

Biological Sciences



POISON IVY AND POISON SUMAC AS AN ETIOLOGIC FACTOR IN CONTACT DERMATITIS IN THE CENTRAL STATES^a

Fred A. Barkley^b

Henry Shaw School of Botany, St. Louis, Mo.

INTRODUCTION

In view of the fact that "poison ivy" is responsible for many skin eruptions caused by plants in the Central States, it is felt that a discussion of the identification of the poisonous members of the sumac family should be welcomed by the general practitioner.

As an aid to those who see patients only after skin manifestations have developed, a brief review of the clinical diagnostic features and therapy has been included.

The poisonous members of the genus *Rhus* L.^c (11) (19), (9) (24) (6) (7) (8) (13) (25) (29) (31) have long been regarded as the outstanding causative agents in the production of contact dermatitis in the United States, although dermatitis caused by other plants (36) is sometimes attributed to *Rhus* poisoning (14). In this area the sumacs (*Rhus* spp.), the spurges (Euphorbiaceae), bermuda grass (*Cynodon dactylon*), ragweeds (*Ambrosia* spp.), cockleburrs (*Xanthium* spp.), sunflowers (*Helianthus* spp.), sneezeweeds (*Helentium* spp.), and the cultivated primroses (*Primula* spp.) are the plants that cause the great majority of cases of contact dermatitis; the poisonous members of the sumac family apparently affecting the greatest proportion of the population.

Plant-contact poisoning, dermatitis venenata, or contact dermatitis is believed due to hypersensitiveness which may be inborn (1) or possibly acquired prenatally. However, contact dermatitis is generally believed to be a true sensitization phenomenon and that first exposure is not followed by any ill effect. It is conceded to be the most confusing of all the groups of allergy (39). *Rhus* dermatitis is generally believed to be a true sensitization phenomenon. Hypersensitiveness to it is usually considered to be either passively or otherwise acquired (4). Poison ivy and poison sumac ordinarily affect a very considerable fraction of the population when exposed (39)^e.

CHARACTERISTICS OF THE SUMAC FAMILY

The cashew or sumac family^f (ANACARDIACEAE^g) Lindl. (9) (24) (5) (6) (7) (8) (13) (28) (29) (36) (41), Spondiaceae Kunth (25) (31) (32), Terebinthaceae D. C. (15) may be characterized as follows: Trees, shrubs, or vines, with resinous or milky acrid juice, some possessing an exceedingly active poisonous principle contained in intercellular secretory canals; dotless, alternate, simple or pinnately compound leaves, without stipules, and small, often polygamous flowers; calyx of 3 to 6 sepals; corolla of 3 to 5 petals, imbricate, larger than the calyx; androecium of 3 to 6 or more stamens; ovulary 1-celled and 1-ovuled, with 3 to 5 styles

^a See footnotes attached.

^b See footnotes attached.



Figure 1. Flower of *Rhus Toxicodendron* X9.

or stigmas; fruit mostly drupaceous; seed without albumen, borne on a curved stalk arising from the base of the cell. Mostly tropical.

The family is represented in the United States by *Rhus*, *Pistacia*, *Cotinus*, and *Metopium*, all of the subfamily Rhoideae. *Rhus* and *Metopium*¹ have poisonous members of the United States.

Most of the poisonous members of the genus *Rhus* belong to the section of *VENENATAE*² Engl., which may be described as follows: The sap of the intercellular secretory canals containing an active poisonous substance; leaves odd-pinnate or three-foliolate, thin (in the three-foliolate forms petiole usually as long as, or longer than, terminal leaflet) flowers polygamous or dioecious, borne in loose and slender axillary panicles, white or greenish; sepals 4 to 6; petals 4 to 6 (see fig. 1); fruit smooth, glabrous (or pubescent at first in *Rhus quercifolia*), whitish or dun-colored; the style terminal; stone striate to ribbed (smooth in *Rhus quercifolia*). Native to Asia and both the Americas.

The most conspicuous characteristic of this section is the white or greenish drupe, which possesses smooth glabrous exocarp and ribbed stone¹, as contrasted with the other sections of the genus which have distinctly pubescent drupes and smooth stones. Some of the species are used medicinally^m (12) (40). Engler and Prantl (9) list two species of this section for North America: *Rhus Vernix* L. and *Rhus Toxicodendron* L. These are the two species of *Rhus* listed by Weber (37) as cutaneous irritants.

DIFFERENTIAL MORPHOLOGY OF THE VENENATAE

The more poisonous species is *Rhus Vernix* L.ⁿ (19) (40 (*Rhus venenata* DC. or *Toxicodendron pinnatum* Mill.), the **POISON SUMAC**, also called swamp sumac, poison oak, poison elder, poison dogwood, poison ash, or thunderwood. It is easily distinguished from the other members of the *VENENATAE* native of the United States^o by its odd pinnate leaves, with 7 to 13 leaflets. It grows in clumps as shrubs to a height of ten feet, or singly as trees to as tall as thirty feet. Poison sumac is often confused with elderberry (opposite leaves), certain ashes (opposite leaves), mountain ash (toothed leaflets), and dwarf sumac (winged rachis). It can, however, be distinguished from all other plants with which it is confused by its alternate, pinnately compound leaves with entire margins, and lack of wings on the rachis (fig. 2), and by its axillary drooping clusters of waxy, white berry-like fruits. While the poisonous properties of poison sumac are considered somewhat stronger than those of poison ivy, its rare occurrence in any location except swamps and bogs seems to result in its causing fewer cases of dermatitis.

The other species (or species complex), *Rhus Toxicodendron* L., *Folia toxicodendri*, the **POISON IVY**, also called poison oak, poison creeper, poison vine, poison climbing sumac, climbing ivy, three-leaved ivy, markweed, picry, black mercury, mercury, giftsumach, giftbaum, Sumach veneneu, Toxicodendro, zumaque venenoso, or Sumagre venenosa, grows in the form of woody vines, trailing shrubs, or low erect bushes, and adapts itself to a great variety of conditions. The various forms are so much alike in general character that familiarity with any one form will make it possible to recognize the plants wherever encountered. Poison ivy is often confused with boxelder (opposite leaves), fragrant sumac (red pubescent fruits), and Virginia creeper (five-leaflets and blue berries). Poison ivy plants are most readily recognized by their leaves, which are always divided into three leaflets and are always alternately arranged on the stem; and by their whitish, single-seeded, waxy fruits that persist far into the winter, long after the leaves have fallen.

Some of the various forms of *Rhus Toxicodendron* L. have been variously designated as species. Some of the better established ones are *Rhus Toxicodendron* auths. (*Rhus radicans* L., *Toxicodendron pubescens*

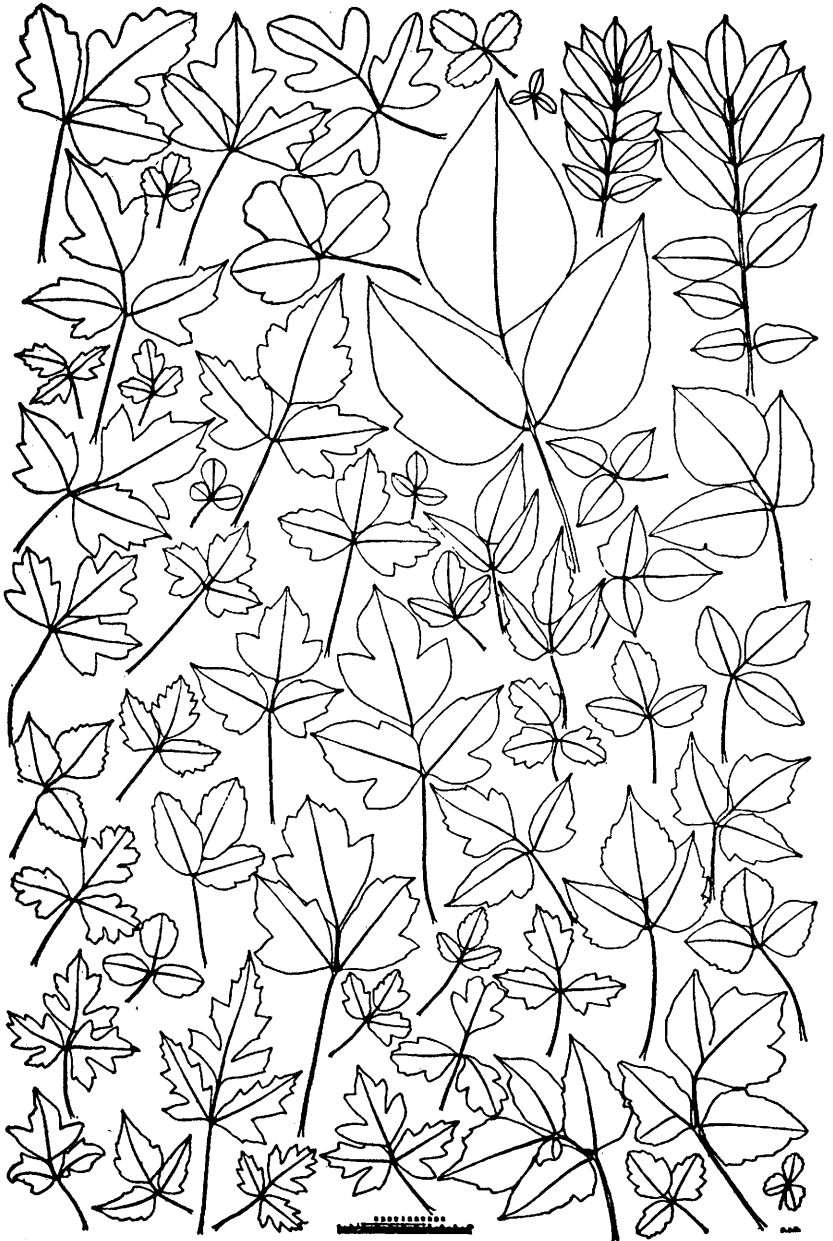


Figure 2. Leaf tracings of leaves typical of various specimens of *Rhus Vernix* (upper right) and *Rhus Toxicodendron* and its segregates.

Mill., etc.), *Rhus quercifolia* (Michx.) Steud. (*Rhus Toxicodendron quercifolia* Michx.) *Toxicodendron monticola* Greene, or *Toxicodendron quercifolium* Greene), *Rhus eximia* Standl. (*Toxicodendron eximium* Greene or *Toxicodendron biternatum* Greene), and *Rhus Rybergii* Small (*Toxicodendron punctatum* Greene) in our range; *Rhus diversiloba* T. & G. (*Rhus lobata* Hook., *Toxicodendron diversilobum* Greene, or *Rhus diversiloba radicans* (T & G.) McNair) and *Rhus Greenei* McNair *Rhus divaricata* (Greene) McNair or *Toxicodendron divericatum* (Greene) of the west coast; and *Rhus orientalis* (Greene) Schneider (*Rhus Toxicodendron hispida* Engl. or *Toxicodendron orientale* Green) of China and Japan. When one observes the polymorphism of both foliage and plant in individual specimens, the desirability of allotting these forms specific rank seems questionable. Engler and Prantl (9) consider *Rhus diversiloba* as a subspecies of *Rhus Toxicodendron*. Those botanists who believe in innumerable species would favor the acceptance of the many species formed, while the more conservative would be inclined to consider them as not more than subspecies.

