

THE TRANSMISSION OF RHUS POISON FROM PLANT TO PERSON *

RHUS DIVERSILOBA T. AND G.

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Poison oak (*Rhus diversiloba* T. and G.), like its near relative poison ivy (*Rhus toxicodendron* L.), contains an irritant poison which is capable of affecting the human face so as to cause great discomfort and make recognition impossible. The poison affects different persons differently. Some assert themselves immune, others are poisoned by contact with the plant, and yet others believe that merely to pass the plant in an automobile is sufficient to give rise to an attack of poisoning.

Believers in the toxicity of poison oak may be divided into 2 classes, those who believe the poison to be a gas, and those who consider contact with some part of the plant necessary for infection. These factions obviously cannot be reconciled. The following experiments were carried out to ascertain which opinion is correct.

1.—The poisonous petroleum-ether extract of poison oak was sterilized at 180 F. for 1 hour in an Arnold sterilizer. The extract thus treated was still poisonous, a fact effectually disproving any asserted bacterial nature of the poison. The poison of *Rhus toxicodendron*, its very close relative, was once thought by Burill¹ to be infectious.

2.—The poisonous petroleum-ether extract from 1 pound of leaves was distilled normally until the residue charred. Neither distillate nor residue was poisonous.

3.—The poisonous petroleum-ether extract from 1 pound of leaves was distilled with steam. The distillate was not poisonous, the residue extremely so.

4.—The poisonous petroleum-ether extract from 1 pound of leaves was distilled under 20 millimeters' vacuum until the residue charred. No part of the fractional distillate was poisonous, nor the residue.

5.—One pound of freshly chopped poison oak leaves was placed in a glass alembic. Air at 5 pounds' pressure to the square inch was caused to pass through the leaves and out of the beak. The under side of the wrist was held for 15 minutes at the outlet of the apparatus. No dermatitis developed. One of the leaves thus treated with steam when rubbed on the arm caused dermatitis.

6.—One pound of chopped leaves was treated as described in the foregoing. The outgoing air was bubbled through cottonseed oil for half an hour. The cottonseed oil was not poisonous.

* Received for publication April 17, 1916.

¹ *Am. Mo. Mic. Jour.*, 1882, 3, p. 192. *Proc. Am. Assn. Adv. Sc.*, 1882, 31, p. 515. *Am. Nat.*, 1883, 17, p. 319. *Gard. and For.*, 1895, 8, p. 368.

7.—Some poison oak leaves were placed in a glass tube and heated until the leaves smoked. This smoke when blown on the wrist caused dermatitis.

8.—The previous experiment was repeated, with the modification of filtering the smoke through glass wool. The glass wool was kept at a temperature of over 100 C. to prevent any possible condensation of the poison. The filtered smoke was not poisonous.

9.—An ethyl acetate solution of the poison had been kept for more than 10 months in an open beaker. More ethyl acetate was added from time to time to replenish that lost by evaporation. This solution was poisonous.

10.—A poison oak leaf was glued to the center of the concave side of a watch glass 6 inches in diameter. A piece of iron window screening 3 inches in diameter was taped in place over the leaf. The watch glass was then taped for 1 hour to the breast of a person very sensitive to the poison. No dermatitis resulted.

The results of the foregoing experiments demonstrate that the poison of *Rhus diversiloba* is nonvolatile, even when mixed with a volatile oil. It may, however, be carried by the particles of soot in smoke.

Of those parts of the plant that might be carried by the wind the pollen, trichomes, and cork cells were investigated.

The pollen was collected by shaking the flowers over a glass funnel to the stem of which a test tube was attached. This pollen was found to be nontoxic when rubbed into the skin. Similar nontoxic results have been obtained with the pollen of *Rhus vernicifera* by Inui,² of *Rhus vernix* by Warren,³ and of *Rhus toxicodendron* L. by Rost and Gilg.⁴ Microscopical examination showed 4 resin ducts in the receptacle and pedicel of the male flower, one in each petal. There were no resin ducts in the stamens or their basal filaments. An alcoholic extract of the pollen of *Rhus diversiloba* was nontoxic, nor did it or the pollen assume a dark brown color when treated for 5 minutes with potassium hydroxid, as does the poison.

It is concluded, therefore, that the poisonous principle of *Rhus diversiloba* cannot be transported by the agency of the pollen. The unripe fruit on the female plant is extremely poisonous, but when fully ripe—that is, when the pericarp separates from the waxy endocarp—the drupes are nontoxic.

Schwalbe⁵ considered the poison of *Rhus diversiloba* to be excreted from glandular hairs on the surface of the plant. Rost and Gilg⁴ have shown that similar hairs are not easily detached from fresh material of *Rhus toxicodendron*. I have found that these hairs, as well as their exudate, are nonpoisonous.

² Botan. Centralbl., 1900, 3, p. 352.

³ Am. Jour. Pharm., 1913, 85, p. 545.

⁴ Ber. d. deutsch. pharm. Gesellsch., 1912, 22, p. 296.

⁵ Med. Rec., 1903, 63, p. 855. München. med. Wchnschr., 1902, 49, p. 1616.

Two different forms of trichomes have been noticed on the plant, similar to those found by Mobius⁶ on *Rhus vernicifera* and by Rost and Gilg on *Rhus toxicodendron*; namely, a unicellular or polycellular needle-shaped hair, and a polycellular club-shaped hair. Morphologically the club-shaped hairs seem to be glandular: 1st, the upper multi-cellular portion is sharply marked off from the basal portion, which resembles a stalk; 2nd, the upper portion has thinner walls than the basal portion; 3rd, they are found mostly on the young rapidly growing organs of the plant, especially the floral region and the leaves, less on the green stem, and hardly at all on the woody portion.

When the green stem, pedicel, or main ribs of the leaf, which are covered with trichomes, are rubbed on sensitive skin no dermatitis results. Care must be taken, however, that the epidermis of the plant is not broken severely enough to cause the resinous sap to exude.

The fresh green leaves were placed in a finger bowl and soaked at room temperature in 95% alcohol for 10 minutes. The leaves had been examined first under a hand lens to make sure that through possible injury no resinous sap was on the surface. When placed in the finger bowl the sap was prevented from running down the pedicel from the cut end into the alcohol. The leaves when taken out of the alcohol, had lost their gloss. The pale yellowish alcoholic solution remaining was concentrated by boiling in an open beaker. It was found to be nontoxic. It was not darkened by potassium hydroxid nor did it respond to other chemical tests for the poison.

These results indicate that neither the plant trichomes nor their exudate is poisonous.

Hubbard⁷ advanced the idea that possibly insects carry the poison from plant to person. This theory cannot be denied, but it is doubtful whether many severe cases of *Rhus* dermatitis are caused by the small amount of poison that insects can carry.

The one portion of the plant that is toxic is the resinous sap. This sap rapidly exudes from all parts of the injured plant. When on woolen cloth it preserves its toxic properties for a length of time varying with the atmospheric and temperature conditions to which it is subjected. The sap gradually oxidizes and the poison loses its noxious properties, a black indelible stain being left on the cloth. These stains are often prominently apparent on khaki, linen, etc., after the articles have been laundered. The oxidation is most rapid when the temperature is blood heat and the atmosphere humid. A cold atmosphere delays the oxidation.

The presence of the poisonous sap on clothing accounts for many of the recurrent cases of *Rhus* dermatitis. For example: A lady spent

⁶ Abh. Senckenberg, