specimens with small linear, revolute leaflets collected in the Mogollon Mountains. Specimens from northern New Mexico, Wheeler Peak and Pecos Wilderness Area resemble Rydberg's description of P. fruticosa var. grandiflora Lehm.

The cytotaxonomy of this species has been reported on by Bowden (1957), showing that European species are tetraploid 2n = 28, North American forms diploid 2n = 14 and that some Asiatic types form a polyploid complex consisting of diploids, one triploid (2n = 21) and various hexaploids (2n = 42). Minute morphological differences do exist and some of these are possibly associated with differences in chromosome number. Differences noticed in New Mexico specimens are possibly environmental.

This species apparently has some forage value since browsing damage was evident in many instances. Members of the species are sometimes cultivated and the leaves have been known to have been used as a substitute for tea,

Harrington (1967). Flowering occurs from May through September.

Potentilla arguta Pursh Fl. Amer. Sept. 2: 736. 1814.

P. arguta Pursh ssp. typica Keck.

Drymocallis agrimonioides (Pursh) Rydb.

Perennial, with a thick, stout, almost woody root covered with brown, papery, dead leaf bases; stem stout, erect, 40-90 cm high, 4 mm in diameter, weakly hirsute on lower part, more densely pubescent and somewhat glandular above, striate; basal leaves pinnate, reaching a length of 40 cm from base of petiole to tip of middle leaflet, sometimes with rudimentary leaflets interspersed; sheathing stipular bases broad, 5 mm wide, 6-8 cm long; rachis moderately hirsute; leaflets 7-13 with doubly serrate margins and brown tips, both surfaces green but weakly to moderately pubescent and noticeably veined, the lower pairs appear alternate, ovate to obovate, decreasing in size from apex to the base, the upper 3 larger, more rhomboid than the lower ones, the middle leaflet 5-6 cm long, 3-3.5 mm wide; stem leaves few, short-petioled with doubly serrate margins and acute tips, similar to basal leaves; the inflorescence a dense cyme; flowers numerous; corolla white, 2.5-3.0 cm in diameter; petals 5, 1-1.5 cm long, 5-7 mm wide, broad-orbicular to obovate, only slightly longer than the sepals; sepals 5, ovate-acute, 1.0 cm long, 0.4 cm wide; bractlets linear-lanceolate, slightly smaller than the sepals; receptacle

moderately to densely hairy both inside and out; stamens 20-25, filaments 4 mm long, styles thin, spindle-shaped, somewhat persistent on the achenes, 0.7-1.0 mm long; achenes smooth, ovoid, brown, 1.0-1.2 mm long, 0.5-0.8 mm wide.

Type locality: On the banks of the Susquehanna, Pennsylvania.

Distribution: New Brunswick to New Jersey, westward to Oklahoma, Colorado and northern New Mexico to about the continental divide, northward to Mackenzie (Slave Lake and Fort Simpson).

New Mexico: Mountains of northern New Mexico, 6,500-9,500 ft.; near Cuba, Hondo Canyon, Johnson Mesa, Sugarette Canyon, Sierra Grande, and the Santa Fe and Las Vegas Mountains.

The described species does not completely fit any described members of the section Drymocallis without stolons in that the specimens may have as many as 13 leaflets. It best fits the description given by Clausen, Keck, and Hiesey (1940) and Rydberg (1908). It may be an intermediate form between P. fissa which is stoloniferous and occasionally has 13 leaflets and P. arguta which is without stolons. These species are known to occur sympatrically and intermediates have been reported by Clausen, Keck, and Hiesey (1940). Its New Mexico distribution as shown by Clausen, Keck, and Hiesey (1940) also is similar to localities where specimens have been collected. In the same work cited and subsequent work by

Clausen and Hiesey (1958) has aided in understanding relationships between members of Drymocallis, particularly the P. arguta, P. glandulosa, and P. fissa complex. Their experiments included environmental studies, through transplant experiments at different elevations, (near sea level to over 10,000 ft. elevation) in California from the Pacific Coast Range through the San Joaquin Valley, the Sierra Nevada Range and into the Great Basin at Benton, Mono County. Additional studies in hybridization, clonal systems and cytogenetics, followed by statistical analyses of data gathered. They determined that all twenty-eight species described by Rydberg (1908) could be treated as 3 taxonomic species, P. arguta, P. fissa and P. glandulosa. They did, however, recognize 2 subspecies of P. arguta, 11 subspecies of P. glandulosa, and none for P. fissa. They also determined all members to be diploid with n = 7, yet variable enough to differ morphologically and physiologically and thereby together occupy varied habitats which almost entirely encircle the Northern Hemisphere. P. arguta, in its range, occurs in flower from June through August in mountain valleys and meadows. Potentilla fissa (Nutt.) Torr. and Gray. Fl. N. Amer. 1: 446. 1840.

P. scopulorum Greene.

P. glandulosa var. fissa Wolf.

Plants perennial; stems several, stout, sometimes striate, leafy, branched, brown-hirsute, glandular,

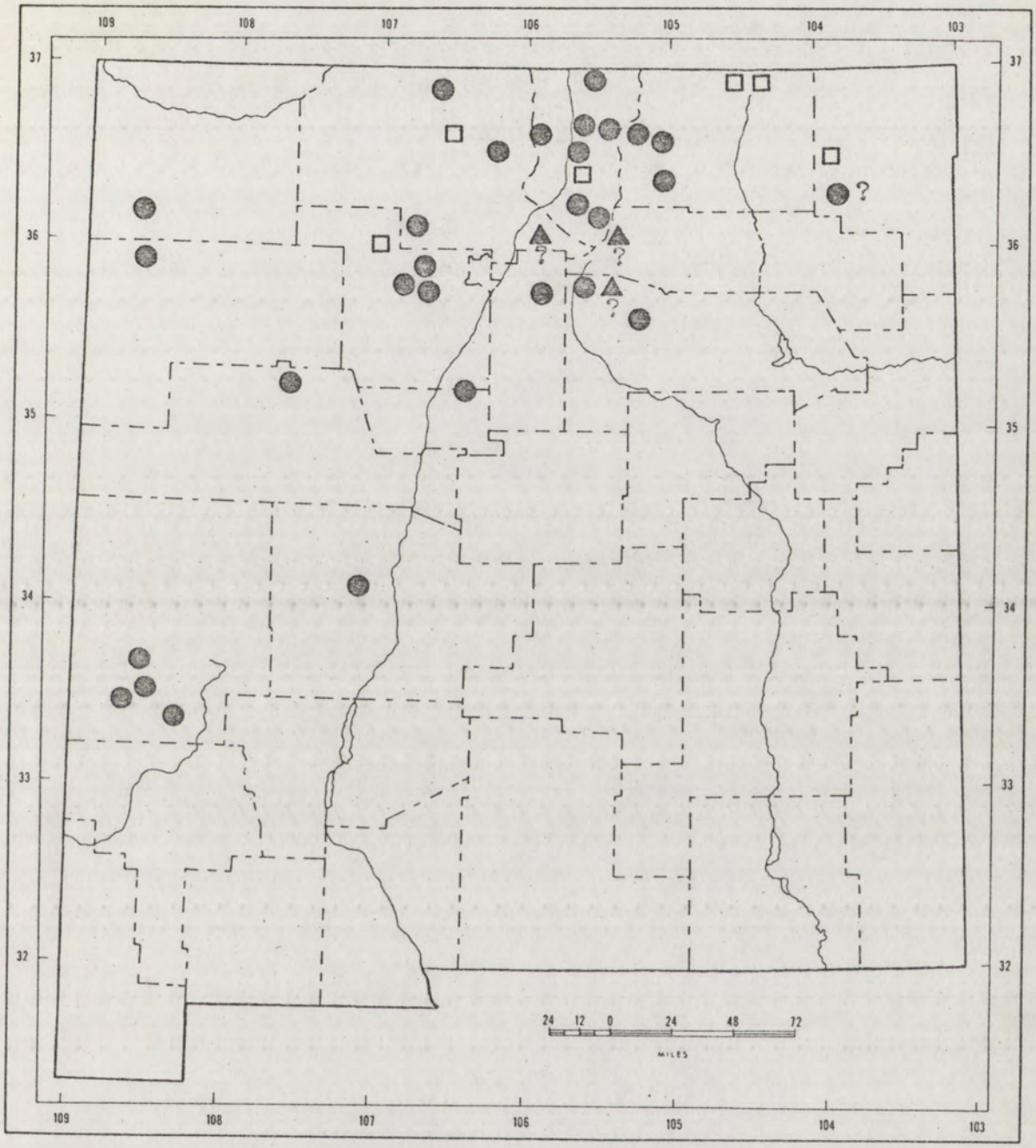
sometimes anthocyanous, 15-30 cm tall, arising from long, slender stolons; all leaves pinnate, 9-11 or occasionally 13-foliolate, short-petioled; leaflets wedge-shaped to orbicular, strongly veined, green and slightly hairy on both surfaces or sub-glabrous above, doubly serrate to deeply incised, decreasing appreciably and gradually in size from the apex to the petiolar portion; rudimentary leaflets often interspersed between other leaflets; the inflorescence a narrow, many-flowered cyme; flowers large, 15-20 mm in diameter; petals cream-colored, spreading, concave, orbicular, greatly exceeding the sepals; sepals 5-10 mm long, triangular, acuminate, glandular; bractlets sometimes toothed, lanceolate-ovate, shorter than the sepals; pistils numerous; styles thin, spindle-like; achenes small, medium brown.

Type locality: Upper Bear Creek, Colorado.

Distribution: From the Black Hills of South Dakota and the Big Horn Mountains of Wyoming through the Rocky Mountains to northern New Mexico.

New Mexico: Northern New Mexico, localities unknown (Clausen, Keck, and Hiesey, 1940).

No specimens of the described species have been examined by me and its description is based on those given in the keys and descriptions of Rydberg (1898, 1908, 1922), Harrington (1964), Kearney and Peebles (1964), Tidestrom (1941) and Clausen, Keck, and Hiesey (1940). This species is principally distributed in the spruce-fir belt of high



Map 1. Distribution of P. fruticosa, P. arguta, and P. fissa.

montane regions. Within its range intermediates between it and P. arguta are known to occur. For the most part, however, it is distinct in that it is one of the few members of the section Drymocallis which has stolons. It is relatively abundant through Colorado, Wyoming and southwest South Dakota, but apparently rare in New Mexico. Flowering June through August.

Potentilla glandulosa Lindl. Bot. Reg. 19: Pl. 1593. 1833.

Drymocallis glandulosa (Lindl.) Rydb.

Drymocallis glabrata Rydb.

Potentilla glandulosa ssp. arizonica (Rydb.) Keck.

Plants perennial; stems slender, erect to ascending, sparsely leafy, 20-40 cm high, weakly striate, villous to viscid-glandular, arising from the crown of a branching rootstock; rachis slender, viscid-glandular, 4-15 cm long; leaflets 7-11, ovate to obovate, rhomboid to nearly orbicular, with smaller leaflets interspersed between the larger ones, coarsely serrate or doubly serrate to 8 cm long and 3.5 cm wide but generally smaller, equally green on both surfaces and only slightly hairy; the inflorescence a narrow few-flowered cyme; petals light yellow, obovate, emarginate, nearly orbicular, 7 mm long, 7 mm wide; sepals ovate, villous or glabrate, 4 mm long; bractlets narrow ovate to linear, only slightly shorter than the sepals; pistils numerous; stamens 20-25; styles very thin, filiform, about 2 mm long; achenes glabrous, small not more than 1 mm long.

Type locality: California, locality not given.

Distribution: Mountains; from the Black Hills of South Dakota to British Columbia, California and New Mexico.

New Mexico: Mountains; northern and southern 7,000-9,000 ft.; near Glenwood, west of Bonita Lake, Ensenada, Chama, Johnson Mesa, Gallinas Canyon.

The above description is based on only three New Mexico specimens lacking flowers. The characteristics of the inflorescence, corolla, calyx, pistils, stamens and achenes are based on seven similar California specimens so these may not be representative of those found in New Mexico. This taxon is apparently relatively abundant in New Mexico, yet Clausen, Keck, and Hiesey (1940) do not report it on their distribution map as being present in New Mexico while Wooton and Standley (1915) report it from several locations in northern New Mexico. It is said to flower from May through June in wet soil in the transition zone. Our specimens are probably P. glandulosa ssp. arizonica (Rydb.) Keck which does occur in Arizona and Utah at 7,000-9,000 ft. The New Mexico specimens examined have only been collected in May, but these have not yet produced flowers.

This taxon has been studied extensively by Clausen, Keck, and Hiesey (1940 in which the effect of varied environments were studied and by Clausen and Hiesey (1958) on the genetic structure of ecological races. Differences in morphological characters were studied in relation to

climatic, physiological and genetic factors which operate in bringing about variability. They show how this variability could have led to errors in describing P. glandulosa as several distinct species. They conclude that variation may be continuous or discontinuous within one subspecies where in others random variation for the same character may occur. Their studies although not purely taxonomic in nature have shown relationships among the members of the section Drymocallis.

Potentilla thurberi A. Gray Mem. Amer. Acad. (11) 5: 318. 1894.

Perennials, stems large, relatively stout, erect or ascending, 60 cm high or less, glabrous to glabrate sometimes with brown dead leaf bases still attached to the crown, arising from an almost woody rootstock; basal leaves few to many, digitately 5-foliolate, occasionally 7-foliolate; petioles up to 16 cm long; leaflets thin, obovate, coarsely toothed, 3-6 cm long, 2-2.5 cm wide, glabrous to glabrate on both surfaces, or weakly silky-ciliate along the veins below or sometimes ciliate along the margins and at the tips of the teeth; cauline leaves few, shorter petioled, smaller, but similar to the basal leaves; the inflorescence is a several-flowered cyme; flowers 1.5-2 cm in diameter; petals 5, red to purple, almost orbicular or broad obovate, sometimes obcordate, 8-9 mm long, 7-8 mm wide; sepals green, but sometimes purple-tinged at their margins, sparsely to moderately

pubescent, ovate-acuminate, 7-8 mm long, 3-4 mm wide; bractlets linear-lanceolate, 1.5-2 mm wide, only slightly shorter than the sepals; stamens 20 or fewer; filaments thin, dark purple, the anthers lighter purple; ovate, 0.5-0.6 mm long; pistils numerous; styles filiform; achenes about 30, glabrous, ovoid but laterally compressed, sometimes lightly keeled along their ventral aspect, 1-2 mm long, 0.8-1 mm wide.

Type locality: Near Santa Rita del Cobre, New Mexico.

Distribution: Mountains of New Mexico, Arizona, southern California and northern Mexico.

New Mexico: Western to south central 7,000-9,000 ft.; Santa Rita, Mogollon, White, San Francisco, Jemez, Sacramento, San Mateo and Magdalena Mountains, and the Black Range.

The described species is not as abundant in the state as its variety, P. thurberi var. atrorubens, from which it varies but little. It does not appear to intergrade with any of the yellow-petalled potentillas and is quite distinct within its range. It differs from its variety mostly in having pubescence and thinner leaflets.

It is related to other purple-petalled potentillas which occur in Mexico. The type is found in coniferous forests, among ponderosa pine, and in meadows. It blooms from June through October.

Potentilla thurberi var. atrorubens (Rydb.) Kearney and Peebles, Flowering Plants and Ferns of Arizona. 401. 1942.

P. atrorubens Rydb.

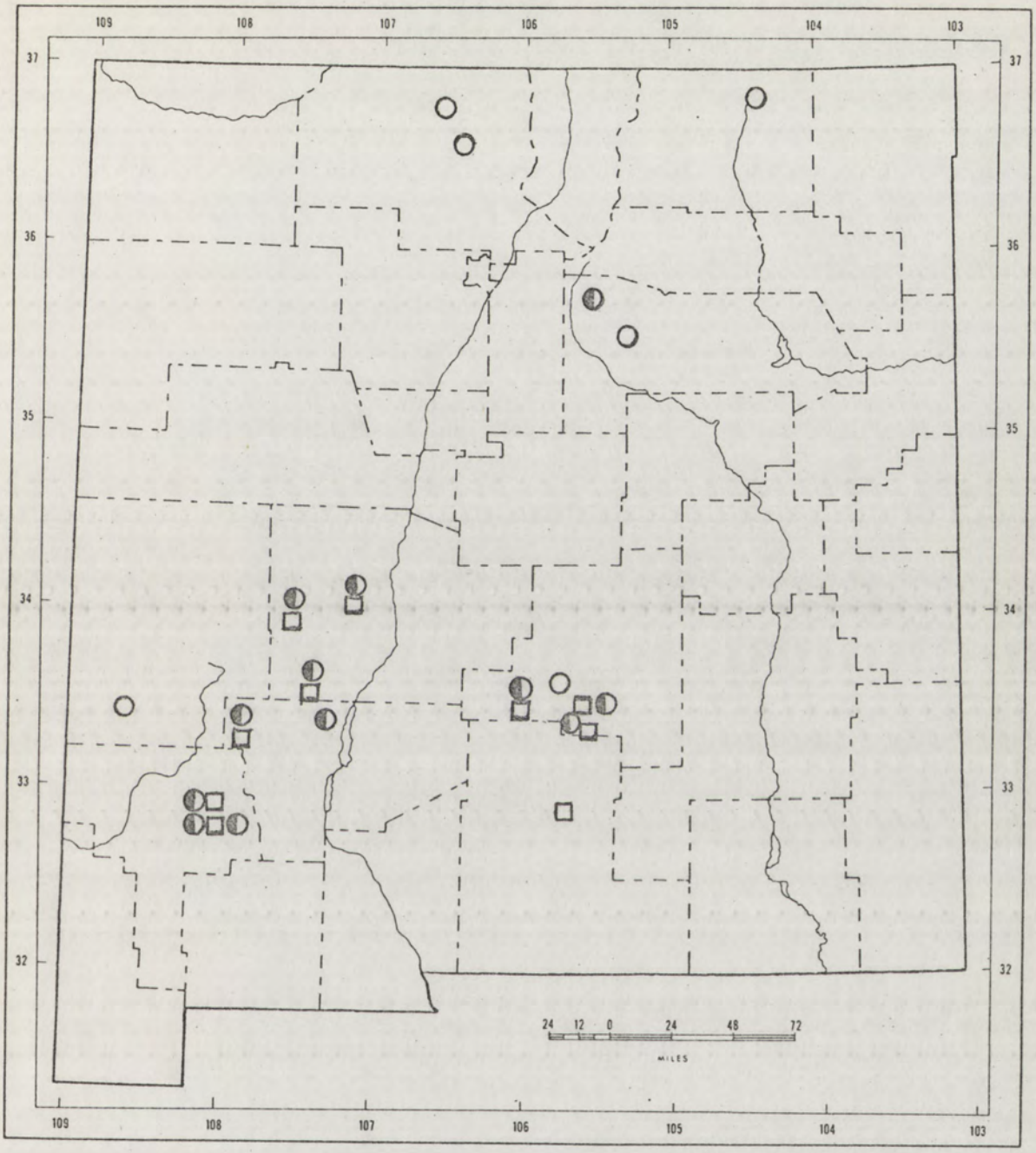
P. thurberi Rothrock.

Perennials; stems many, moderately stout, erect to ascending, 20-60 cm high, weakly striate, villous, from a woody taproot; basal leaves many, the petioles with long, spreading, villous hairs, digitately 5-foliolate, rarely 7-foliolate; leaflets moderately thick, glabrate to silky-villous above, tomentose below, obovate, serrulate to serrate, 2-5 cm long, 2-3 cm wide, ciliate at the tips of the teeth; upper cauline leaves usually sessile, 3-to 5-foliolate, similar to the basal leaves, the lower ones, longer petioled with long, linear lanceolate, ligule-like, stipules, 1 mm broad, 2 mm long; the inflorescence is an open, few-to many-flowered, branched cyme; flowers 1.5 cm in diameter; sepals silky, ovate to triangular-acuminate, 5-8 mm long, 2-3 mm wide, yellow-green along their inner bases and bearing scattered purple specks; bractlets lanceolate, about equal to the sepals; petals 5, red to purple, broadly obovate, retuse, 6-9 mm long, 5-9 mm wide; stamens 20, both anthers and filaments red; pistils numerous; styles filiform; achenes 25-30, glabrous, ovoid, 1 mm long, 0.5-0.8 mm wide.

Type locality: Mt. Graham, Arizona.

Distribution: Arizona, New Mexico, and northern Mexico.

New Mexico: Known from the Las Vegas, Magdalena, Mogollon, San Mateo, and White Mountains, the Black Range,



Map 2. Distribution of P. glandulosa, P. thurberi, and P. thurberi var. atrorubens.

and Santa Rita.

The described variety is very similar to P. thurberi var. thurberi and differs principally in being more pubescent throughout. It also appears to have more cauline leaves, and the leaflets appear somewhat thicker. Its New Mexico distribution is greater than that of var. thurberi which has not been collected as far northward. Its more northerly distribution may indicate that it is different physiologically from var. thurberi, although they are almost morphologically identical.

It occurs in the yellow pine belt in dry or moist soil from June through August.

Potentilla anserina L. Sp. Pl. 495. 1753.

Potentilla argentina Huds.

Argentina anserina (L.) Rydb.

Argentina vulgaris Lam.

Perennials; stems nearly absent or very short, arising from a cluster of roots, prostrate, spreading, producing thin stolons; stolons up to 70 cm long, glabrous or with loose spreading hairs, green to reddish brown, rooting at regular intervals of 8-10 cm; leaves interruptedly pinnate, 7-to 25-foliolate with smaller leaflets interspersed; leaflets 1-3 cm long, 0.5-1.2 cm wide, green-glabrate above, silvery-sericeous to tomentose below, sharply serrate; flowers solitary, 1.2-2 cm in diameter; peduncles thin, glabrous to weakly pubescent, arising in the axils of leaves or at the site

of rooting stolons, about 7 cm, occasionally up to 14 cm long; petals 5, yellow, ovate to obovate, 0.5-1 cm long, 4-5 mm wide; sepals lanceolate, about one half as long as the petals, pubescent; bractlets ovate-truncate in outline, deeply divided at their tips into 3 equal parts; the receptacle densely silky within, slightly pubescent outside; styles lateral, somewhat persistent, thin-filiform 1.5-2 mm long; stamens 20 or more, 0.5 mm long, brownish; achenes numerous, ciliate at their base, corky, grooved dorsally, 1 mm long, 0.5 mm wide.

Type locality: Europe.

Distribution: From Chile, northward through Mexico to Greenland and Alaska, and from New York and New Jersey to California; also widespread in Asia and Europe.

New Mexico: Known from Tierra Amarilla, Chama, Ensenada, Taos, Los Lunas, Socorro, Mesilla Valley, Eagle Nest, Cimarron Canyon, El Valle, near Bernalillo, and from the Santa Fe, Las Vegas, Mogollon, Sacramento, and San Mateo Mountains.

Some forms of this species are native to Europe and Asia and have been introduced into eastern America. Other forms are native to some areas of North America, Rydberg (1908). The species is very distinct and apparently not closely related to other Potentilla species and it does not appear to intergrade with other forms with which it is found. It differs little morphologically from one area to the next, differences being mostly in size of leaves,

number of leaflets and pubescence. It is often treated as a separate genus of the Rosaceae. It is always found near water, usually in sandy-gravelly areas. Its apparent lack of much variability probably indicates that it is an old species having reached a particular stable evolutionary state and in equilibrium with its environment wherever found. Its 2n chromosome number is reported to be (2n = 14-21) Munz (1959).

In New Mexico it occurs from 5,000-9,000 ft. being more abundant in the transition zone. It blooms from May through October.

Potentilla anserina L. var. concolor Ser. in DC. Prod. 2: 582. 1825.

P. anserina sericea (L.) Hayne, (var.) Arzneigew.

Argentina argentea Rydb.

Plants perennial; stems short, almost none, from a fascicled root and producing many stolons; leaves pinnate, 10-20 cm long, 15-to 29-foliolate, having the larger leaflets interrupted by smaller ones; rachis with spreading hairs; leaflets 1-3 cm long, obovate, serrate and having 7-20 ovate-lanceolate, or ovate teeth, both surfaces with silky-white pubescence, only slightly greener above; runners 10-50 cm long, silky-white with spreading or ascending hairs; pedicels silky-white, 2-7 cm long; calyx and hypanthium silky-white; sepals ovate-lanceolate or ovate, 4-6 mm long; bractlets elliptic or oblong, usually entire, about equal to the sepals; petals

yellow, broadly oval or obovate, 6-9 mm long; stamens 20-25; styles lateral, somewhat persistent; achenes 2 mm long, brown, corky, glabrous, numerous, grooved dorsally.

Type locality: Not given but the type is known from Wood Mountain, Assiniboia, Saskatchewan.

Distribution: Western Canada, south to New Mexico, and westward into California.

New Mexico: Northern, wet soil, 6,500-8,000 ft.; reported from Gallo Springs, and the Tunitcha Mountains (Wooton and Standley, 1915).

The described species has not been seen by me and its description is based on that given in the taxonomic keys and descriptions of Harrington (1964), Rydberg (1898, 1906, 1908), Kearney and Peebles (1964), Tidestrom (1941) and Nelson (1909). It is commonly known as silverweed or goose tansy. It differs from P. anserina var. anserina mostly in the type of silvery, but not tomentose, pubescence on both leaf surfaces, is reportedly more robust with stouter and shorter runners, enlarged at the nodes and has more leaflets. It is apparently a rare plant in New Mexico with possibly a limited northerly distribution. It may be but an ecological form of P. anserina.

Its habitat and time of blooming is probably the same as for P. anserina var. anserina.

Potentilla pennsylvanica L. Mant. Pl. 76. 1867.

P. strigosa (Pursh) Pall.

Plants perennial; stems erect to ascending, slender, 5-40 cm high, strigose to villous, almost uniformly thickened; basal leaves pinnate 5-to 11-foliolate, numerous, obovate in outline, sometimes reaching 15 cm in length; rachis coarsely to densely villous, leaflets usually 2-4 cm long (sometimes 6 cm), 0.5-2.5 cm wide, sessile except the middle leaflet which is occasionally short-stalked, deeply cleft to pinnatifid, obovate-oblong in outline with linear oblong segments extending more than half way to the midrib, finely green-silky to strigose above, gray-green, strigose to tomentulose below; stem leaves similar, shorter petioled than the basal leaves and may appear more finely dissected; inflorescence a several-to many-flowered, sometimes crowded cyme; flowers up to 1.5 cm in diameter; petals 5, yellow, obovate, 3-7 mm long; 3-4 mm wide; sepals acute to acuminate, 2-6 mm long; bractlets narrower than and only slightly shorter than the sepals; the hypanthium cup is silky-villous within and the receptacle is hairy; stamens 20 or fewer; pistils numerous; styles short, thickened at their base and as long as or slightly shorter than the mature achenes; achenes numerous, ovoid, 1 mm long, 0.6 mm broad, irregularly striate to rugulose.

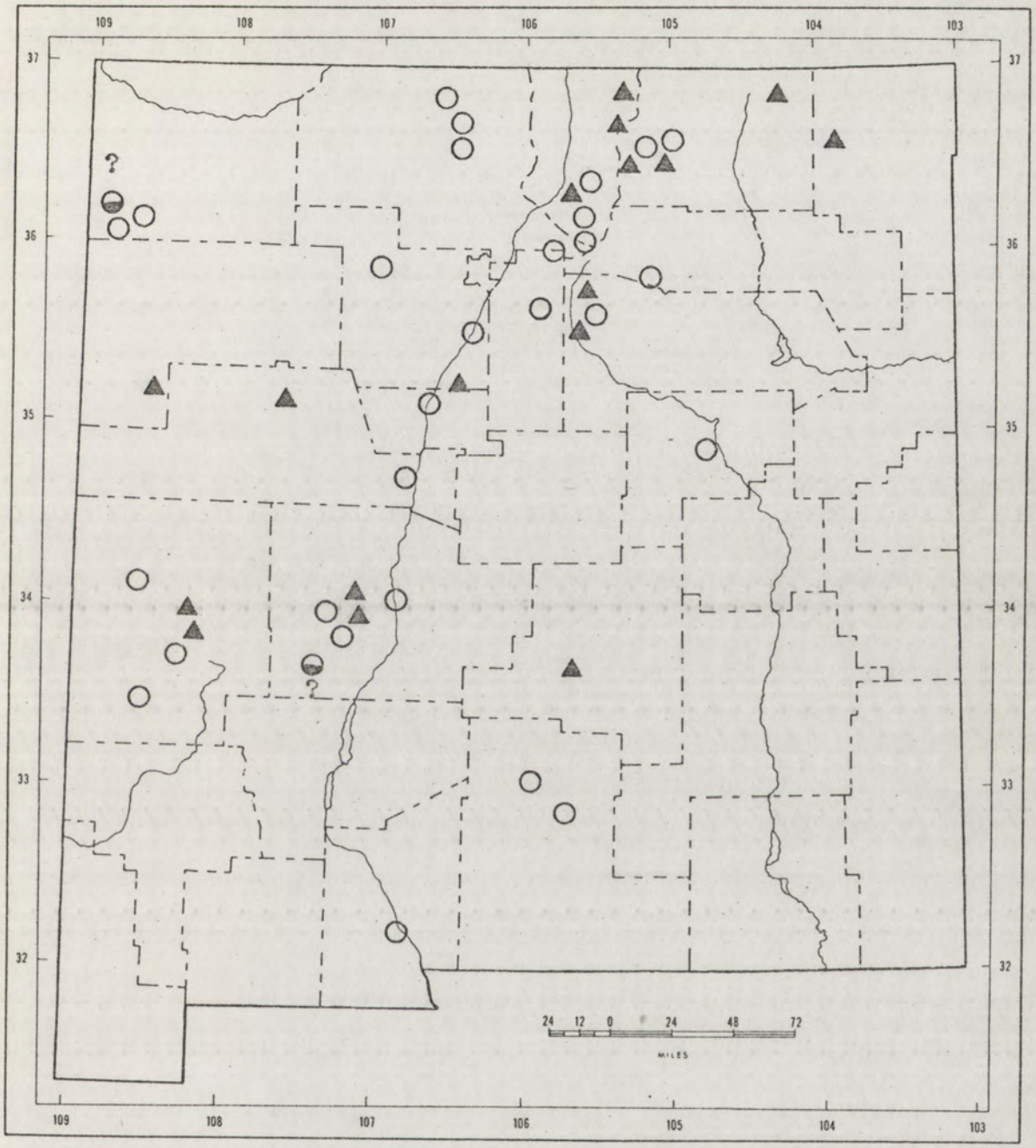
Type locality: On the Missouri.

Distribution: From Hudson Bay to Kansas, southwestward through New Mexico, Arizona, Colorado, and California; also in British Columbia and northern Asia.

New Mexico: The White, Mogollon, Sandia, and

Magdalena Mountains; Eagle Nest, Flechado Pass, Lake Maloya, Hondo Canyon, Mt. Taylor, Sierra Grande, Wheeler Peak.

The described species may include P. bipinnatifida Dougl., P. arachoidea Dougl., P. pennsylvanica arachnoides (Dougl.) Lehm. and forms of P. plattensis. This species is apparently highly variable. The characteristics used in separating it from closely related types are inconsistent from one publication to the next. This inconsistency has led to descriptions of several species which are so similar that most of them probably do not deserve species rank. Characteristics of pubescence may vary with age of the plant, locality where collected, and within different parts of the same plant. The achenes are usually described as smooth, but I find this true only when they are green. They become wrinkled or striate when brown and mature. The style is most characteristic, being short and thickened at the base and usually smaller than the mature achene. Size of parts, time of flowering, size at flowering, number of basal leaves, and other quantitative characters are all variable and generally specimens collected from higher less-sheltered areas are smaller. The type localities where specimens of these several related taxa have been collected are similar. The habitat is generally above or with ponderosa pine. It is abundant and flowers mostly in June and July, but often blooms through September.



○ P. anserina

▲ P. pennsylvanica

? ◒ P. anserina var. concolor

Map 3. Distribution of P. anserina, P. pennsylvanica, and P. anserina var. concolor.

Potentilla plattensis (Nutt.) Torr. and Gray, Fl. N. Amer. 1: 439. 1840.

P. nelsonii Rydb.

P. pinnatisecta A. Nels.

Perennials; stems usually 10-30 cm high, subcespitose, erect or spreading, with appressed hairs or strigose, arising from a short thick rootstock; basal leaves many, pinnate or pinnatifid, with 4-6 pairs of leaflets, occasionally more; leaflets 3-4 cm long, cleft at least to the midrib into linear-lanceolate segments which are about 4 mm long, equally green on both surfaces, bearing appressed silky to strigose hairs; stem leaves small, 3-to 7-foliolate, resembling the basal leaves; the inflorescence a few flowered, narrow cyme; flower diameter about 1 cm; petals 5, yellow, obovate, 5 mm long, 3 mm wide, longer than the sepals; sepals ovate-acute, strigose; bractlets linear-lanceolate, about one half as long as the sepals; the receptacle silky-hairy, yellow-green within; stamens about 20; anthers ovate, 0.5 mm long; pistils numerous; styles filiform, not thickened at their base, about 1.5 mm long; achenes ovoid, glabrous, striate, sometimes with a very small, thin keel along the ventral margin, 1.1 mm long, 0.5 mm wide.

Type locality: Plains of the Platte.

Distribution: From New Mexico to Utah and Saskatchewan.

New Mexico: Northern; 7,000-9,000 ft.; Costilla

Valley, Red River and Sandia Peak.

This species is generally described as distinct in its leaf form when compared with P. pennsylvanica which it resembles. I find little, if any, difference between the two in specimens which I have examined. An inadequate number of specimens were available for study. Only two specimens labeled P. plattensis are present in The University of New Mexico Herbarium and one of these is identical to those labeled P. pennsylvanica. I did not collect any specimens which I can say are definitely P. plattensis and those I examined are questionable. The description is based on two specimens from The University of New Mexico Herbarium and from descriptions given in the literature.

P. plattensis supposedly differs from P. pennsylvanica in having stipules which are relatively large for the size of the plant, and in having styles which are larger than the mature achene. These characteristics do fit one of the specimens examined, [Nelson 5,691 (2,346), 7/2/32, Red River, New Mexico], but do not fit the collection by Gordon and Norris [174 (11,796), 8/5/49].

The species is reported to be found flowering in sub-alpine environments from June through August.

Potentilla crinita A. Gray. Mem. Amer. Acad. II 4: 41. 1849.

Plants perennial, stems several, slender to moderately stout, erect or ascending, 15-40 cm high, often reddish or with reddish streaks, lightly pilose; leaves

mostly basal, pinnate, 11-to 17-foliolate, usually conduplicate with the rachis 6-8 cm long, stem leaves few 5-to 7-foliolate resembling basal leaves; leaflets 1-1.5 cm long, 4 mm wide, linear-oblong to oblong-cuneate, entire below the middle, coarsely toothed from middle to apex, green, moderately to densely pilose on the lower surface, glabrate or only slightly pilose above; the inflorescence is an open, spreading, many-flowered cyme; sepals ovate to ovate-acuminate, usually purple-tinged, densely pilose, only slightly shorter than the sepals; bractlets similar to but slightly shorter and narrower than the sepals; stamens about 10; pistils 10-15; styles filiform, 2 mm long; achenes smooth to striate, sometimes ciliate at their bases, 1.2-1.5 mm long, 1.0-1.1 mm wide.

Type locality: Along Santa Fe Creek, New Mexico.

Distribution: Colorado, New Mexico, Utah, and Arizona.

New Mexico: Mountains; 7,000-8,500 ft.; Chama, Dulce, Tierra Amarilla, Santa Fe, Santa Barbara Canyon, Reserve, Beaverhead and Sandia Crest.

This species appears to be limited to a few of the southwestern states in dry mountain regions of the yellow pine belt. Its outstanding characteristic is a wilted appearance because of conduplicate leaflets. It is also one of the few with cilia at the base of the achenes and a large number of leaflets. The closely related P. lemmonii are sometimes included as a variety of

P. crinita. The species flowers from April through September.

Potentilla crinita A. Gray var. lemmonii (S. Wats.) Kearney and Peebles, Journ. Wash. Acad. Sci. 29: 480. 1939.

Potentilla lemmonii (S. Wats.) Greene

Ivesia lemmonii S. Wats.

Plants perennial; stems 15-50 cm high, erect or ascending, slender, few leaved, branched above, silky-strigose to sub-hirsute, sometimes with a reddish-brown tinge, arising from a branched somewhat woody root; basal leaves pinnate 11-to 17-foliolate; the rachis hirsute-villous, up to 20 cm long in large specimens; cauline leaves few, or absent, pinnate 5-to 9-foliolate, resembling the basal leaves; leaflets oblong to lanceolate, 1-3 cm long, 3-5 mm wide, gray, appressed, silky, entire or 2-3 toothed only at the apex, some with a few teeth above the middle; the inflorescence is an open-branched, several-flowered cyme, pedicels thin; calyx hairy; sepals lanceolate-acuminate or ovate-acuminate, entire, 3-6 mm long; bractlets narrower and shorter than the sepals, almost linear in some; petals yellow, obovate, 4-5 mm long, 3-5 mm wide; stamens about 20; pistils 5-15, styles filiform, 1.5-2 mm long; achenes few, dark brown when ripe, 1.5-1.8 mm long, 1.1 mm wide, usually glabrous but sometimes with a few short cilia along their ventral margin.

Type locality: Oak Creek near Flagstaff, Arizona.

Distribution: New Mexico to Arizona, Nevada, Colorado, and Utah.

New Mexico: Canjilon and north of Ruidoso.

The described species resembles typical P. crinita in form but the leaves are seldom conduplicate, leaflets bear fewer teeth, and are usually toothed only at their tips; also the achenes are fewer and slightly larger. It has been considered a variety of P. crinita by Kearney and Peebles (1939, 1942, 1964). Other authors list it as P. lemmonii or may not distinguish between it and P. crinita. Wooton and Standley (1915), as do many authors through 1941, list it separately as P. lemmonii.

In New Mexico two forms can be distinguished. Those found in northern New Mexico are generally smaller having leaflets toothed only at the apex. The more southerly form is larger and sometimes has leaflets which are entire, toothed only at the middle, or at the apex. In both forms the leaflets are flat, not conduplicate as is characteristic for P. crinita.

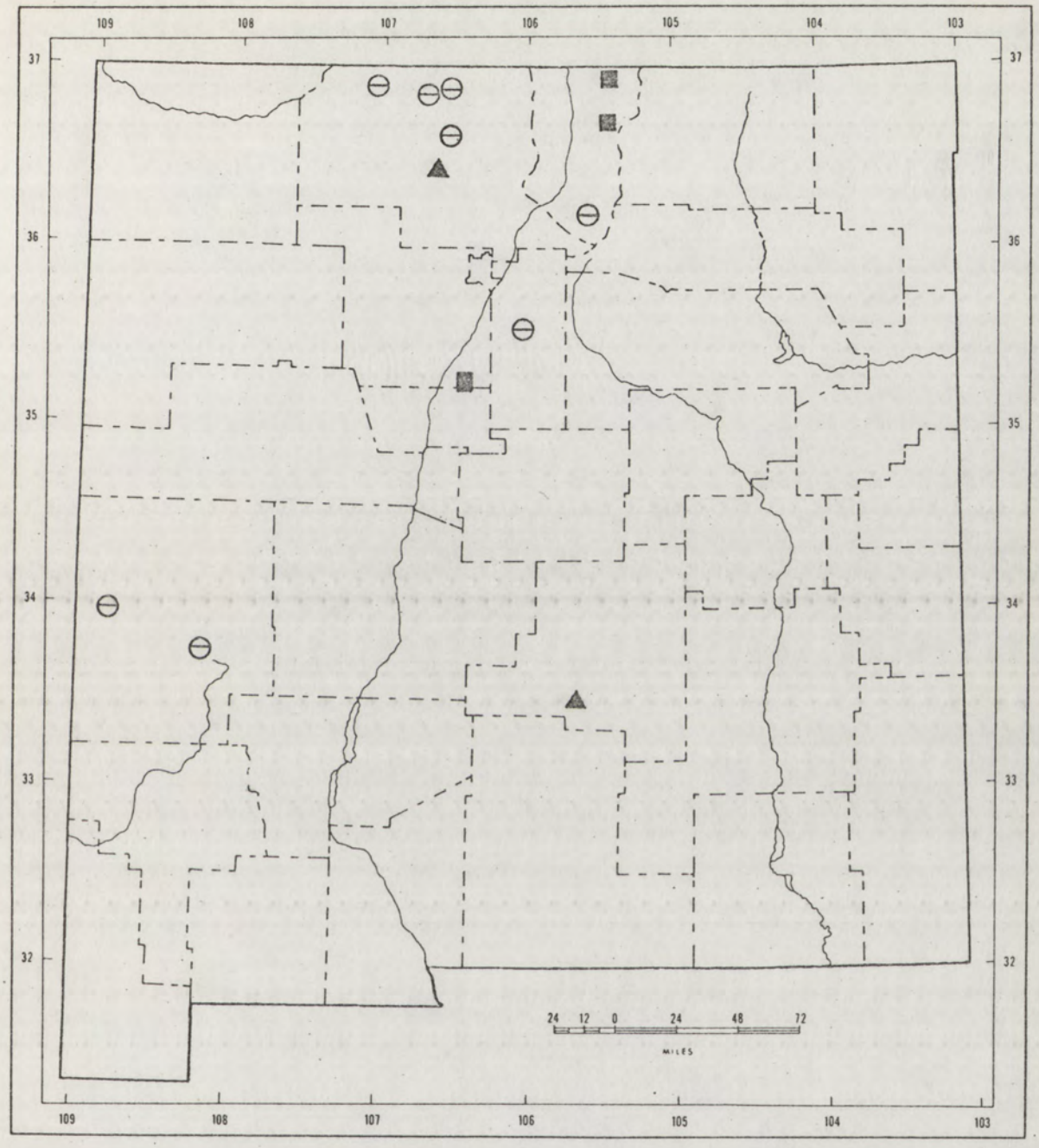
The species occurs in dry open areas among the lower limits of the yellow pine zone. It is probably more abundant in New Mexico than is indicated. It is reported to flower from April through September.

Potentilla pulcherrima Lehm. Stirp. Pug. 2: 10. 1830.

P. pennsylvanica pulcherrima Torr. and Gray.

P. hippiana pulcherrima S. Wats.

P. gracilis var. pulcherrima Fourn.



■ P. plattensis

⊖ P. crinita

▲ P. crinita var. lemmonii

Map 4. Distribution of P. plattensis, P. crinita, and P. crinita var. lemmonii.

Perennials; stems erect to ascending, originating from the crown of a stout, almost woody rootstock, often with brown leaf bases sheathing the crown, 25-60 cm high, occasionally smaller, villous to glabrate; basal leaves digitate or pinnate, 5-to 9-foliolate; petioles 10-11 cm long, occasionally 20 cm long; cauline leaves few, 3-to 5-foliolate, short petioled, resembling the basal leaves; leaflets oblong-obovate to oblanceolate, sometimes appearing crowded, 3-5 cm long, 1-1.8 cm wide, green, silky above, gray-tomentose below, coarsely serrate; the teeth ovate, cut almost to the midrib, ciliate at their tips; the inflorescence an open, many-flowered cyme; flower diameter 1.2-1.6 cm; petals 5, yellow, obovate, emarginate, 5-8 mm long, 4-6 mm wide; sepals ovate-acuminate, lightly to densely hairy, 4-8 mm long, 1.5-2 mm wide; bractlets as long as the sepals or shorter, lanceolate; both bractlets and sepals yellow-green at their inner bases; the receptacle weakly to densely villous; stamens 20 or fewer, filaments thin; anthers ovate, 0.5-1 mm long; pistils numerous; styles filiform, 2 mm long; achenes numerous, ovate, glabrous, 1.1 mm long, 0.6 mm wide.

Type locality: Original locality not given, but apparently in the Rocky Mountains between 52 and 62 degrees north latitude.

Distribution: Mountains; Saskatchewan, Alberta, southward to Utah and New Mexico.

New Mexico: Widespread, 7,500-11,000 ft.; known from

Gilmore's Ranch, Sierra Grande, Placer Creek, Tierra Amarilla, Pecos Baldy, Santa Fe Ski Area, Mt. Taylor, and from the White, Sacramento, San Pedro, Jemez, San Mateo, Manzano and Magdalena Mountains.

This species is variable in a number of characteristics and it appears that it is often a "catch-all" group with many varieties or intermediates. It has been treated as a species in the section Graciles. When treated with the Graciles complex as in Clausen, Keck, and Hiesey (1940), the variability is understandable, as members of this section show extreme variability with hybrids linking P. pulcherrima with several members throughout its range.

Forms of P. pulcherrima are variable morphologically even among members from the same population. Leaves may be either digitate, or pinnate, with the leaflet number varying from 5 to 9 on the same plant. A glandular condition of the calyx has been described by a few authors but not reported by most. The glandular condition is characteristic of var. filipes, and P. nuttallii Lehm. as described by Rydberg (1908). P. pulcherrima differs from P. Nuttallii as described by Clausen, Keck, and Hiesey (1940) who have treated it as a variety of P. gracilis. It differs from var. filipes in having pinnate and digitate leaflets, a condition which is not present in var. filipes. This indicates that it is not closely related to P. gracilis which, according to Clausen, Keck,

and Hiesey (1940), always has digitate leaflets.

Rydberg (1898), states that P. pulcherrima was originally described with pinnate approximate leaflets, which is the case with most specimens I have identified as this species. Other characteristics may equal or approximate those given for some members of the P. gracilis complex (as treated by Clausen, Keck, Hiesey 1940). The form which I have treated as var. filipes is often considered to be a separate species or combined with P. pulcherrima yet it is always digitate in leaf form.

The chromosome numbers have been reported to vary from one location to another, Clausen, Keck, and Hiesey (1940). They found that forms from the Wasatch Mountains of Utah had a 2n = 70, while those from Pikes Peak, Colorado, are 2n = 108. They also state that forms of P. pulcherrima are more frost resistant than forms of P. gracilis. Although P. pulcherrima is known to reproduce vegetatively, an abundance of pollen also indicates probable sexual reproduction.

The variability of this species and an indication of possible intermediates is illustrated by Harrington (1964); he states that he cannot distinguish forms of P. pulcherrima from P. viridor Rydb.; P. concinna and P. propinqua Rydb. Among New Mexico plants the same conditions are apparently true.

The species is fairly common in the mountains in mixed conifer stands and in open meadows, and blooms from June

to September, or reportedly as early as March. The latter may also be true of New Mexico specimens.

Potentilla ambigens Greene Erythes 1: 5. 1893.

Plants perennial; stems many, stout, ascending to erect, 30-70 cm high, 3 mm in diameter, moderately hirsute throughout, arising from the crown of a woody taproot; basal leaves irregularly pinnate, 9-to 15-foliolate; rachis stout, moderately to densely hirsute, coarsely serrate, at least the upper pairs decurrent, sometimes confluent, almost equally green on both surfaces, glabrate to glabrous above, lightly silky below, at least along the veins; cauline leaves few, resembling the basal leaves but fewer-foliolate; inflorescence a many-flowered, usually loose cyme; flowers 1.5-1.8 cm in diameter; receptacle hairy at its base, densely silky within; petals yellow, obcordate, 6-8 mm long, 3-5 mm wide; sepals 5-7 mm long, about 3 mm wide; hairy; bractlets variable, usually shorter than the sepals sometimes slightly longer even in the same plant; stamens 20-25 on filiform filaments; pistils 20 or fewer; anthers lance-ovate, 1 mm long; styles filiform, only slightly enlarged at their base; achenes large, smooth when green and striate or reticulate-veined when mature, 1.2-1.8 mm long, 1.1 mm wide.

Type locality: Moist meadows along Bear Creek above Morrison, Colorado.

Distribution: Mountains from New Mexico to Wyoming.

New Mexico: Northern and south-central mountains; 7,000-10,000 ft.; Sierra Grande, the White, Sacramento, Santa Fe, and Las Vegas Mountains.

This species is reasonably distinct at least in the character of the leaves, pubescence, and achenes and has not been combined with other species by most authors although its leaves may resemble those of P. hippiana var. diffusa in being decurrent and confluent. In some specimens most achenes appear to never mature completely so that only a few mature large achenes remain along with wrinkled and undeveloped ones. The members of this species are apparently not widely distributed in New Mexico. Those I have considered in this study include only specimens from Otero County. Other specimens in The University of New Mexico Herbarium were also collected in Otero County. The species has also been reported by Wooton and Standley (1915) from various localities in the state.

Potentilla ambigens apparently hybridizes with P. hippiana where the two are found in sympatry. Some of my specimens from Otero County which I have labeled P. hippiana are similar in having 15 leaflets although they are not hirsute (Garcia 1,915, 9/7/69; Garcia 1,864, 9/7/69).

Potentilla hippiana Lehm. var. diffusa Lehm. Delect. Sem. Hort. Hamb. 8. 1849.

P. propinqua Rydb.

P. hippiana pulcherrima Wats.

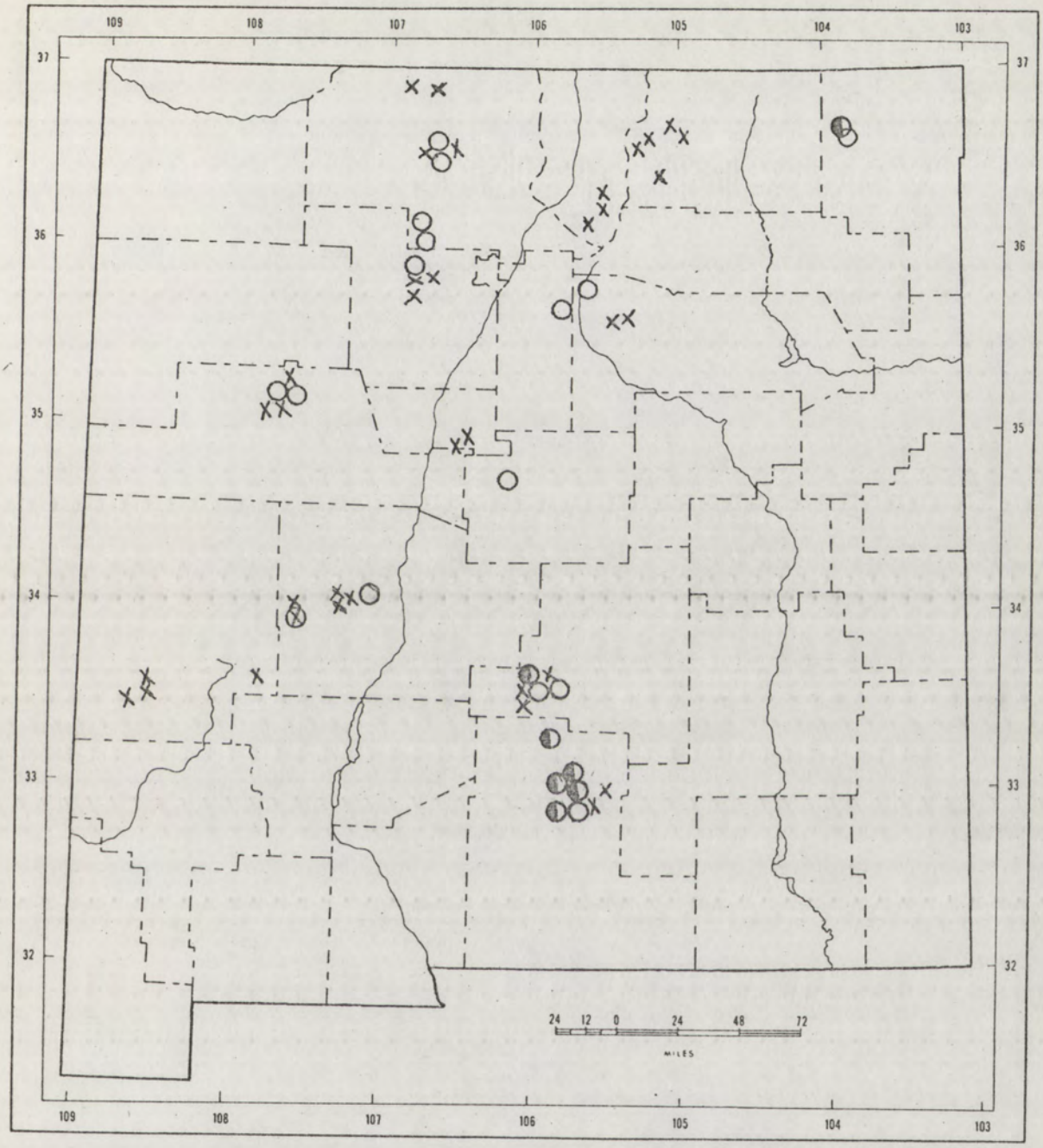
P. hippiana propinqua Rydb.

Plants perennial; stem stout, ascending to erect, from the crown of a thick woody root covered with brown dead leaf bases; silvery-sericeous to villous or glabrate; basal leaves pinnate, usually 9-11 leaflets, sometimes fewer or more, closely resembling var. hippiana. Stem leaves similar to basal leaves; leaflets oblanceolate, sometimes with rounded tips, serrate or coarsely crenate, one or two pairs often decurrent or confluent, green-silky above, white-tomentose below; the inflorescence an open many-flowered cyme; pedicels long in fruit; sepals ovate or ovate-lanceolate, silky, 4-6 mm long; bractlets narrowly lanceolate 3-5 mm long; petals yellow to yellow-orange, obovate, emarginate 5-8 mm long, 3-5 mm wide; stamens 20-30, anthers ovate, less than 1 mm long; pistils many; styles filiform 1.5-2 mm long; achenes about 30, glabrous, resembling those of var. hippiana in size and shape.

Type locality: Along Santa Fe Creek, New Mexico.

Distribution: Canada, through South Dakota, southward to New Mexico and Arizona.

New Mexico: Mountains; 7,000-10,000 ft.; northern to southern, Eagle Nest, Cimarron Canyon, Chama, near Tererro, Pecos Wilderness, La Junta Canyon, Las Trampas Canyon, Santa Barbara Canyon, Mt. Taylor, Black Range, and from the Sandia, Mogollon, White, Jemez, Raton, and



● P. ambigens

× P. hippiana var. diffusa

○ P. pulcherrima

Map 5. Distribution of P. ambigens, P. hippiana var. diffusa, and P. pulcherrima.

Magdalena Mountains.

This taxon of the P. hippiana complex may not warrant varietal status and some authors do not care to include it separately. Harrington (1964) combines it with P. pulcherrima, P. concinna, P. filipes and P. viridor. Tidestrom (1941) and Wooton and Standley (1915) combine it with var. hippiana. According to Rydberg (1901) it should differ from var. hippiana in the following characters: the upper surface of the leaves as well as the pedicels, hypanthium, and calyx is only silky and not tomentose; the cyme is more open and flat-topped and the upper segments of the leaves are decurrent and sometimes confluent. The above is true also, at least in part for var. hippiana and my separation is primarily based on the presence of the greener silky upper leaf surface and one or more pairs of strongly decurrent or confluent leaflets which usually have more rounded apices. It is possible that var. diffusa intergrades with P. pulcherrima and its forms as well as with P. concinna, P. viridor or P. ambigens and therefore most resembles the forms with which it is associated. It blooms from June through September.

Potentilla hippiana Lehm., Stirp. Pug. 2: 7. 1830.

P. leucophylla Torr.

P. leneophylla Torr.

P. pennsylvanica hippiana Torr. and Gray.

Plants perennial; stems many, erect or ascending, 6-60 cm high, silky to silvery-sericeous, often stout,

somewhat cespitose, from a thick, brown, scaly, branching woody root; basal leaves all pinnate, usually 7-to 13-foliolate, rarely more or fewer; cauline leaves pinnate, few to many, resembling the basal leaves; leaflets variable, oblanceolate, cuneate-oblong to narrowly obovate-oblong, usually coarsely toothed, sometimes to the base; serrate or crenate, seldom cleft to the midrib, green appressed-silky to silky gray-tomentose above, gray-tomentose beneath, sometimes appearing almost equally gray on both sides, sometimes decurrent on the rachis or even confluent, 2-6 cm long, 1-1.5 cm wide; the inflorescence is an open few-to many-flowered cyme; pedicels often thin, but sometimes short and thick; sepals, ovate-lanceolate, acute, 4-8 mm long, silky, sometimes yellow-green at their base; bractlets resembling the sepals but narrower and shorter; petals light yellow to yellow-orange, 6-9 mm long, 4-5 mm wide, obovate, sometimes emarginate; stamens 20-30, 0.5-1 mm long, ovate; styles filiform, or slightly thickened at the base, 2 mm long, longer than the mature achene; achenes about 30, glabrous, pear-shaped, 1.2-1.5 mm long, 1 mm wide.

Type locality: Sources of the Platte, Colorado.

Distribution: Saskatchewan and Alberta southward to New Mexico and Arizona.

New Mexico: Northern to southern New Mexico, in the mountains at 7,000-10,500 ft.; Chama, Tierra Amarilla, Eagle Nest, Pajarito Park, Sugarette Canyon, Agua Fria

Peak, Apache Summit, Tres Ritos, Evergreen Valley, Mt. Taylor, and the Santa Fe, Las Vegas, White, Mogollon, Jemez, Magdalena and Manzano Mountains.

This species is very variable throughout its range, consisting of possibly several forms which intergrade. The more typical specimens are from northern New Mexico near Raton. These most completely fit written descriptions of P. hippiana Lehm., but others also resemble P. coloradensis Rydb. and P. effusa Dougl., and possibly P. filicaulis (Nutt.) Rydb., and the variety P. hippiana var. diffusa Lehm. Some specimens have from 9-13 leaflets which is characteristic of P. coloradensis but have more than 20 pistils while P. coloradensis is described as having fewer than 20. P. effusa is described as having 5-11 interrptedly pinnate leaflets as do some specimens here included but the leaves are not always interruptedly pinnate. P. filicaulis is described as having sub-digitately 5-to 7-foliolate leaflets as do some specimens but this is sometimes variable within the same plant changing with age. P. hippiana is difficult to separate from var. diffusa which usually is described as having 9-11 leaflets, these green-silky above and tomentose beneath. Both conditions vary within some of the plants which I have examined. Some specimens from throughout the range of the species in New Mexico may have narrower, more numerous leaflets, larger achenes, and leaves which resemble those of P. pulcherrima when the two

taxa are sympatric. When found with P. ambigens it may have as many as 14-15 leaflets with at least some of the upper leaflets decurrent or confluent. Leaflets are variable in shape and number often on the same plant, being narrowly oblong-lanceolate to oblong-obovate, sometimes with rounded tips. This species appears to be one of the most widespread and variable of the potentillas in New Mexico, being found abundantly in the yellow pine belt in dry or damp soil, often in disturbed areas along roadsides and campgrounds, meadows, in direct sunlight or in the shade. It flowers from May through September.

Potentilla pulcherrima Lehm. var. filipes Wolf. Bibl. Bot. 16 (71): 209. 1908.

P. filipes Rydb.

P. gracilis Porter and Coulter.

Perennials; stems several, from the crown of a stout rootstock, erect or ascending, villous to silky-hirsute few-leaved; basal leaves digitate 5-to 7-foliolate, on hirsute petioles up to 20 cm long; cauline leaves few, usually 5-foliolate, occasionally few toothed, 2 cm long, 4 cm wide, but occasionally 3 cm long and 5 cm wide; leaflets noticeably veined, white to brownish-tomentose below, green, glabrate to strigose above, obovate to oblanceolate, 7 cm long, 2.5 cm wide, occasionally larger, coarsely toothed to the base in larger ones, usually sessile, radiating from a very short region of the petiole

which resembles a concave point and does not exceed 3 mm in length, weakly ciliate along the margins, densely ciliate at the tips; the inflorescence a few-flowered cyme with relatively thin pedicels; flowers 1.5 cm in diameter; petals 5, yellow, obovate, weakly emarginate, 7 mm long, 5 mm wide; sepals lanceolate-acuminate, 6 mm long, 2.5 mm wide; bractlets linear-lanceolate, equal to the sepals or only slightly shorter; both bractlets and sepals are pubescent and somewhat yellow-green along their inner bases; the receptacle brownish, silky-villous, somewhat glandular; stamens 18-20, pistils numerous, styles filiform, 2 mm long; achenes smooth, ovoid, occasionally weakly keeled along their ventral margin, 1.0-1.1 mm long, 0.6 mm wide.

Type locality: Wahatoya Canyon, Spanish Peaks, Colorado.

Distribution: Manitoba to New Mexico, Arizona, Utah, and Athabasca.

New Mexico: Widespread, mountains, 7,500-11,500 ft.; Chama, Rio Pueblo, Sugarette Canyon, Flechado Pass, Tularosa Canyon, La Junta Canyon, Truchas Peak, and from the Santa Fe, Las Vegas, White, Sacramento, Chuska and Sandia Mountains.

There is no distinction made between this form and P. pulcherrima in more recent taxonomic keys, yet most of the older works include it as P. filipes Rydb. I have chosen to include it as a variety of P. pulcherrima since it is undoubtedly closely related. It differs

sufficiently, however, to suggest a possible intermediate between P. gracilis and P. pulcherrima. It is somewhat like P. nuttallii as described in all of Rydberg's works, but unlike the P. gracilis var. nuttallii described by Clausen, Keck, and Hiesey (1940).

In our specimens the leaves are typically digitately 5-to 7-foliolate while in other forms of P. pulcherrima the leaves are digitate or pinnate and 5-to 9-foliolate. This indicates to me a possibly closer relationship to P. gracilis than to P. pulcherrima. Clausen, Keck, and Hiesey (1940) state that forms of P. gracilis always have digitate leaves. In addition our forms are lightly glandular, at least on the calyx, with brownish to white tomentose pubescence on the leaflets which are also noticeably brown-veined below.

This variety produces an abundance of pollen, many mature achenes, and probably reproduces sexually as well as sexually. It occurs usually at sub-alpine elevations, frequently in meadows, flowering from June through August.

Potentilla diversifolia Lehm. Stirp. Pug. 2: 9. 1830.

P. glaucophylla Lehm.

P. glaucophylla Wats.

P. dissecta Pursh.

P. diversifolia var. intermittens Rydb.

P. diversifolia var. genuine Wolf.

Perennials; stems several, decumbent or ascending, seldom erect, sometimes weakly striate near the base,

glabrous or with weakly appressed hairs, up to 60 cm high but usually less than 30 cm, arising from the crown of a taproot; basal leaves many, thin, digitate, occasionally sub-pinnate, 5-to 7-foliolate; petioles may reach 10 cm in large specimens; leaflets obovate or oblong-obovate, cuneate, deeply crenate or sharply toothed apically, sometimes halfway to the midrib, 3 cm long or less, 1-1.5 cm wide, about equally green on both surfaces, silky-appressed or glabrate, sometimes ciliate at the tips of the teeth; cauline leaves few, similar to the basal leaves, 3-to 5-foliolate; the inflorescence an open, few-to several-flowered cyme with thin pedicels; flower diameter may reach 2 cm; petals light yellow, obovate-cordate, 8-9 mm long, 6-8 mm wide; sepals lanceolate-acute to linear, sometimes yellow at their bases, 5-7 mm long, 1-2 mm wide; bractlets linear-lanceolate, slightly shorter than the sepals; the receptacle hairy, at least at its base, silvery-silky within; stamens 20 or more; filaments filiform; anthers oval to round in outline, or nearly so, about 0.5 mm long; pistils numerous; styles filiform, 2 mm long; achenes many, ovoid to pear-shaped, 1.4-1.5 mm long, 0.9-1 mm wide, lightly keeled along the ventral margin and thus appear bulged dorsally.

Type locality: Summits of the Rocky Mountains, British Columbia.

Distribution: From the Rocky Mountains of the Yukon, Alberta and British Columbia to New Mexico and Arizona;

Vancouver Island to the Sierra Nevada of central California; local in the Black Hills, South Dakota.

New Mexico: Wheeler, Truchas and Lake Peaks; near the head of the Nambe; Las Conchas, Pecos Baldy, Las Trampas Canyon; Sandia, San Francisco, San Pedro and Sacramento Mountains, 8,000-12,000 ft.

This species is usually described as a relatively small plant by most authors, and this appears to be true of most specimens examined. Some specimens, however, reach heights of 60 cm as described by other authors. Its most distinct characteristics are its thin leaflets, its rounded anthers, and its large light-yellow petals. In leaf form it resembles descriptions of P. gracilis and P. pulcherrima with which it may occur. It is reported to be confined to alpine environments and widespread near tree line and above.

In the transplant experiments of Clausen, Keck, and Hiesey (1940), it was shown to decrease markedly in size when moved to lower elevations. It was also shown to be a relatively distinct species with less individual morphological variation than members of P. gracilis. It was reported to flower earlier along with simultaneous development of the leaves, to be highly frost resistant, to produce mature achenes every year regardless of season abnormalities, and to produce an abundance of pollen. They also suggest that reproduction might be primarily sexual. The 2n chromosome number is variable, being 2n = 83-101 in

different plants. The high chromosome number has been inferred to be related to fitness and probably indicates a polyploid (hexaploid or octoploid) origin of P. diversifolia.

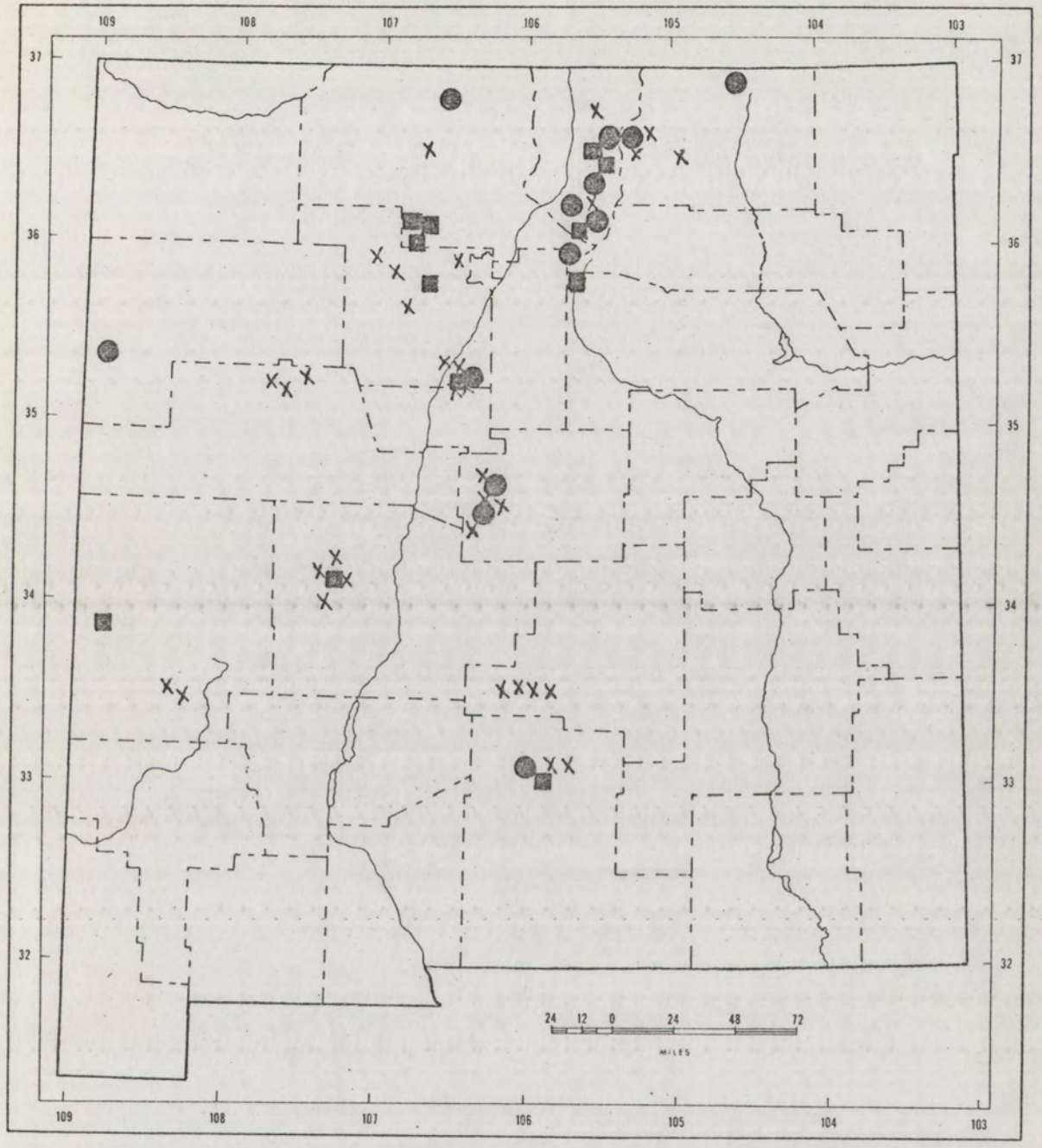
Because of its rapid development, it is well suited to the short growing season at high elevations and has been described as being in almost complete harmony with the climate in its native environments.

The species is most usually reported to flower from June through August, but the studies of Clausen, Keck, and Hiesey (1940) show that flowering may begin as early as March, at least, at some California localities.

Potentilla sierrae-blancae Wooton and Rydberg. Mem. Botan. Dept. Columbia Univ. 2: 57. 1898.

Plants perennial; stems low-growing, 4-6 cm high, slender, villous, almost leafless, one or few-flowered, arising from a branched caudex; basal leaves numerous, 5-foliolate, with slender petioles 3-4 cm long; leaflets oblong to linear, 0.5-3 cm long, slightly tapering at their base, entire except at the three-toothed apex, almost perfectly glabrous and dark green on both surfaces; the inflorescence is a one or few-flowered cyme; hypanthium villous, about 5 mm in diameter; sepals ovate-lanceolate, about 4 mm long; bractlets linear-oblong to obtuse, about two-thirds as long as the sepals; petals, stamens, pistils, and achenes not described.

Type locality: Sierra Blanca, New Mexico.



Map 6. Distribution of P. hippiana, P. diversifolia, and P. pulcherrima var. filipes.

Distribution: Known only from the type locality.

No specimens of the described type were available for study and its description is based on that given by Rydberg (1898, 1908), Wooton and Standley (1915), and Tidestrom (1941).

The species is apparently rare in New Mexico or at least not very abundant. In collecting in the White Mountains I encountered no specimens of the described type, nor were any present in an extensive collection of Bob Hutchins also from the White Mountains. The type description resembles in part P. bicrenata and P. concinna, but these are not glabrous throughout as described for this species, although some specimens of P. bicrenata do approach it. The shape of leaflets and teeth in P. bicrenata are also similar as is the described habitat.

It was collected first by Wooton in August, 1897, and its original description was based on one specimen which was already past flowering. It should occur in flower from June through July in areas of yellow pine and spruce. Potentilla bicrenata Rydb. Bull. Torrey Botan. Club 23: 431. 1896.

Perennials; stems short, erect or ascending, from a scaly rootstock, up to 12 cm high but usually 5-9 cm or less, thin, delicate, few-leaved, almost scapose, some with 3-5 short spreading branches; basal leaves digitate, usually 5-foliolate, occasionally 3-to 6-foliolate; petioles 3-4 cm long, with broad sheathing stipular bases; leaflets sessile

or short-stalked, silky, green above, ciliate along the margins, white-tomentose below, oblong or oblong-cuneate, entire except at the apex where there are usually 3-5 small teeth, rarely as many as 9; the mid-tooth of the terminal leaflet sometimes mucronate; the inflorescence 1-to 3-flowered; flowers 1-1.5 cm in diameter; receptacle hairy; petals 5, yellow, truncate-cuneate, or weakly obcordate-cuneate, 3-7 mm long, 2-4 mm wide; sepals ovate or ovate-lanceolate, entire, about equal to or two-thirds as long as the petals; bractlets somewhat shorter and narrower than the sepals; stamens 10-15 with filiform filaments; pistils numerous; styles filiform; achenes minute, 0.5 mm long, glabrous, laterally flattened but slightly swollen at the base.

Type locality: Agua Fria, New Mexico.

Distribution: New Mexico to Wyoming and south westward into Arizona.

New Mexico: Agua Fria, Stinking Lake, Tierra Amarilla, Las Trampas Canyon, 1 mile southwest of Truchas, and the Sandia Mountains.

This species appears reasonably distinct in its characteristics but may intergrade with other forms. It is combined with P. concinna by Harrington (1964) and by Martin and Castetter (1970). Specimens which I have determined to be P. concinna differ greatly from those I have determined to be P. bicrenata. It is not nearly as variable in leaf form or tooth pattern, nor has it been

seen by me in the same type of habitat. It is similar to descriptions of P. sierrae-blancae, but differs in having more teeth at the apex, and in not being glabrous throughout. It is supposedly related to P. oblanceoata, but does not have the type of serrate leaflets described for this species although the teeth are upwardly directed as in P. oblanceolata. It most closely fits the description and illustration in Rydberg (1898).