DISTRIBUTION

The range of *Rhus Vernix* extends from the southeastern portion of the central states eastward and northward along the Atlantic seaboard, and into the Great Lakes region (fig. 3). While the species is not reported west of Arkansas, it should be considered as a possible source of dermatitis in the swampy woodland regions of eastern Oklahoma and Texas.

Several of the forms of *Rhus Toxicodendron* occur in the range under consideration (fig. 3). However, unless, or until, these variants are shown to be distinct species and as having different toxic agents, I believe the forms in the south-central region may be considered for purposes of diagnosis and treatment simply as *Rhus Toxicodendron*. One anxiously awaits the solution of this problem, both taxonomically and toxicologically, particularly since we have in our territory (fig. 3) at least eight of these forms.

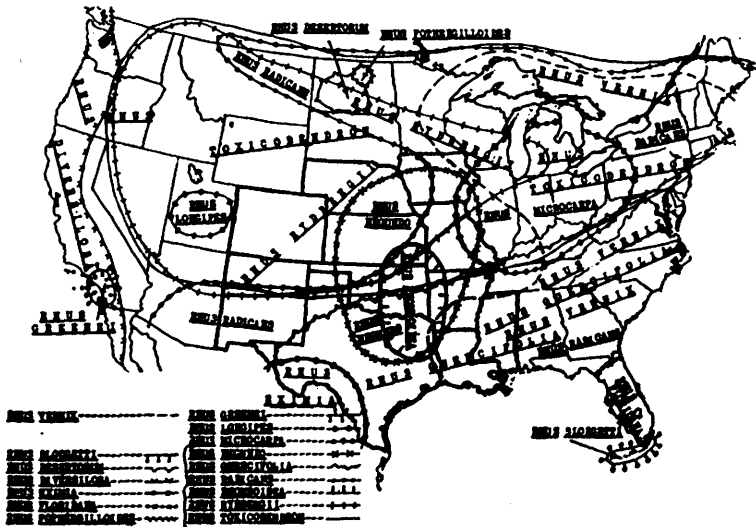


Figure 3. Map showing the approximate distribution in the United States of *Rhus Vernix*, and of *Rhus Toxicodendron* and its several segregates (as listed in various widely used manuals and monographs.)

TOXIC AGENT

McNair (16) has shown that in *Rhus diversiloba*, the intercellular secretory canals (which show no essential differences from those of other species of *Rhus*) are found in the roots, stem, leaves, and fruit, in the phloem of the primary vascular bundles, in the secondary bast of the stem, in the phloem of the mesocarp of the fruit, and in the hypocotyl and cotyledons of the embryo. Since the fresh sap emulsion contained in the secretory canals is the only part of the plant capable of producing dermatitis, the anthers, pollen, xylen, epidermis, cork cells, and trichomes were shown to be non-toxic. To date there has been no indication that the poison is bacterial, and at present it is believed to be due (40) to the polyhydricphenol, lobanol (16), or (acid resin?) toxicodendrol (21). As broken surfaces are required to make contact with the poison-containing sap, the least number of cases appear during the dormancy of the plant while the greatest number are contracted when the leaves and flower parts are immature and therefore most easily fractured (16). Poisoning without contact with the plant may occur from the smoke of the burning plant or by contact with substances that have the poisonous sap on them, such as clothing, shoes, cordwood, books, and the hair of animals. Parts of the plant are capable of causing poisoning, even after long drying, but the malignancy decreases in drying due to loss of fluidity of the sap and from the oxidation of the poison (16).

DIAGNOSIS

Evidence of *Rhus* poisoning is established by a history of recent exposure and the rapid onset of an acute dermatitis characterized by sharply defined lesions of linear arrangement (evidence of leaf or twig contact). The onset is sudden, a few hours or days after exposure, with involvement of the face, neck, wrists, hands, or other parts. There is a tendency for the dermatitis to spread by "autoinoculation" (4). The first manifestation is an erythematous flush on which thin-walled vesicles soon appear. At a later stage the involved areas become bright red, warm, and slightly edematous. The vesicles mature into bullae which may coalesce or rupture with exudation of serum and the formation of moist sticky crusts. After the lesions become confluent, they cannot be readily distinguished from those of any other dermatitis of external origin except by chemical and patch tests. The usual chemical method consists in dampening the affected areas with dilute caustic soda or potash. Small darkened spots or lines appear, which can be decolorized with dilute nitric acid (16). A properly performed patch test, as in other contact dermatitis, is essentially pathognomonic. This latter test consists in the application to the unbroken skin surface of fresh, whole or powdered leaves, pastes made from the crude resin, or oil solutions of the toxic principle.

It has been shown that there exists a natural immunity to poison ivy. Tests on young infants show this is not due to inadequate mechanism but to lack of previous contact (35). The immunity in any case is relative, since exposure to massive doses or to a highly concentrated extract of the poisonous principle will almost invariably produce untoward results.

A large portion of people is susceptible, and studies indicate that about five per cent of the population in some areas are treated annually for *Rhus* dermatitis.

THERAPY

Prophylactic measures, such as washing the skin just before or after exposure with a five to ten per cent ferric chloride solution in either fifty per cent alcohol or in twenty-five per cent glycerine, or by washing repeatedly just after exposure with a soap containing an excess of alkali,

usually prevent skin irritation. After the appearance of the skin eruption many local remedies, such as hot $KMnO_4$ baths and lead or aluminum acetate lotions, have been found useful. More recently extracts containing the toxic agent in hydro-alcoholic saline or almond oil solution are being successfully employed to produce rapid and in many cases relatively permanent immunity.

CONCLUSIONS

Poison sumac and poison ivy have been shown to grow in the central portion of the United States. The taxonomy and distribution of these poisonous representatives, their differential morphological characteristics, toxic agent, diagnostic features, and therapy have been briefly reviewed.

Poison sumac, because of its rare occurrence in any location except swamp and bogs, causes relatively few cases of contact dermatitis. The poison ivy (or poison oak) is represented in our area by eight forms. They grow abundantly in a great variety of situations and are the cause of a large number of cases of contact dermatitis. The importance of these species in the production of a large per cent of plant dermatitis makes them worthy of the consideration of the general practitioner.

ACKNOWLEDGMENTS

It is my pleasant duty to acknowledge the suggestions, information, and assistance generously afforded me in their respective fields, during the preparation of this paper, by Dr. James B. McNair, of Los Angeles, Calif.; Drs. W. C. Spain, John M. Newell, and Miriam Meeker, of the New York Post-Graduate Medical School and Hospital, New York City; Dr. A. S. Foster, of the Department of Botany of the University of California, Berkeley, Calif.; Drs. G. J. Goodman and P. B. Sears, of the Department of Botany of the University of Oklahoma, Norman, Okla.; Drs. R. L. Howard and R. M. Balyeat, of the Balyeat Hay Fever and Asthma Clinic of Oklahoma City; and by Dr. J. M. Greenman, Miss Nell Horner, and Dr. G. T. Moore, of the Missouri Botanical Garden, St. Louis.

FOOTNOTES

a. Contribution of the Botanical Laboratory of the University of Oklahoma, No. For a condensed discussion see Barkley and Howard (2).

b. R. M. Balyeat Fellow in Allergy of the Department of Botany, University of Oklahoma, on leave of absence 1934-1935.

c. Also called *Turpinia* Raf., *Styphonia* Nutt., and *Schmalzia* Desv. (9).

d. Synonymous with universal irritant.

e. Spain, Newell, and Meeker (33) have shown, in an investigation of the susceptibility of adults, that the proportion of the population affected increases arithmetically as the concentration of the irritant is increased geometrically.