The species is limited in its distribution to a few of the southwestern states where it is reported to be found in stands of yellow pine. Our specimens are found in dry ground among yellow pine and also at lower elevations among pinon and juniper. It blooms from July through August.

Potentilla subviscosa Greene. Bull. Torrey Botan. Club. 8: 97. 1881.

P. subviscosa var. ramulosa Kearney and Peebles.

Perennials; stems many, prostrate to ascending, arising from short crowns of taproots, 20 cm or less in height, somewhat glandular, hirsute; leaves mostly basal, digitately 5-foliolate on petioles 3-5 cm long; cauline leaves reduced, 3-foliolate; leaflets 1-4 cm long, obovate-cuneate in outline, deeply cleft into oblong divisions; the middle leaflet often 3-parted to near the base; leaf surfaces sparingly villous, viscid glandular or sub-hirsute especially on the veins and near the margins; sepals ovate, acute to obtuse, glandular, about 4 mm long; bractlets

oblong or ovate to obtuse, shorter than the sepals; petals yellow, 5-6 mm long, narrow-cuneate, spatulate, one half longer than the sepals; pistils many but relatively few mature, leaving about 15; stamens 10-12; achenes glabrous but marked with irregular, somewhat branched, raised nerves on the surface; styles attached near the apex of the achene, short glandular-thickened at their base, or elongate-filiform.

Type locality: Mogollon Mountains, New Mexico.

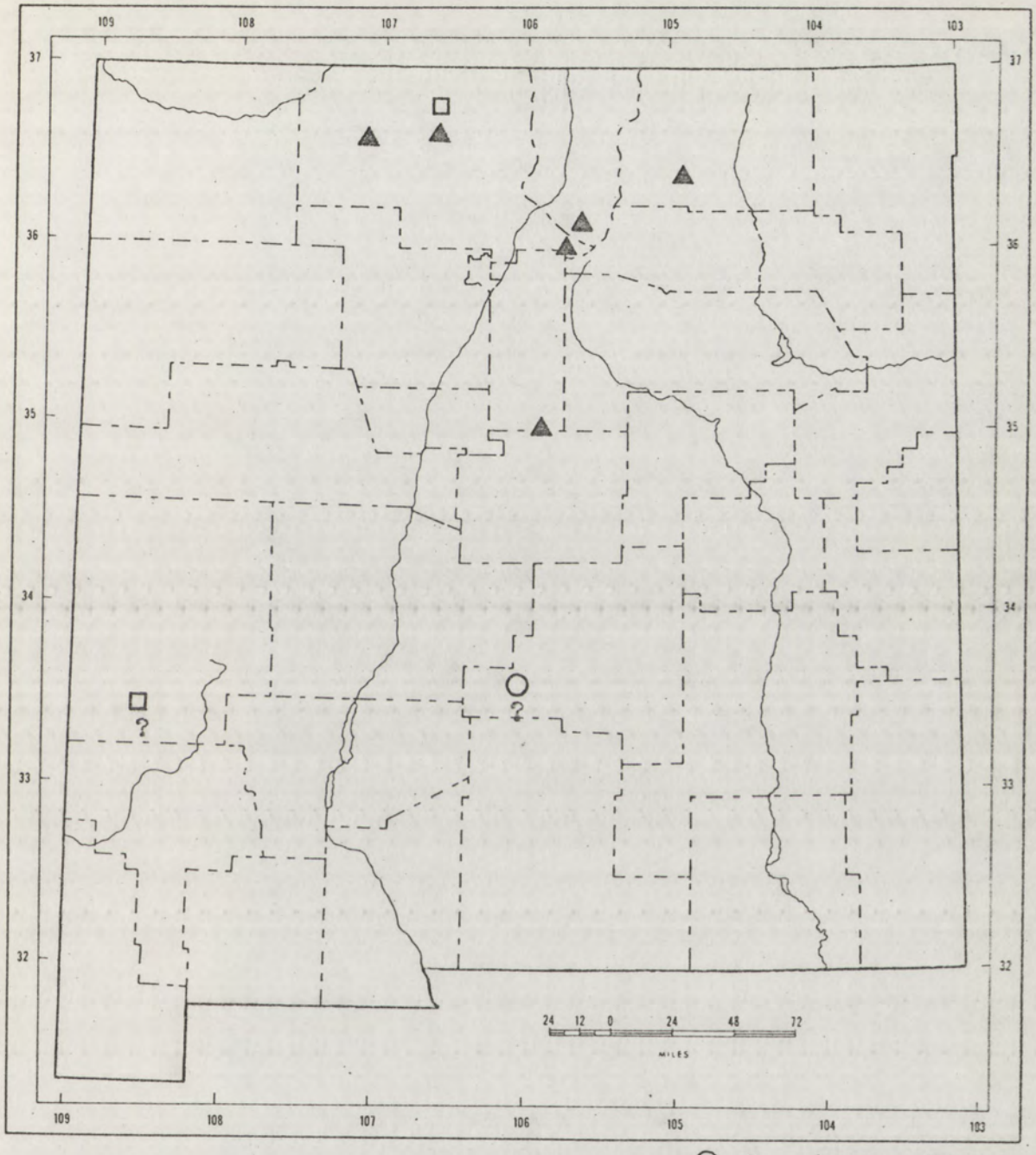
Distribution: Mountains of Colorado, Arizona, New Mexico, and northern Mexico.

New Mexico: Northern to western and southern, 7,000-10,000 ft.; Canjilon, Ruidoso, and Mogollon Mountains.

This species includes the var. ramulosa Kearney and Peebles. It is related to P. wheelerii Wats., and P. viscidula Rydb.

This species is supposedly more widespread than is indicated. None of this type are in The University of New Mexico Herbarium. It was first collected by Greene in April of 1881 and is apparently an early flowering type and therefore possibly not in bloom during time when I made collections in these areas. It is reported to occur in coniferous forests and flowering from April to June.

I have not examined any of the described species and its description is based on that given by Greene (1881), Rydberg (1896, 1898, 1908), Tidestrom (1941), Kearney and Peebles (1942, 1964), Harrington (1964), and Wooton and



Map 7. Distribution of P. sierrae-blancae, P. bicrenata, and P. subviscosa.

Standley (1915).

Potentilla concinnaeformis Rydb. Mem. Dept. Botan. Columbia Univ. 2: 54. Pl. 15, 1898.

Perennials; stems few, decumbent at the base, ascending, up to 20 cm high, usually smaller, very slender, lightly appressed to villous, brownish, arising from the crown of a scaly spreading rootstock; basal leaves digitate, 5-to 7-foliolate; petioles 2-4 cm long, villous sub-hirsute with spreading hairs; leaflets obovate to oblong-obovate, 2 cm long or less, about 7 mm wide, green, lightly silky above, gray-white silky to somewhat tomentose below; cauline leaves few, resembling the basal leaves, 3-to 5-foliolate, short petioled or sessile; the inflorescence an open few-flowered cyme; flower diameter 1.2 cm; receptacle silky-villous, glandular; petals 5, yellow, obovate-cuneate, often retuse, 5-7 mm long; 3-5 mm wide; sepals ovate-acuminate, 4-6 mm long, silky, yellow-green at their bases; bractlets oblong-lanceolate to linear-lanceolate, about one-third shorter than the sepals; stamens 20 or fewer, on slender filaments; anthers ovate yellow-brown, 1 mm long; pistils numerous; styles filiform, 2 mm long; achenes ovoid, glabrous, minute, 0.6 mm long, 0.5 mm wide.

Type locality: Mt. Agassiz, Arizona.

Distribution: Arizona to southern Utah, and New Mexico.

New Mexico: Collected only in the Jemez Mountains.

This species is similar in appearance to members of the section Graciles where it is undoubtedly included by some authors. It might also be combined with P. concinna because of its size, or with P. subviscosa because it is glandular. It has neither the variability in leaflet form that is common to P. concinna nor the cleft divisions described for P. subviscosa. It most closely resembles forms of the type I have called P. pulcherrima var. filipes, from which it differs mostly in size, and it possibly might be but a dwarf form.

These forms are always 5-to 7-foliolate, and like P. gracilis are always digitate. It is therefore probable that it is but a variant of species of the Graciles complex. It is similar to forms described as P. modesta but these are sometimes described as 3-to 5-foliolate. It resembles, at least in part, some descriptions of P. diversifolia, but differs in having larger anthers, and glandular pubescence. Its outstanding characteristics are: the very slender brownish stems, few flowers, small achenes, and small size.

This species has not previously been reported from New Mexico.

It occurs in mixed conifer at about 8,000-9,500 ft.; flowering from June through July. It should exist in similar areas throughout northern New Mexico.

Potentilla grayi Wats. Proc. Amer. Acad. 8: 560. 1873.

P. clarkiana Kellogg.

P. flabellifolia (Hook) Jepson.

P. flabellifolia var. grayi (Wats.) Jepson.

Perennials; somewhat tufted in appearance; stems one to several, 12-30 cm high, somewhat leafy, lightly hirsute below, glabrate above, arising from the crown of a thick primary root; basal leaves many, 3-foliolate, digitate or appearing pinnate; leaflets about equally green on both surfaces, glabrate to weakly strigose above, lightly strigose below mostly along the veins, broadly ovate, fan-shaped to nearly orbicular, coarsely serrate with 7-9 teeth; the middle leaflet with the terminal tooth smaller, lateral leaflets short-stalked or sessile, 1-4 cm long, 1.5-2.5 cm wide; cauline leaves similar to basal leaves, shorter petioled or sessile with their leaflets having 5-9 teeth; the inflorescence a moderately leafy cyme with short pedicels; petals 5, yellow, ovate, weakly emarginate, 4-5 mm long, 2-3 mm wide; sepals ovate-acute, entire, strigose, slightly shorter than the petals; bractlets ovate; about one half as long or nearly equal to the sepals; stamens about 20, anthers rounded; pistils numerous; styles filiform, attached below the apex of the achene, about equal in length to the achene; achenes numerous, striate, 1-1.1 mm long, 0.8 mm wide.

Type locality: Yosemite Valley, California.

Distribution: Mountains of California, northern New Mexico.

New Mexico: Collected only near Tererro in the upper

Pecos, San Miguel County.

The most obvious characteristics of this species are its 3-foliolate, tufted basal leaves which have long-stalked middle leaflets. It is apparently not widespread in New Mexico or has been included with forms which it resembles. As here described it does not completely fit descriptions of P. grayi. It resembles P. norvegica, P. rivalis var. millegrana, P. biennis and P. leucocarpa in the shape of some of the leaflets and in having numerous achenes, but neither of these have the noticeable long-stalked middle leaflet. Its achenes resemble those of P. norvegica and are more striate than those of P. rivalis var. millegrana, while the achenes of P. biennis and P. leuocarpa are described as smooth.

It is possible that I have placed to much emphasis on one or several characteristics thus, the specimens upon which the description is based might really be varieties of one of the above mentioned species. It has not been previously reported as present in New Mexico in any of the literature consulted.

Potentilla sibbaldii Hall f. ex. Ser., Mus. Helv. 1: 51. 1818.

Sibbaldii procumbens L.

P. procumbens Clairv.

Plants perennial; stems small, thin, scape-like, leaflets or few-leaved, strigose to hirsute, 1.5-4 cm high, arising from a scaly branching rhizome; basal leaves

3-foliolate, on thin, filiform petioles 1.0-3.0 cm long; leaflets ovate, entire with cuneate bases, 3-toothed from a truncate tip, short pilose on both surfaces, 0.5-1.5 cm long, 0.3-0.8 cm wide; the inflorescence a 2-to 5-flowered open cyme; sepals slightly hairy, ovate, 2 mm long, 0.8 mm wide; receptacle hairy; bractlets linear-lanceolate, slightly shorter than the sepals; petals 5, yellow, small, spatulate, 1.5 mm long, 0.8 mm wide, becoming almost white when dry; stamens about 5, on short filaments; pistils about 10; achenes few, small, smooth, 0.6 mm long, 0.3 mm wide.

Type locality: Lapland.

Distribution: Arctic and Alpine regions of America, from Greenland to Alaska, southward in the mountains of New Hampshire, westward through Colorado, New Mexico to California; also in Arctic-alpine regions of Europe and Asia.

New Mexico: Northern mountains, 10,500-13,500 ft.; Pecos Baldy, Red River, Truchas and Wheeler Peaks, and in the Santa Fe and Las Vegas Mountains.

This species is distinct in its appearance when compared to other potentillas. The scape-like stems, the relatively few, small flowers, and the truncate three-toothed leaflets make it easily identifiable.

It is reported by Coker (1966) to have better vegetative growth if found in sheltered freely-draining areas where the vegetation with which it is found is 2-5 cm

high, and absent when the associated vegetation is greater than 10 cm tall. It is very shade intolerant, highly frost and drought resistant, but can assume rapid new growth at the onset of favorable conditions. Coker also states that reproduction is vegetative as well as sexual. He reports that only about half of the seeds reach maturity but that their viability may be as great as 35-80 percent.

The chromosome number has been reported to be n = 7, Coker (1966).

In New Mexico the species is not vary abundant and is limited to the higher northern mountains. It is generally found in bald areas of short grass. Its frost and drought hardiness apparently make it well suited to the short growing season. It blooms from June through September.

This species is included as a separate genus of the Rosaceae by a number of authors but as a member of the genus Potentilla by about an equal number. It was first recorded as a British plant in 1684 and named after R. Sibbald.

Potentilla oblanceolata Rydb. Mem. Dept. Botan. Columbia Univ. 2: 53. 1898.

Perennials; stems few, short, about 10 cm high, few-leaves, simple, decumbent or spreading, silky villous, arising from the crown of a rootstock; basal leaves numerous, digitately 3-to 5-foliolate; leaflets green-silky above, white tomentose below, 3-5 cm long, narrowly

oblanceolate, serrate with narrow, small upwardly directed teeth; the hypanthium white tomentose and silky; petals yellow broadly obcordate; sepals lanceolate, equal to or slightly smaller than the petals; bractlets narrowly lanceolate, nearly equal to the sepals; pistils numerous; styles short-filiform; achenes not described.

Type locality: Southwestern Chihuahua, Mexico.

Distribution: Mountains of Chihuahua, Mexico, southwestern New Mexico and possibly southeastern Arizona.

New Mexico: Unknown localities in the southwestern part of the state, possibly Hidalgo or Catron Counties.

The above described species is based on the type collected by Palmer in 1885, locality unknown. It is related to P. concinna and might be a more southerly form of the same species, which it resembles. It resembles in part both P. bicrenata and P. sierrae-blancae. If it is a good species it is apparently quite rare in New Mexico, or possibly combined with the above mentioned types. No synonymy for this species exists in the literature, and few taxonomic keys include it. Only a note exists in Wooton and Standley (1915), of its presence in New Mexico.

No specimens of this type have been examined by me and its scant description is based on that given in Rydberg (1898, 1908), Tidestrom (1942).

The species is reported to be found in open dry areas, 6,000-7,000 ft. Its time of blooming has not been reported. Potentilla concinna Richards. In Frankl. 1st. Journ. 739.

1823.

P. concinna var. humifusa (Nutt.) Lehm.

P. concinna humistrata Rydb.

P. humifusa Nutt.

P. pulchella Spreng.

Perennials; stems few to many, densely villous throughout their length, slender, 15 cm tall or less; basal leaves digitately 5-foliolate, occasionally 7-foliolate, or young leaves 3-foliolate; petioles densely villous with spreading hairs, 8 cm long or shorter; leaflets more or less variable in size and shape, often in the same plant, obovate-cuneate, deeply toothed above the middle, or oblong and toothed to the base, usually 2-3 cm long (sometimes 4 cm), 0.8-1.5 cm wide, green, silky to glabrate above, silky to gray tomentose below, ciliate at the tips of the teeth; cauline leaves similar to the basal leaves but shorter petioled, 3-to 5-foliolate; the inflorescence a several-flowered open cyme; pedicels thin, 1-3 cm long; flowers 1-1.2 cm in diameter; petals 5, light yellow, obovate, sometimes retuse, 3-6 mm long, 3-5 mm wide; sepals ovate-acute, villous, 3-4 mm long, 2-3 mm wide, yellow-green along their inner bases; bractlets slightly shorter and narrower than the sepals; stamens 20 or fewer, their filaments filiform; pistils 20-30; styles terminal, filiform to slightly thickened at the base, about as long as or slightly longer than the mature achenes; achenes ovoid, glabrous when green, weakly striate when

mature, bearing a thin keel along their ventral margin, 1.8 mm long, 1.2 mm wide.

Type locality: Wooded regions of British America.