f. Pammel (20) has an interesting discussion of the economic importance of the sumac family (pp. 607 to 614).

g. Sometimes spelled *Anachardiaceae* (26) (27).

h. This is often divided into several genera (5) (26) (27) (28) (31) (32) (36) (41).

i. *Metopium* Linnæa Engl. (*Rhus Metopium* L., *Metopium Metopium* (L.) Small, or *Rhus oxymetopium* Griseb.) (12) (31) (32) (40), CORAL SUMAC, mountain manchineel, bum-wood, poison-wood, hog-gum, or doctor-gum, native of Florida and the Keys, is the only species of the United States, reported as poisonous, that is not a member of the genus *Rhus*. However, according to the N. S. D. (12), "It is quite likely that very many other plants of this family, not now suspected, will be found poisonous in greater or less degree."

j. *Rhus Michauxii* Sargent (*Rhus pumila* Michx.), of the section *TRICHOCAERPAE* Engl., has sometimes been considered (12) (40) a very poisonous species, but recent manuals do not list it as such. It does not occur in our range.

k. The section *VENENATAE* Engl. of *Rhus* L. is often considered by botanists as a separate and distinct genus, *Toxicodendron* [Tourn.] Mill. (5) (26) (27) (28)

(33) (36) (41). Small (31) originally used the name *Rhus* for this restricted genus, but now uses the name *Toxicodendron* (32).

l. Or if having smooth stone and pubescent fruits (*Rhus quercifolia*) with trifoliate leaves with leaf stalk (petiole) almost as long or longer than the terminal leaflet.

m. According to the N. S. D. (12), *Rhus Toxicodendron* was "..... recommended formerly as an internal remedy in incontinence of urine dependent upon atony of the bladder, acute articular and chronic muscular rheumatism, paralysis, and other affections, its use has not produced good results and has been abandoned."

n. "An infusion of the young branches and leaves is employed in homoeopathic practice" (29, p. 664.)

o. *Rhus vernicifera*, *Rhus silvestris*, *Rhus trichocarpa*, *Rhus succedanea*, and *Rhus Delavayi* are similar poisonous species of other regions.

p. The variability of form of trifoliate poisonous species of *Rhus* is shown in the following tentative key which indicates some of the many species which have been erected for these very similar forms of the Section VENENATAE of the United States. It might be remarked here that shrubby forms of poison ivy often have a limb becoming vine-like when it touches some support; and that both deeply notched and entire leaflets are often found on the same plant.

I Leaves pinnately 7-13-foliate; tall shrub or small tree *R. vernix*
II Leaves less than 7-foliate.

- Seeds smooth, fruit usually papillose or pubescent *R. quercifolia*

-- Seeds roughened, fruit usually smooth.

/ Seeds irregular in outline; West Coast species *R. Greenei*

// Seeds regular in outline.

A Leaf blades variable, from 3-5 (usually 3); leaflets of variable shape with rounded or obtuse apex; west Coast species.

1 Shrub *R. diversiloba*

11 Vine *R. dryophyllum*.

AA Leaflets 3; not West Coast species.

1 Upright shrubs, mostly without aerial roots.

+ Leaflets deeply cleft for the most part; distribution limited to Texas and Mexico *R. eximia*.

++ Leaflets for the most part not deeply cleft; distribution not limited to Texas and Mexico.

a. Leaflets with coarsely toothed or lobed blades.

• Leaves distinctly pubescent, at least on veins beneath.

• Drupes 5 - 8 mm thick, crenately lobed, southern and eastern.....

R. Toxicodendron

•• Drupes 4 - 5 mm thick.

) Occurring in Oklahoma, Texas, and adjacent territory *R. rhomboloba*

••) Occurring in North Dakota *R. fothergillii*

••) Leaves glabrous or nearly so.

• Leaflets thick, sinuate, terminal one decidedly longer than broad, its petiolule usually 1-2 cm long. Western *R. Rydbergii*.