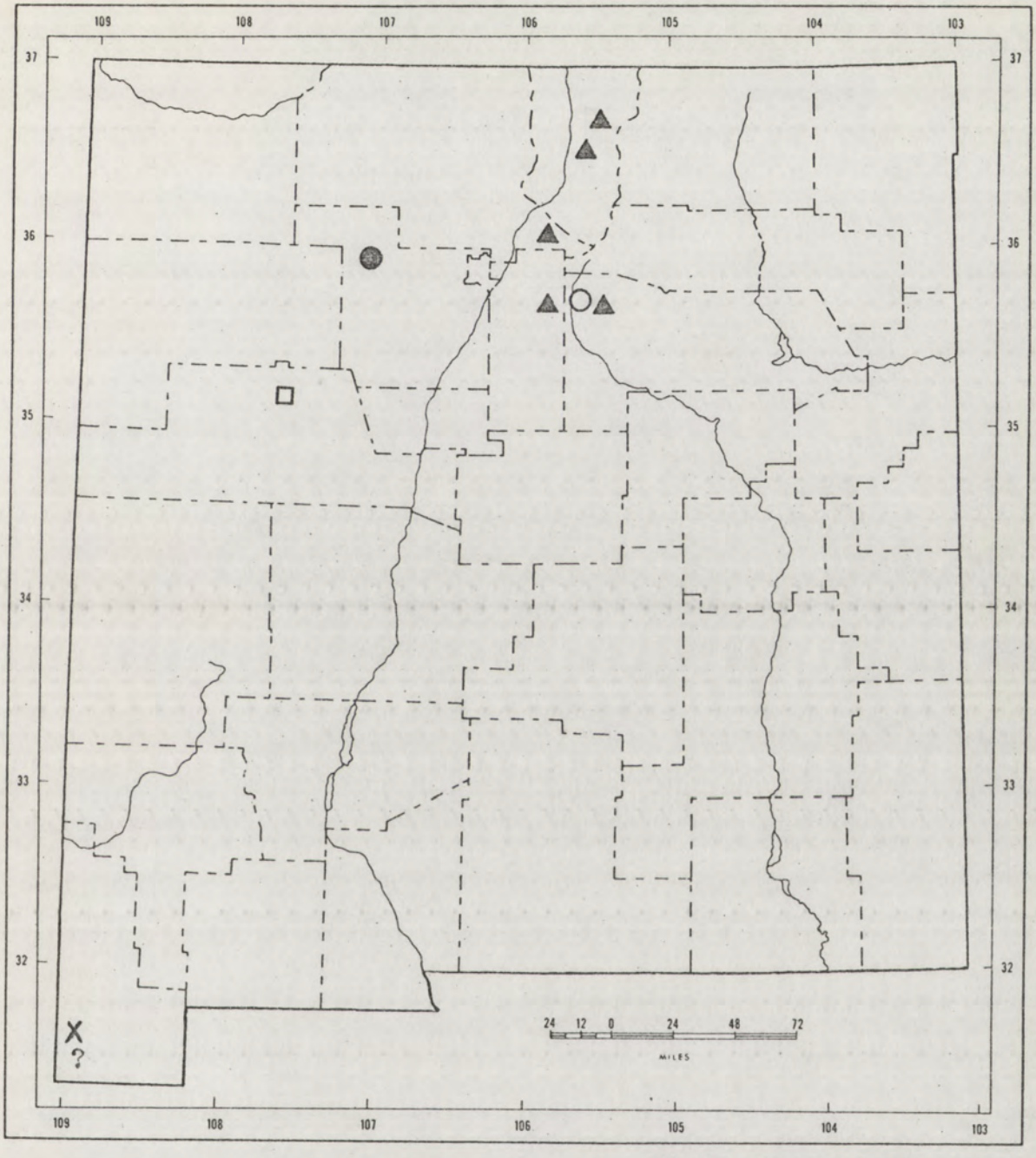
Distribution: Saskatchewan and Alberta, southward through Colorado, to New Mexico, westward through Arizona, Utah and Idaho.

New Mexico: Northern and central, Mt. Taylor, and Sugarette Canyon near Raton.

The outstanding characteristic of this species is the variability in the size, shape, and tooth pattern of the leaflets. The leaves too are very variable, being described by some authors as sometimes approximately pinnate. Other characters are also variable enough that complete contradiction may exist from one taxonomic description to the next. These variable characters are sometimes those considered as important in separating one species from another, but the lack of stability of these characters indicates that the species must intergrade with other taxa.

The character of the style which is used in separating this species from others is described as long and filiform by Harrington (1964), short and thick by Kearney and Peebles (1964), and short and filiform by Rydberg (1908), and Coulter (1909). In our specimens I find the styles filiform and not exceeding 2 mm in length.

Harrington (1964) and Martin and Castetter (1970) include P. bicrenata with this species. I find that it



Map 8. Distribution of P. concinnaeformis, P. grayi, P. sibbaldii, P. concinna, and P. oblanceolata.

varies greatly from the specimens I have determined to be P. bicrenata. This may indicate that they very greatly within their range. I find them more closely resembling descriptions of P. modesta Rydb. except that P. modesta is sometimes described as having numerous 3-foliolate leaflets by some authors.

The species flowers from May through July in mountain meadows in areas of Pinus ponderosa. It is probably more widespread than is indicated.

Potentilla rivalis Nutt., Torr. and Gray. Fl. N. Amer. 1: 437. 1840.

Tridophyllum rivale Greene.

Plants annual or biennial; stems several, erect to ascending, simple or branched below, branched above, villous-hirsute, somewhat glandular, sometimes tinged with purple or brown, leafy, 15-70 cm tall; leaves pinnate, on short petioles, 3-foliolate or the lower one 4-to 5-foliolate, sometimes all 3-foliolate, villous or glabrate; leaflets obovate, or cuneate-oblong, serrate or coarsely toothed, sometimes incised, the terminal leaflet sometimes 3-parted, 2-5 cm long; the inflorescence a leafy, branched cyme with ascending branches, pedicels short; sepals ovate-acute, 2.5-4 mm long; bractlets oblong, acute or obtuse, about 3 mm long, shorter than the sepals; petals small, 2.5 mm long, 1.8 mm wide, oblong-cuneate, shorter than the sepals; stamens 5-20; carpels many; styles terminal, short, 1 mm long, conical; achenes numerous,

light brown, smooth to weakly striate, about 1 mm long, 0.5 mm wide.

Type locality: Alluvial soil along Lewis River, Washington.

Distribution: British Columbia to Saskatchewan and Mexico.

New Mexico: Along streams and river valleys, wet ground, pinon and yellow pine belt, 5,500-7,500 ft.; Santa Fe Creek above Mimbres, Sugarette Canyon and Willow Creek.

The species closely resembles P. norvegica, particularly in forms which are 3-foliolate but differs in being glandular, having narrower leaves and smaller achenes. It differs from its variety P. rivalis var. millegrana in having longer more deeply incised leaflets, sometimes with coarser teeth, toothed nearly to the base and less cuneate in shape. It is found in more moist areas than P. norvegica which may be found far from any stream or water source. Its common name, brook cinquefoil, is indicative of the habitat in which it is found. It generally flowers from June through August. Potentilla rivalis var. millegrana (Engelm.) Wats./Lehm. Delect. Sem. Hort. Hamb. 11. 1849.

P. millegrana Engelm.

P. leucocarpa Rydb.

P. biennis Greene.

P. lateriflora Rydb.

Annual or biennial plants; stems several, slender, leafy, ascending, divaricately branched above and below, short-pilose to soft-hirsute or glabrate, somewhat glandular, green or tinged with brown or reddish brown, 10-60 cm high, arising from a moderately thick, often short, primary root; leaves digitately 3-foliolate with relatively short, hirsute petioles 2-4 cm long; all leaflets thin, coarsely toothed, cuneate oblong or oblanceolate to obovate-cuneate, truncate in outline, about equally green and only slightly pilose on both sides; larger leaflets reach 4-5 cm in length, 2 cm in width and may be toothed to the base, they are more generally 1-3 cm long, 0.8-1.2 cm wide; the inflorescence a leafy, open, many-flowered, short-pedicelled cyme, with flowers arising even from near the base; petals 5, light yellow, narrowly obovate, 2.5-3 mm long, 2-2.2 mm wide; sepals lanceolate-ovate, 3-5 mm long, larger than the petals, brownish-pubescent at their bases; bractlets similar to and equaling the sepals or only slightly shorter; stamens 10-15; pistils numerous; styles short, less than 1 mm in length, thickened at their base; achenes numerous, smooth to weakly striate, white to light brown, small, usually less than 1 mm long.

Type locality: St. Louis, Missouri.

Distribution: Illinois to Manitoba and Washington, southward to New Mexico and California.

New Mexico: Mountains; 5,500-7,500 ft.; Gila

Wilderness, Sapello Creek, Upper Pecos, Santa Barbara and Las Trampas Canyons, Wheeler Peak, near Tererro, north of Ramah, and the Sandia Mountains.

The species is apparently very variable as shown by the large number of synonyms. P. biennis Greene, which I have included as a synonym as well as P. millegrana Engelm., are often given full species status but I find no distinct character which will separate these and have chosen to include them under the variety of P. rivalis. They are similar enough that even varietal status may not be deserved. The taxa here included, resemble P. norvegica in a number of characters and sometimes differ in the degree to which the character is expressed. They differ in being glandular and more diffusely branched. The name, var. millegrana, is indicative of the numerous small achenes. The achenes are usually described as smooth and such is the case when green, but mature achenes are often striate.

The species is widespread from June through August in about the same montane environments as P. rivalis var. rivalis.

Potentilla norvegica L. Sp. Pl. 499. 1753.

P. monspeliensis L.

P. norvegica hirsuta Michx.

P. monspeliensis norvegica Rydb.

Annuals or biennials; stems leafy, stout, 20-60 cm high, mostly ascending, sometimes erect, often tinged with

brown or red, branching above, soft hirsute or villous along their length, arising from a slender taproot; basal leaves digitately 3-foliolate on hirsute petioles 2-8 cm long; cauline leaves smaller, narrower but similar to basal leaves; leaflets sessile or short-petioled, soft-hirsute, about equally green on both surfaces, obovate, serrate 3-3.5 cm long, 2-2.5 cm wide; the inflorescence a leafy, many-flowered cyme; petals 5, yellow, obovate, 2.5-3 mm long, 2-2.5 mm wide, shorter than the sepals; calyx of 5 ovate-acute sepals 4-5 mm long, 2.5-3 mm wide, longer than the petals; bractlets oblong-ovate, sometimes acute, equal to the sepals; stamens about 20, with small almost round to cordate anthers; styles numerous, conical, 1 mm long, somewhat thickened at their base; achenes numerous, small, brown, longitudinally striate to rugulose, 1 mm long, 0.5 mm wide.

Type locality: Botanical Garden, Montpellier, France.

Distribution: Europe and Asia, Greenland and Labrador to Alaska, southward and westward through Kansas, New Mexico, and California.

New Mexico: Mountains; 5,000-9,000 ft.; Farmington, Chama, Pajarito Park, Mt. Taylor, Wheeler Peak, Santa Fe, Las Vegas, Tunitcha and Mogollon Mountains.

The populations of P. norvegica are apparently very complex morphological variations, having been treated as separate species under a variety of specific epithets. In spite of their variability the chromosome number has been

reported to be constant at n = 28, Munz (1959). This species closely resembles the described P. biennis Greene, P. millegrana Engelm., P. rivalis Nutt., and P. nicolletii Wats. In P. norvegica, however, stems are usually stouter and less branched and the achenes larger also the leaflets are more broadly obovate than in P. millegrana, the leaves are not more than 3-foliolate, in contrast to 3-7 leaflets in P. rivalis and P. nicolletii, and the middle leaflet is not 3-parted as described for P. rivalis. The group is more widespread in New Mexico than is apparent by specimens in my collection or those in The University of New Mexico Herbarium. Specimens from Wheeler Peak and Mt. Taylor resemble one another more than those from Catron County which have more deeply cleft instead of serrate leaflets and more slender stems. The species is found in disturbed areas, roadsides, and clearings, generally in moist ground; flowering from June through October.

Potentilla paradoxa Nutt.; Torr. and Gray. Fl. N. Amer. 1: 437. 1840.

P. supina Michx.

Tridophyllum paradoxum Greene.

Annual, biennial, or short lived perennial; stems 30-60 cm high, 4 mm thick, somewhat leafy, ascending or decumbent, sparingly villous to hirsute above, villous to glabrate below, sometimes weakly striate along their length; all leaves pinnate, with 4-5 pairs of widely

separated leaflets on a long villous rachis which may reach 30 cm in length; leaflets sessile, 6-9 cm long, 2-3 cm wide, green and glabrate above, gray-green and lightly villous below, oblong-obovate, coarsely dentate, cuneate, ciliate only at the tips of the teeth, the lower-most pair often remote on the rachis, the upper-most pair strongly decurrent and sometimes confluent; cauline leaves similar to basal leaves but smaller; the inflorescence an open, many-flowered cyme; flowers about 1.2 cm in diameter; petals 5, yellow, obovate-cuneate, sometimes emarginate, 4-5 mm long, 3-4 mm wide, equal to or only slightly exceeding the sepals; sepals ovate-acuminate; bractlets oblong-ovate, shorter than the sepals; receptacle villous, the hairs brownish; stamens about 20; pistils numerous; styles thin, 2 mm long, slightly thickened at their base; achenes numerous; 1.5 mm long, 1.0 mm wide, sometimes weakly striate but mostly smooth with a prominent wing-like enlargement along the ventral surface.

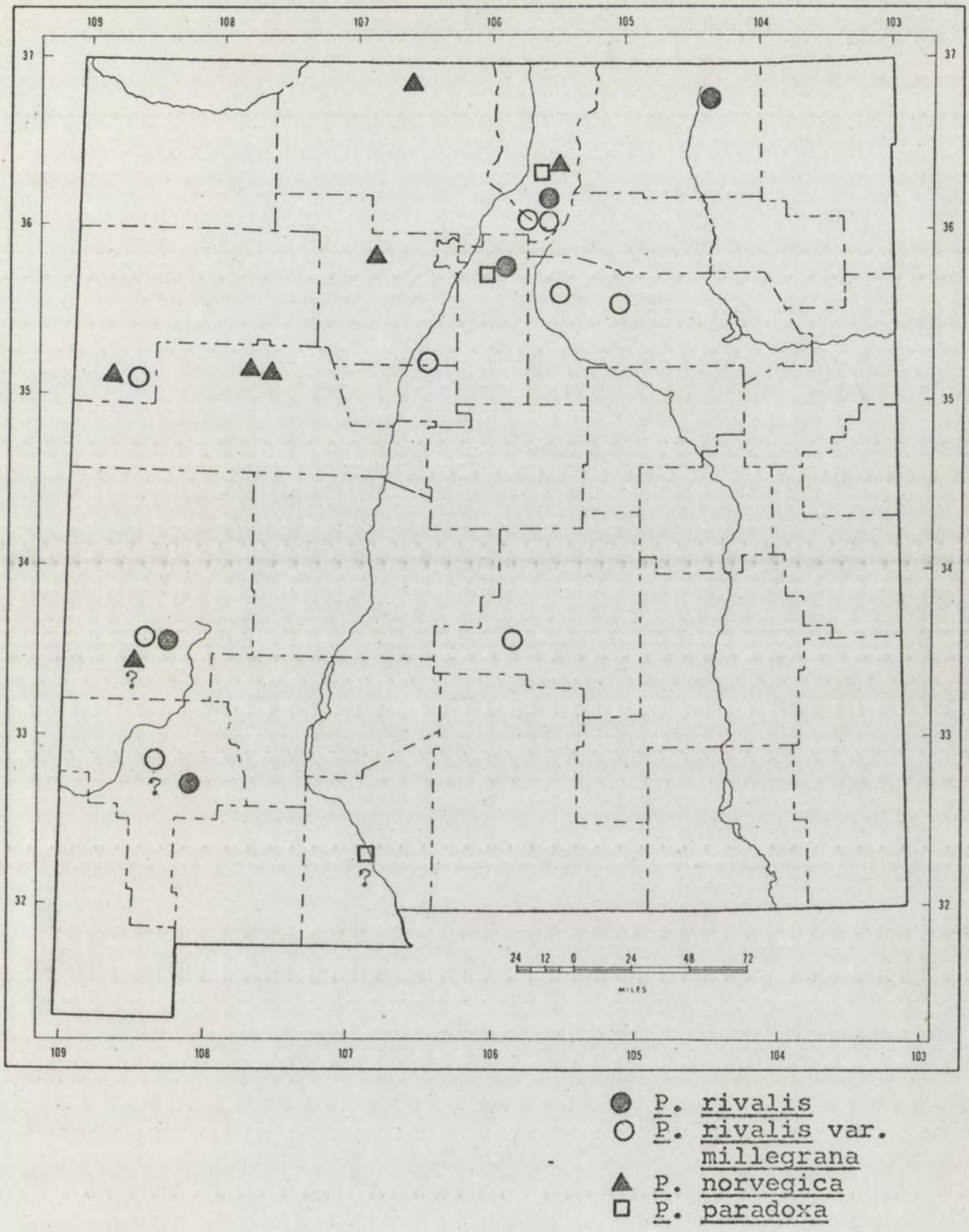
Type locality: Banks of the Ohio.

Distribution: New York and Ontario to Washington and New Mexico; also in Mexico and eastern Asia.

New Mexico: Fields, valleys and mountains; 4,500-8,000 ft.; Santa Fe, Mesilla Valley, Hondo Canyon.

The species is recognized principally by its bushy appearance, prominent corky enlargement along the ventral margin of the achene, and by the widely spaced leaflets. It resembles P. ambigens in general leaf shape and in

having some leaflets decurrent, but differs in being stouter and in having coarsely dentate leaflets. It occurs in damp ground in mountain regions and according to Wooton and Standley (1915) at lower elevations in the sandy bed of the Rio Grande. The species is distinct and does not appear to intergrade with others found in the same locality. Its name is derived from the strange prominent enlargement on the ventral suture of the achene, Fernald (1950). The species is probably more widely distributed in New Mexico than is apparent by the known distribution and should exist throughout the northern half of New Mexico in moist, mountain areas. Flowering occurs from June through August.



Map 9. Distribution of P. rivalis, P. rivalis var. millegrana, P. norvegica, and P. paradoxa.

SUMMARY AND CONCLUSIONS

Through observations made on the genus in the field, from a comparison of individual specimens, and from accounts in the literature, the following conclusions have been drawn.

1. Field observations indicate the following:

A. Occurrence and modifications. The taxa usually occur in sympatry with other species of the genus and most are found in montane habitats, usually between 7,000-9,000 ft., but sometimes they may occur at higher or lower elevations as well. The habitats occupied range from dry south-facing exposed slopes of gravel and scant grass to mountain meadows or windswept crests, near or far from streams or other water sources. They often occupy disturbed areas and are abundant along roadsides and campgrounds. All taxa appear to be hardy and able to compete with associated vegetation wherever found. With at least some widely occurring species, environmental modifications, particularly in size of parts, are very evident. For example, P. fruticosa becomes greatly stunted at higher, drier elevations. Other modifications, particularly in the degree of pubescence, are evident. Most taxa when growing in the shade are less pubescent throughout than when found growing in the open.

B. Reproduction. It is mostly vegetative, from spreading, branching rhizomes, from crown buds, or occasionally by means of stolons. Reproduction is

undoubtedly sexual, as well, since abundant pollen and numerous achenes are commonly produced. Flowering occurs throughout the summer in most species.

C. Associated animals. Many species are apparently insect pollinated as honeybees, bumblebees, and large moths have been seen visiting the blossoms of most species collected. Other organisms seen in association with the species include aphids, small red mites and small brown beetles which are undoubtedly parasites, and are found more abundantly on glandular-viscid types of potentillas. Larger animals may browse certain potentillas.