•• Leaflets thin.

) Western. The terminal leaflet orbicular, abruptly short acuminate,

coarsely toothed *R. Longipes*

••) Northeastern. The terminal leaflet lanceolate, acuminate, cuneate at the base, sharply toothed, acutely lobed, or entire.

Fruit 3-4 mm. in diameter *R. microcarpa*

aa Leaflets not coarsely toothed or lobed.

• Western. Leaflets undulate or rarely few-toothed; glabrous above; occurring in North Dakota *R. desertorum*

•• Eastern.

• Leaflets with entire blades, glabrous; Key West *R. Blodgettii*

•• Leaflets lanceolate to ovate-lanceolate, acuminate, the middle one cuneate at the base, sharply toothed, acutely lobed, or entire. Fruit 3-4 mm. in diameter. Northern *R. microcarpa*

11 Usually vines, climbing by aerial rootlets.

a. Distribution limited to Florida *R. floridana*

aa Distribution not limited to Florida.

• Leaflets coarsely toothed, drupes 4-5 mm in diameter *R. Negundo*

•• Leaflets undulate or rarely few-toothed, drupes 5-6 mm in diameter.....

R. radicans.

q. While *Rhus vernix* has been reported from eastern Oklahoma, the report has not been documented by specimens, and therefore is not included.

r. In recent correspondence, Dr. Spain, Newell and Meeker say that they "feel that, in all probability, the susceptibilities (to *Rhus Toxicodendron* and *Rhus diversiloba*) are the same. Out of sixty-seven persons (tested in their experiment (33)

and found) sensitive to poison ivy, sixty-two were susceptible to approximately the same concentration of poison oak. The five cases where the reaction was not similar had only slight reactions and did not return for retesting." They point out that among the uncontrolled factors in the experiment, the probable explanation of the slight variation is the fact that the extracts of the poison ivy were made from fresh leaves, while those from poison oak were made from dried leaves.