2. Other observations and accounts in the literature indicate the following relationships:

Potentilla fruticosa is not closely related to other potentillas and is distinct in being the only woody shrub. Potentilla arguta, P. fissa, and P. glandulosa are closely related to one another but not closely related to other potentillas. Potentilla thurberi is morphologically similar to other digitate potentillas but distinct in its red petals. No hybridization is indicated between it and yellow-petalled potentillas, thus it is apparently not closely related to the latter. Potentilla anserina does not appear to be closely related to other taxa. Its almost complete lack of stems and its stoloniferous method of propagation make it distinct. No hybridization between it and other taxa is indicated. Potentilla pennsylvanica and P. plattensis appear closely related to one another in

general morphology but unrelated to other taxa. Potentilla crinita, P. hippiana, and P. ambigens, although often differing greatly from one another, may show intermediate characteristics for leaf shape and are apparently capable of hybridizing but able to retain a reasonable degree of recognizable individuality. Potentilla pulcherrima appears to be related to both pinnate and digitate taxa and may be linked to P. diversifolia, P. concinna, and P. concinnaeformis at one extreme and to P. hippiana at the other when they occur sympatrically. Digitate and sub-pinnate forms of P. pulcherrima, P. diversifolia, and P. concinna occur and hybridization between these and other taxa is indicated. Potentilla sierrae-blancae, P. bicrenata, P. oblanceolata, P. subviscosa, and P. concinna appear to be related in a number of characters, and at least P. bicrenata and P. concinna have been combined in the same taxon by several authors. There is an indication that P. concinna is highly variable and that several similar taxa may be but environmental modifications or ecological races of P. concinna. Potentilla sibbaldii does not appear closely related to any other potentillas, and it does not appear to hybridize with any other potentillas. Potentilla rivalis and P. norvegica appear more closely related to one another than to P. grayi which differs principally in its tufted basal leaves with long stalked middle leaflets. Neither of these three species appear closely related to

the other potentillas in New Mexico. *Potentilla paradoxa* is more closely related to *P. rivalis* than to other potentillas in New Mexico, but is distinct in the prominent enlargement on its achenes and its bushy appearance.

LITERATURE CITED

Bowden, W. M. 1957. Cytotaxonomy of Potentilla fruticosa, allied species and cultivars. J. Arnold Aboretum 38:381-388.

Clausen, J., D. Keck, and W. M. Hiesey. 1940. Potentilla glandulosa and its allies, Potentilla gracilis and its allies. Carnegie Inst. Wash. Publ. 520:26-175.

Clausen, J., and W. M. Hiesey. 1958. Genetic structure of ecological races: the ecological races of Potentilla glandulosa. Carnegie Inst. Wash. Publ. 615:1-155.

Coker, P. D. 1966. Sibbaldia procumbens L. J. Ecol. 54(3):823-831.

Coulter, J. M., and A. Nelson. 1909. New manual of botany of the Rocky Mountains. American Book Co., New York. 646 p.

Fernald, L. M. 1950. Gray's manual of botany. Eighth ed. American Book Co., New York. 1,632 p.

Greene, E. L. 1881. Potentilla subviscosa. Bull. Torrey Botan. Club 8:97.

Harrington, H. D. 1964. Manual of the plants of Colorado. Sage Books, Denver. 666 p.

Harrington, H. D. 1967. Edible native plants of the Rocky Mountains. Univ. of New Mexico Press, Albuquerque, New Mexico. Pp. 201-203.

Jepson, W. L. 1957. A manual of the flowering plants of California. Univ. of California Press, Berkeley. 1,238 p.

Kearney, T. H., and R. H. Peebles. 1939. Potentilla crinita var. Lemmonii. Wash. Acad. Sci. 29:480.

Kearney, T. H., and R. H. Peebles. 1942. Flowering plants and ferns of Arizona. U. S. Government Printing Office, Washington. 1,069 p.

Kearney, T. H., and R. H. Peebles. 1964. Arizona flora. Eighth ed. Univ. of California Press, Berkeley. 1,081 p.

Keck, David D. 1938. Revision of Horkelia and Ivesia. Lloydia 1:74-142.

Martin, W. C., and E. F. Castetter. 1970. A checklist of gynmosperms and angiosperms of New Mexico. Dept. of Biology, Univ. of New Mexico, published privately. 245 p.

Munz, P. A., and D. D. Keck. 1959. A California flora. Univ. of California Press, Berkeley. 1,681 p.

Rydberg, P. A. 1896. Potentilla subviscosa. Bull. Torrey Botan. Club 23:430.

Rydberg, P. A. 1898. A monograph of the North American Potentilleae. Mem. Dept. Botan. Columbia Univ. 2: New Era Printing Co., Lancaster, Pa. 224 p.

Rydberg, P. A. 1901. Potentilla propinqua. Bull. Torrey Botan. Club 28:176.

Rydberg, P. A. 1906. Flora of Colorado. Agr. Exp. Sta. of the Colorado College of Agr., Fort Collins, Colorado. 448 p.

Rydberg, P. A. 1908. Potentilla, in N. Amer. Flora. 22: 268:376.

Rydberg, P. A. 1922. Flora of the Rocky Mountains and adjacent plains. Second ed. Intelligence Printing Co., New York. 1,143 p.

Tidestrom, Ivar. 1941. A flora of Arizona and New Mexico. Catholic Univ. Press, Washington, D. C. 899 p.

Wooton, E. O., and P. C. Standley. 1915. Flora of New Mexico. Contrib. U. S. Nat. Herb. 10:1-794.

APPENDIX

APPENDIX

Citation of Specimens

Potentilla fruticosa L. Bernalillo Co.: Sandia rim, 6/29/30, Castetter 5,692 (269); Sandia Crest, south of observation platform, 9/9/64, Powers 47 (36,219); Sandia Crest, 7/5/61, Potter 538 (33,413); Sandia rim, near Kiwanis cabin, 8/20/69, Garcia 938, 939. Catron Co.: Tularosa Mts., 9/4/48, Norris and Zweifel (11,784); Gallita Forest Camp, Mogollon Mts., 8/10/52, Castetter 5,709 (8,586); Gallita Campground, Mogollon Mts., 6/21/52, Castetter and Dittmer 5,711 (7,247); Willow Creek, Mogollon Mts., 5 mi. east of Bearwallow Mountain, 8/20/58, Jones (24,590); Willow Creek, 6/9/61, Jones (26,002); Willow Creek, Mogollon Mts., 6/14/69, Jones (25,372); Willow Creek, Mogollon Mts., 8/20/58, Jones (24,595); 10 mi. east of Mogollon, 7/7/62, Jones (32,037); Willow Creek, Mogollon Mts., 7/5/69, Garcia 113; Indian Creek, Mogollon Mts., 7/5/69, Garcia 156. Colfax Co.: road to Agua Fria Peak, 8/10/69, Gordon and Norris 411 (11,793); Cimarron Canyon, 1 mi. east of fish hatchery, 8/26/69, Garcia 1,457; Eagle Nest, open meadow along Highway 64, 8/26/69, Garcia 1,409. McKinley Co.: 8 mi. west of Whiskey Lake, Chuska Mts., 7/22/35, Carter 8,210 (12,711). Rio Arriba Co.: San Pedro Peak, San Pedro Mts., 7/25/64, Fleck (43,565), 7/4/63 (43,569); near Escondido, 10/62, Miller 255 (35,050); north of Chama, 7/23/49, Castetter and Dittmer 5,497 (10,318); north of Chama,

8/7/51, Clark 15,988 (12,508); 3 mi. northeast of Canon Plaza, 8/6/66, Christenson (38,115); Chama, near Chama River, 8/30/69, Garcia 1,533; 1 mi. north of Chama, 8/30/69, Garcia 1,532. Sandoval Co.: 4 mi. east of intersection St. Rd. 126 on St. Rd. 4, 7/8/56, O'Neill 1 (27,612); Valle Grande, Jemez Mts., 7/9/60, Jones 160 (25,769); La Cueva, Jemez Mts., 9/15/30, Castetter 5,693 (271); Las Conchas, 9/18/60, Howe 3 (31,690); Jemez Mts., along Cebolla Creek, 6/20/69, Garcia 18. San Juan Co.: Washington Pass, Lookout Station, Chuska Mts., 9/2/58, McKnight 580, 802, 202 (24,120). San Miguel Co.: Evergreen Valley 7/20/65, Broeske (42,730); 3 mi. southeast of Cowles, 9/20/69, Garcia 2,085; Pecos Wilderness Area above Panchuela Campground, 9/20/69, Garcia 2,086. Santa Fe Co.: Santa Fe Canyon, 8/31/62, Weissenborn 79 (35,326). Socorro Co.: east slope Water Canyon, Magdalena Mts., 9/10/59, Martin 3,663 (25,008). Taos Co.: 1 mi. above Twinning, 6/10/51, Clark (6,586); Costilla Canyon, 7/18/53, Castetter 5,708 (8,795); Pot Creek above Ft. Burgwin, 6/25/61, Potter 507; near Wheeler Peak, 7/24/65, Bobisud 216 (42,188); near Tres Piedras Dist., 7/62, Scoggins 45 (38,724); Tres Piedras Dist., 7/62, McKenzie 60 (38,720); trail to Wheeler Peak through Twinning Canyon, 8/7/49, Gordon and Norris 345 (11,792); La Junta Canyon, above Tres Ritos, 7/4/48, Dittmer 5,498 (10,317); top of Gold Hill, above timber line, 8/13/55, Castetter 9,816 (19,936); Hondo Canyon, Wheeler Peak ski

area, 8/23/69, Garcia 1,086; Santa Barbara Canyon, along Santa Barbara Creek, 7/26/69, Garcia 598. Valencia Co.: Lee's Horse Camp, Mt. Taylor, 7/9/32, Castetter 5,690 (2,092).

Potentilla arguta Pursh. Colfax Co.: Johnson Mesa, 8/16/10, Wooton (18,560); Sugarette Canyon, southside of Lake Maloya, 8/25/69, Garcia 1,267, 1,268, 1,269. Rio Arriba Co.: Ensenada, 8/16/04, Wooton 2,712 (18,889). Sandoval Co.: 4 mi. east of Cuba, on St. Rt. 126, 7/16/56, O'Neill (37,704). Taos Co.: Hondo Cabin, Carson National Forest, 6/9/60, Dixon 74 (26,091).

Potentilla glandulosa Lindl. Catron Co.: fish hatchery near Glenwood, 5/14/60, Martin 4,060 (28,674). Lincoln Co.: Bear Canyon, west of Bonita Lake, White Mts., 5/12/61, Tomlison (29,534).

Potentilla thurberi A. Gray. Catron Co.: Willow Creek, Mogollon Mts., 8/20/58, Jones (24, 588); ½ to ¼ mi. south of highway on east slopes on top of San Francisco Mts., 8/67, Pierce 20,163 (38,768A), (38,768B); between Mogollon and Willow Creek, Mogollon Mts., 7/23/59, Jones (24,672); Willow Creek, vicinity of creek, 7/25/62, Martin and Jones (29,142). Grant Co.: locality unknown, 8/15/63, Turner 300 (35,618); East Canyon, Sec. 17, 8/27/63, Ingersoll 144 (35,206); Iron Canyon, Black Range, 7/22/59, Jones (29,466). Lincoln Co.: vicinity of Bonita Lake, White Mts., 8/20/68, Hutchins 1,465 (41,948); south Fork Creek area, White Mts., 8/31/68, Hutchins 1,638 (41,618);

8/1/65, 728 (41,769); 2.4 mi. west of Alto, 8/18/49, Gordon and Dunn 840 (11,794); near Ruidoso, 7/4/49, Castetter and Dittmer 5,710 (8,686). Otero Co.: Bear Canyon, Mescalero Reservation, no date, Humphrey 13 (12,707). Sandoval Co.: headwaters of Guadalupe, Jemez Range, 7/23/32, Williams 5,505 (1,861). Sierra Co.: Black Range, Wright Campground, 9/11/50, Clark 3,277 (3,277), 3,278 (3,278); Black Range, 8/15/46, Clark 14,036 (21,880). Socorro Co.: Beartrap Canyon, 10/3/64, Moore (36,555); Magdalena Mountains, 6 mile trail, 9/14/69, Garcia 2,006.

Potentilla thurberi A. Gray var. atrorubens (Rydb.). Catron Co.: 3 mi. east of Mogollon, Mogollon Mts., 7/26/62, Martin and Jones 126 (30,905); Mogollon Mts., Willow Creek Ranch, 7/5/69, Garcia 232, 233, 234, 235, 236, 237, 238, 239, 240. Grant Co.: Black Range, east of Santa Rita, woods along stream, 8/13/42, Clark 10,354 (5,725). Lincoln Co.: south fork of Eagle Creek, 5 mi. west of Alto, White Mts., 7/21/69, Hutchins 2,273 (42,921); White Mts., 7/29/23, Ewing, E-42 (1,528); White Mts., 7/29/23, Nelson 5,695 (1,825). San Miguel Co.: Gallinas Canyon, 7/15/65, Broeske (42,727). Socorro Co.: Beartrap Canyon, San Mateo Mts., 7/27/60, Jones 504 (25,633); Beartrap Canyon, San Mateo Mts., 7/29/61, Jones (36,373).

Potentilla anserina L. Bernalillo Co.: east of Bernalillo bridge, 6/30/53, s.n. 5,681 (1,445). Catron

Co.: below Fox Mt., Martin and Jones 154 (30,616); edge of Wall Lake, 6/21/52, s.n. 5,704 (1,448); Willow Creek, 10 mi. east of Mogollon, Mogollon Mts., 6/14/60, Jones 87 (28,771); 10 mi. east of Mogollon, 7/24/60, Jones 472 (28,660); 12 mi. east of Beaverhead, 6/20/52, s.n. 5,698 (34,491). Colfax Co.: Eagle Nest Lake, meadow, 7/17/32, Nelson 5,501 (2,156); Cimarron Canyon, along Cimarron River, 1 mi. below Eagle Nest Dam, 8/26/69, Garcia 1,488. Guadalupe Co.: south bank of Pecos River, 2 mi. west of Santa Rosa, 6/18/51, Clark (6,713). Mora Co.: Shoemaker Canyon, 6/7/65, Broeske (42,724). Otero Co.: near Cloudcroft, 9/16/57, s.n. (33,971), (35,971). Rio Arriba Co.: Truchas Peak, 8/6/49, Gordon and Norris 202 (11,788); roadside Ojo Seco, near Truchas, 6/14/52, s.n. (14,438); Ensenada, near Brazos River, 8/30/69, Garcia 1,637, 1,638; 1 mi. northwest of Chama, along N.M. 29, 8/30/69, Garcia 1,582, 1,583. Sandoval Co.: La Cueva, Jemez Mts., 8/11/31, Nelson 5,500 (659). Socorro Co.: 19 mi. west and 2 mi. south of Magdalena, Beartrap Canyon, San Mateo Mts., 7/12/57, Fleharty 7 (23,623). Taos Co.: Santa Barbara Canyon, east of Rodarte, 7/26/69, Garcia 736, 737; Santa Barbara Canyon, east of Penasco, 7/17/53, s.n. 5,701 (14,468); Las Trampas Canyon, below El Valle, 8/31/69, Garcia 1,741, 1,742, 1,743.

Potentilla pennsylvanica L. Bernalillo Co.: Sandia rim, Sandia Mts., 7/8/31, Nelson 5,502 (825); Sandia Crest, near Kiwanis cabin, 8/20/69, Garcia 969, 970.

Catron Co.: 4 mi. north of Collins Park, 7/25/62, Martin 20 (29,121); several mi. north of Beaverhead, 6/21/52, s.n. 5,703 (14,447). Colfax Co.: north of Raton, Lake Maloya, 8/25/69, Garcia 1,215, 1,216, 1,217; summit of Flechado Pass, 8/26/69, Garcia 1,446; Eagle Nest, along roadside, Highway 64, 8/26/69, Garcia 412, 413. Lincoln Co.: Skyline Picnic Area, White Mts., 8/1/65, Hutchins 782 (41,797). San Miguel Co.: above Panchuela Campground, 9/20/69, Garcia 2,082, 2,083, 2,084. Socorro Co.: Magdalena Mts., South Baldy summit, 9/14/69, Garcia 1,947, 1,948, 1,949; Timber Peak, road to South Baldy, Magdalena Mts., 9/14/69, Garcia 1,950, 1,951, 1,952. Taos Co.: Red River Pass, 8/8/51, Clark 16,046 (11,246); Costilla Canyon meadow, 7/18/53, s.n. 5,700 (14,469); Hondo Canyon, 8/23/69, Garcia 1,056, 1,057, 1,058, 1,059, 1,060, 1,061. Valencia Co.: near La Mosca Lookout, Mt. Taylor, 7/12/60, Jones 238 (28,738); 9 mi. northeast of La Mosca Lookout, Mt. Taylor, 7/19/69, Garcia 404, 405, 406.

Potentilla plattensis Nutt. Bernalillo Co.: Sandia Peak, 8/5/49, Gordon and Norris 174 (11,796). Taos Co.: meadow near Red River, 7/2/32, Nelson 5,691 (2,346).

Potentilla crinita A. Gray. Bernalillo Co.: Sandia Crest, 7/31/51, Dittmer 5,689 (6,672). Catron Co.: 12 mi. east of Beaverhead, 6/20/52, s.n. 5,698 (14,490); lakeside head of Largo Canyon, near Reserve, 8/7/52, s.n. 5,705 (14,445). Rio Arriba Co.: Chama, road to cemetery,

8/30/69, Garcia 1,584, 1,585; 1 mi. north of Chama, along St. Rd. 29, Garcia 1,598, 1,599; south of Tierra Amarilla near junction of Highway 162 and 84, Garcia 1,677. Taos Co.: 4 mi. west of Santa Barbara Campground, 7/26/69, Garcia 733, 734, 735.

Potentilla crinita A. Gray var. lemmonii (S. Wats.). Lincoln Co.: 2 mi. north of Ruidoso, near junction of Highway 37 and Alpine Village Rd., 9/7/69, Garcia 1,890, 1,891, 1,892, 1,893. Rio Arriba Co.: 1 mi. west of Canjilon, off St. Rd. 110, 8/30/69, Garcia 1,565, 1,566, 1,567, 1,568; .2 mi. south of junction of Highway 162 and 84, 8/30/69, Garcia 1,678.

Potentilla pulcherrima Lehm. Lincoln Co.: White Mts., gravel loam of South Fork Creek area, 8/31/68, Hutchins 1,646 (41,614); gravel loam of Sierra Blanca Ski area, east slope, 8/21/68, Hutchins 1,582 (40,162); gravel loam of South Fork Creek area, White Mts., 8/1/65, Hutchins 762 (41,809); White Mts., east-facing slope, 8/21/65, Hutchins (41,634); White Mts., south fork of Eagle Creek, 7/21/69, Hutchins 2,261 (42,907); White Mts., 1 mi. south of Monjeau Lookout, 7/2/69, Hutchins 2,216 (43,288); White Mts., 1 mi. south of Monjeau Lookout, gravel loam of Skyline Picnic Area, 10/26/68, Hutchins 1,757 (42,020). Otero Co.: White Mts., gravel loam of Lookout Point, 9/1/68, Hutchins 1,705 (41,703); Sacramento Mts., 3 mi. east of Cloudcroft, with spruce-fir, open woods, 6/7/59, Martin 3,169 (32,443). Rio Arriba Co.:

Placer Cr., Sec. 24, T29N, R6E, loam, 7/28/67, Gierisch 3,150 (40,093); San Pedro Mts., San Pedro Park Trail, 2-3/4 mi. north San Gregorio Lake, 6/21/64, Fleck (43,080); San Pedro Parks Wild Area, 7/12/64, Fleck (43,132); San Pedro Parks Wild Area, 7/25/64, Fleck (43,103); south branch Poleo Cr., San Pedro Parks Wild Area, San Pedro Mts., 7/12/64, Fleck (43,388); north branch Poleo Cr., San Pedro Parks Wild Area, San Pedro Mts., 7/18/64, Fleck (43,145); San Pedro Mts., San Pedro Parks Wild Area, 7/4/63, Fleck (42,999); San Pedro Parks Wild Area, 500 yds. north of San Gregorio Lake, 7/4/63, Fleck (42,985); south of Tierra Amarillo, 8/30/69, Garcia 1,682; .2 mi. from junction Highway 162 and 84, 8/30/69, Garcia 1,684. Sandoval Co.: north of Fenton Lake, Jemez Mts., 6/21/69, Garcia 83; Jemez Mts., Garcia 75. San Miguel Co.: Pecos Baldy, 9/20/69, Garcia 2,127, 2,128, 2,129. Santa Fe Co.: Sangre de Cristo Mts., Santa Fe Ski Area, parking lot, near creek, 7/25/61, Dixon A-175 (30,575). Socorro Co.: San Mateo Mts., Beartrap Canyon, 6/28/60, Jones 149 (28,737); Magdalena Mts., east slope of Water Canyon, 9/10/59, Martin 3,671 (28,503). Torrance Co.: Manzano Mts., along stream, east slope, 8/2/42, Clark (19,014). Valencia Co.: La Mosca Peak, rocky outcrop, 6/26/60, Osborn 130 (26,374); Mt. Taylor, Water Canyon, 6/26/60, Osborn 153 (26,476); Mt. Taylor, in rocks, 6/25/60, Schroeder 37 (26,373); La Mosca Canyon, Mt. Taylor, 7/20/61, Osborn 740 (26,592); Mt. Taylor, 9 mi.

northeast of La Mosca Lookout, open meadow, 7/19/69, Garcia 401, 403; 1 mi. southwest of San Mateo Springs, Mt. Taylor, open meadow, 7/19/69, Garcia 400.

Potentilla ambigens Greene. Otero Co.: Rt. 24, several mi. south of Mescalero, 9/2/52, s.n. 5,706 (14,444); top of divide, Whitetail Road, 6/29/36, Humphrey (12,705); 6/29/36, (12,700); 6/29/36, (12,708); several mi. west of Cloudcroft, 7/3/49, Castetter and Dittmer 5,687 (14,435); 5 mi. northwest of Mescalero sawmill, off Highway 24, meadow, 9/7/69, Garcia 1,881, 1,882, 1,883; 7 mi. northeast of Cloudcroft, off Highway 24 along Silver Springs Canyon, Sacramento Mts., 9/7/69, Garcia 1,863, 1,864; Cloudcroft area, Cox Canyon, 7/3/49, Castetter and Dittmer 5,686 (14,436).

Potentilla hippiana Lehm. var. diffusa (Lehm.). Bernalillo Co.: Sandia Mts., Kiwanis meadow, 8/20/69, Garcia 1,024, 1,025, 1,026, 1,027; Sandia rim, barren places at top, 7/8/31, Nelson 5,502 (887). Catron Co.: ½ mi. east of Willow Creek, on Wilderness Trail #151, 7/5/69, Garcia 207, 209, 210, 211. Colfax Co.: Eagle Nest, along roadside, Highway 64, ¼ mi. north of Clover Leaf Court, 8/26/69, Garcia 1,415, 1,416; summit of Flechado Pass, 8/26/69, Garcia 1,443, 1,444, 1,445, 1,447; Cimarron Canyon, 1 mi. below fish hatchery, 8/26/69, Garcia 1,488, 1,489A, 1,490, 1,491. Otero Co.: 5 mi. northeast of Apache Summit, along roadside, adjacent to ponderosa and scrub oak, 9/7/69, Garcia 1,917; 5.9 mi.

south of Mayhill, yellow pine on canyon slopes, 8/13/49, Gordon and Norris 566 (11,795). Rio Arriba Co.: 1 mi. northwest of Chama, open meadow, along St. Rd. 29, 8/30/69, Garcia 1,620, 1,621, 1,622, 1,623; Chama, along roadside to cemetery, 8/30/69, Garcia 1,605, 1,606. Sandoval Co.: Jemez Mts., on St. Rd. 156, 3 mi. northeast of summit of Fenton Hill, 6/22/69, Garcia 107. San Miguel Co.: 2 mi. north of Tererro, off St. Rd. 63, 9/20/69, Garcia 2,123, 2,124. Socorro Co.: Magdalena Mts., road to South Baldy, near 6 mi. trail #314 and Ryan Trail, open area, gently rocky slope, 9/14/69, Garcia 2,009, 2,010. Taos Co.: La Junta Canyon, 1 mi. north of picnic sites, meadow, 7/27/69, Garcia 748, 749; 2 mi. northwest of Tres Ritos, 7/24/59, Findley (24,876); Las Trampas Canyon, 4½ mi. east of El Valle, along Las Trampas Creek, 8/31/69, Garcia 1,777, 1,778, 1,779, 1,800, 1,801, 1,802; 1 mi. west of Santa Barbara Campground, Santa Barbara Canyon, 7/26/69, Garcia 740, 741, 742, 743. Valencia Co.: 9 mi. northeast of La Mosca Lookout, Mt. Taylor, 7/19/69, Garcia 383; 1 mi. above San Mateo Springs, Mt. Taylor, 7/19/69, Garcia 384, 385.

Potentilla hippiana Lehm. Bernalillo Co.: Sandia Mts., aspen area in small meadow, 7/29/64, Tatschl (37,268); Sandia Peak, gnarled fir and aspen on rocky limestone base, 8/5/49, Gordon and Norris 161 (11,789), (11,791). Catron Co.: Gallita Forest Camp meadow, 8/10/52, s.n. 5,683 (14,433); ½ mi. east of Willow Creek,

on Wilderness Trail #151, 7/5/69, Garcia 208. Colfax Co.: east side of Agua Fria Peak, dark rocky limestone with fir and aspens, 8/7/49, Gordon and Norris 394 (11,790); Lake Maloya, southside of lake, 8/25/69, Garcia 1,295, 1,296, 1,297; Eagle Nest, along Highway 64, 8/26/69, Garcia 1,414, 1,416. Lincoln Co.: White Mts., gravel loam of Skyline Picnic Area, 8/1/65, Hutchins 783 (41,796); 1 mi. south of Monjeau Lookout, White Mts., 7/2/69, Hutchins 2,215 (43,287); White Mts., Gilmore Ranch, Eagle Creek, 8/17/08, Wooton 3,942 (18,016); 2 mi. north of Ruidoso along Highway 37, 9/7/69, Garcia 1,914, 1,915. Otero Co.: 5 mi. east of Apache Summit, along Highway 70, 9/7/69, Garcia 1,916; 6 mi. northeast of Mescalero, open weed patch along Rt. 70, low ground, 9/14/60, Martin 4,506 (24,039). Rio Arriba Co.: 2 mi. from junction of Highway 162 and 84, 8/30/69, Garcia 1,167. Sandoval Co.: Baca Location, no date, Keddy 5 (35,832); lower Vallecitos above Jemez Pueblo, 6/28/31, Nelson 5,696 (968); locality unknown, 1,963, Utzat (35,647); Mt. Taylor, 7/19/59, Martin 3,367 (25,301); Las Conchas upper marsh, 9/18/60, Howe 24 (31,680); Jemez Mts., 3 mi. northeast of Fenton Hill on Highway 126, 6/20/69, Garcia 28, 29, 30; Las Huertas Canyon, lower boundary of Ellis Cooper Ranch and Forest Service land, 8/18/69, Garcia 896, 897, 898; 4 mi. south and 6 mi. west of Los Alamos, Jemez Mts., 7/8/60, Wright 10 (26,272); Valle Grande, Jemez Mts., 7/9/60, Jones 174 (25,662). San Miguel Co.: Evergreen Valley,

7/20/65, Broeske (42,725); Evergreen Valley, 7/15/65, Broeske (42,726). Socorro Co.: Beartrap Canyon, San Mateo Mts., 6/28/60, Jones 157 (25,655); Magdalena Mts., road to South Baldy, near 6 mi. trail #314 and Ryan Trail #2, 9/14/69, Garcia 2,007, 2,008, 2,012, 2,013. Taos Co.: edge of Lost Lake, 8/12/56, Castetter 11,189 (22,183); 2 mi. northeast of Tres Ritos, Sangre de Cristo Mts., Carson National Forest, 7/24/58, Findley (24,491). Torrance Co.: Manzano Mts., crest at head of Kaiser Hill, mixed conifer, 8/18/62, Bedker 697 (40,457); Manzano Mts., Ox Canyon, near crest, 7/4/64, Bedker 1,691 (40,454); Manzano Mts., Kaiser Hill Canyon, 6/20/63, Bedker 1,128 (40,455); Manzano Mts., Red Canyon, 7/5/64, Bedker 1,705 (40,453). Valencia Co.: Mt. Taylor, 7/2/53, s.n. 5,702 (14,466); 1 mi. above San Mateo Springs, Mt. Taylor, 7/19/69, Garcia 386, 387; Mt. Taylor, 7/22/60, Osborn 417 (28,639); summit of Mt. Taylor, 7/18/59, Martin 3,387 (25,900); Mt. Taylor, 7/18/59, Martin 3,367 (25,300).

Potentilla pulcherrima Lehm. var. filipes (Wolf). Bernalillo Co.: Sandia Mts., road leading to upper Capulin Springs, 6/29/69, Garcia 310, 312, 313; ½ mi. below Capulin Springs, Sandia Mts., 6/29/69, Garcia 311; Kiwanis meadow, 8/20/69, Garcia 1,030, 1,031, 1,032. Colfax Co.: Lake Maloya, Sugarette Canyon, north of Raton, 8/25/69, Garcia 1,448, 1,449. Otero Co.: Tularosa Canyon, 3 mi. south of agency, 6/12/36, Roberson and Humphreys (12,704). Rio Arriba Co.: on

trail to Truchas Peak, 8/6/49, Gordon and Norris 251 (11,785). Taos Co.: on trail to Wheeler Peak through Twinning Canyon south of peak, from 9,950 ft. at Twinning to 11,610 ft. at Bull of Woods Mt., 8/7/49, Gordon and Norris 371 (11,786); La Junta Canyon, 7/27/69, Garcia 746, 747; 4 mi. west of Santa Barbara Campground, 7/26/69, Garcia 738, 739. Torrance Co.: Manzano Mts., Fourth of July Campground, mixed hardwood conifer, 6/29/63, Bedker 1,147 (40,452).

Potentilla diversifolia Lehm. Bernalillo Co.: Sandia Mts., Kiwanis meadow, 8/20/69, Garcia 1,029A, 1,029B. Catron Co.: San Francisco Peak, San Francisco Mts., 7/7/35, Whiting and Sanders (2,647). Otero Co.: Sacramento Mts., Sleepy Grass Campground, south of Cloudcroft, 9/6/69, Garcia 1,803, 1,804, 1,805. Rio Arriba Co.: San Pedro Cabin near San Pedro Peak, San Pedro Mts., 7/11/64, Fleck (44,338); South Poleo Creek, San Pedro Mts., 7/18/64, Fleck (43,169); west of San Pedro Parks Trail, marshy meadow, 7/24/65, Fleck (44,055). Sandoval Co.: Las Conchas, 8/20/62, Richards 40 (35,233); Las Conchas, 8/20/62, Weissenborn 78 (35,318). San Miguel Co.: Pecos Baldy, along wilderness trail to summit from Panchuela Campground, 10/20/69, Garcia 2,125, 2,126. Socorro Co.: Magdalena Mts., summit South Baldy, 9/14/69, Garcia 2,010B. Taos Co.: on trail to Wheeler Peak through Twinning Canyon, south of peak, 8/7/49, Gordon and Norris 370 (11,787); Hondo Canyon, Wheeler Peak, below ski

area, 8/23/69, Garcia 1,177, 1,178, 1,179, 1,180, 1,181, 1,182, 1,183, 1,184, 1,185, 1,186, 1,187; Las Trampas Canyon, 8/31/69, Garcia 1,768, 1,769, 1,770.

Potentilla bicrenata Rydb. Rio Arriba Co.: 3 mi. above Truchas, 4/7/50, Dittmer 5,502 (3,496); 1 mi. west of Truchas, off Highway 76, 8/31/69, Garcia 1,697, 1,698, 1,699, 1,700, 1,701, 1,702, 1,703, 1,704, 1,705, 1,706, 1,707, 1,708, 1,709. Taos Co.: Las Trampas Canyon, 4½ mi. east of El Valle, 8/31/69, Garcia 1,727, 1,728, 1,729, 1,730, 1,731, 1,736, 1,737, 1,738, 1,739, 1,740, 1,776, 1,732, 1,735.

Potentilla concinnaeformis Rydb. Sandoval Co.: 3 mi. northeast of Fenton Hill, Highway 126, 6/20/69, Garcia 14, 15, 16, 17, 19, 20, 21.

Potentilla grayi Wats. San Miguel Co.: 2 mi. north of Tererro, off St. Rd. 63, 9/20/69, Garcia 2,092, 2,093, 2,094, 2,095, 2,096, 2,097.

Potentilla sibbaldii Hall. Mora Co.: Pecos Baldy, above timberline, 7/26/31, Castetter 5,506 (732); timberline, 7/26/31, Castetter 5,506 (952). Rio Arriba Co.: road to Truchas from Chimayo, 5/10/51, Clark (6,588). Taos Co.: Gold Hill, south of Red River Village, 8/13/55, Castetter and Dittmer 8,886 (1,998); Wheeler Peak ski area, near summit of south peak through Hondo Canyon, 8/23/69, Garcia 1,168, 1,169, 1,170.

Potentilla concinna Richards. Colfax Co.: meadow, northside of Lake Maloya, 8/25/69, Garcia 1,313, 1,314,

1,315, 1,316. Rio Arriba Co.: 1 mi. west of Truchas, off Highway 76, 8/31/69, Garcia 1,710. Valencia Co.: open summit of Mt. Taylor, 6/17/51, Clark (3,276B), (3,276), (4,447).

Potentilla rivalis Nutt. Catron Co.: Mogollon Mts., Willow Creek, 7/5/69, Garcia 212. Colfax Co.: Lake Maloya, Sugarette Canyon, 8/25/69, Garcia 1,218, 1,219, 1,220. Taos Co.: Santa Barbara Canyon, 7/26/69, Garcia 745..

Potentilla rivalis Nutt. var. millegrana Engelm. Catron Co.: Along edge Indian Creek, Mogollon Mts., 7/5/69, Garcia 213A, 213B, 214, 215A, 215B. San Miguel Co.: 1 mi. south of Cowles, off St. Rd. 63, 9/20/69, Garcia 2,098, 2,099, 2,100, 2,101, 2,102, 2,103. Taos Co.: Las Trampas Canyon, 4½ mi. east of El Valle, 8/31/69, Garcia 1,771, 1,772, 1,773, 1,774, 1,803.

Potentilla norvegica L. Lincoln Co.: meadow, 2 mi. above Bonita Dam, 8/18/49, Gordon and Norris 786 (11,797). Sandoval Co.: Jemez Mts., ½ mi. north of Fenton Lake, along Cebolla Creek, 6/20/69, Garcia 22. San Juan Co.: 3 mi. south of Washington Pass, Chuska Mts., 8/10/58, McKnight 58,081,013 (24,122). Taos Co.: Hondo Canyon, Wheeler Peak, ski area, 8/23/69, Garcia 1,161, 1,162. Valencia Co.: San Mateo Springs, 8/10/60, Osborn 495 (28,742); north Mt. Taylor, San Mateo Springs, 7/22/60, Osborn 320 (27,330); 9 mi. northeast of La Mosca Lookout, 7/19/69, Garcia 399; San Mateo Springs, Mt. Taylor,

7/19/69, Garcia 397, 398.

Potentilla paradoxa Nutt. Taos Co.: Hondo Canyon, Wheeler Peak, lower camp site area, 8/23/69, Garcia 1,140, 1,141, 1,142, 1,143, 1,144, 1,145, 1,146.

Arizona Specimens Cited.

Potentilla crinita A. Gray. Coltons Ranch, Flagstaff, transition zone, 7/21/35, Whiting 756/1,193 (2,645); north of Flagstaff, transition zone, 6/26/35, s.n. 756/810 (2,644).

California Specimens Cited.

Potentilla glandulosa Lindl. Locality unknown, 7/7/60, Denneen, 171 (27,367); Halstead meadow, 7,000 ft.; transition zone, 7/7/60, Denneen 121 (26,995).

Colorado Specimens Cited.

Potentilla diversifolia Lehm. 5 mi. west of Boulder, 6/16/61, Potter 416 (32,961); Boulder County, Bog at Rainbow Lakes, 10,000 ft., 6/20/50, Spinkle 31 (40,097); Wolf Creek, Pagosa Springs, 8/17/31, Clark 4,506 (19,670).