LITERATURE CITED

1. Andrews, George Clinton, 1930. Diseases of the skin. 1091 pp. Philadelphia.
2. Barkley, Fred A., 1934, and Robert L. Howard. Rhus dermatitis in the central states. Proc. Balyeat Hay Fever and Asthma Clinic Staff Meetings. 3:17.
3. Bentham, G., & J. D. Hooker, 1862. Genera plantarum. Vol. 1. 1040 pp. Reeve & Co., London.
4. Bloch, Bruno, 1929. The role of idiosyncrasy and allergy in dermatology. Arch. Dermat. & Syph. 19: 175-197.
5. Britton, Nathaniel Lord, and Addison Brown, 1913. An illustrated flora of the northern United States, Canada and the British Possessions. Ed. 2, vol. II. 735 pp. New York.
6. Chapman, A. W., 1897. Flora of the southern United States. Ed. 3. 655 pp. New York, Cincinnati and Chicago.
7. Coulter, John M., 1891-1894. Botany of Western Texas. Contr. U. S. Nat. Herb II., 588 pp.
8. Coulter, John M., and Aven Nelson, 1909. A new manual of botany of the central Rocky Mountains. 646 pp. New York, Cincinnati, and Chicago.
9. Engler, A., and K. Prantl, 1896. Die natürlichen Pflanzenfamilien. III Teil, 5 Abteilung. Leipzig.
10. Gowen, G. Howard, 1933. Treatment and prevention of Rhus toxicodendron poisoning. J. Allergy 4: 519-522.
11. Grant, C. V., and A. A. Hansen, 1929. Poison ivy and poison sumac and their eradication. U. S. D. A. Farm. Bull. 1166: 1-13.
12. Hare, Hobart Amory., Charles Caspari and Henry Rusby, 1916. The National Standard Dispensary. Ed. 3. 2081 pp. Philadelphia & New York.
13. Jepson, Willis Linn, 1925. A manual of the flowering plants of California. 1238 pp. Berkeley, California.
14. Leech, Paul Nicholas, et al., 1933. New and nonofficial remedies, 498 pp. Chicago.
15. LeMaout, Emm. and J. Decaisne, 1876. A general system of botany (translated by Mrs. Hooker). 1066 pp. London.
16. McNair, James B., 1923. Rhus dermatitis. 298 pp. Chicago.
17. McNair, James B., 1925. The taxonomy of poison ivy. Field Museum of Natural History, Botanical Series 4: 55-76.
18. McNair, James B., 1926. Poison ivy. Field Museum of Natural History, Botanical Leaflet 12: 1-12.
19. Muenschler, W. C., 1930. Poison ivy and poison sumac. Cornell Ext. Bull. 191: 1-11.
20. Pammel, L. H., 1911. A manual of poisonous plants. 977 pp. Cedar Rapids, Iowa.
21. Pfaff, Franz, 1897. On the active principle of Rhus toxicodendron. Jour. Exp. Med. II: 181 - 196. New York.
22. Rackemann, F. M., and A. Colmes. Studies in asthma, V: The clinical characteristics of hypersensitiveness. J. Allergy I: 536-541.
23. Ramirez, Maximilian A., and Joseph Hardan Eller. The "patch test" in "contact dermatitis" (dermatitis venenata). J. Allergy I: 489-495.
24. Robinson, Benjamin Lincoln, and Merritt Lyndon Fernald, 1908. Gray's new manual of botany. Ed. 7. 926 pp. New York, Cincinnati, and Chicago.
25. Rydberg, P. A., 1906. Flora of Colorado. 448 pp. Fort Collins, Colo.
26. Rydberg, P. A., 1922. Flora of the Rocky Mountains and adjacent plains. Ed. II. 1144 pp. New York.
27. Rydberg, P. A., 1919. Key to the Rocky Mountain flora. 305 pp. New York.
28. Rydberg, P. A., 1932. Flora of the prairies and plains of central North America: 960 pp. New York.

29. Sargent, Charles Sprague, 1922. *Manual of the Trees of North America*. Ed. 2. 910 pp. Boston & N. Y.
30. Schneider, Camillo Karl, 1912. *Illustriertes Handbuch der Laubholzkunde*. Band II. 1070 pp. Jena.
31. Small, John Kunkel, 1903. *Flora of the southeastern United States*. Ed. 1. 1894 pp. New York.
32. Small, John Kunkel, 1933. *Manual of Southeastern flora*. 1554 pp. New York.
33. Spain, W. C., Newell, J. M., and Meeker, Meriam, 1934. Susceptibility to poison ivy and poison oak. *Science* 80: (2065): 104.
34. Stroud, C. M., 1931. Allergic dermatitis. *J. Allergy* 2: 118-124.
35. Straus, Henry W., 1931. Artificial sensitization of infants to poison ivy. *J. Allergy* 2: 137-144.
36. Tidestrom, Ivar., 1925. *Flora of Utah and Nevada*. Contr. U. S. Nat. Herb. 25. 665 pp. Washington.
37. Weber, Leonard F., 1930. A list of cutaneous irritants. *Arch. Dermat. & Syph.* 25: 761-770.
38. White, R. Prosser, 1931. *The dermatergoses or occupational affections of the skin*. Ed. 3. 734 pp. New York.
39. Williams, Charles Mallory, 1934. Cutaneous manifestations of allergy. *Arch. Dermat. & Syph.* 29: 333-341.
40. Wood, Horatio C., Charles H. LaWall, Heber W. Youngken, John F. Anderson, and Ivor Griffith, 1926. *The dispensatory of the United States of America*. Ed. 21. 1792 pp. Philadelphia and London.
41. Wootton, E. O., and Standley, Paul C., 1915. *Flora of New Mexico*. Contr. U. S. Nat. Herb. 19: 794 pp.

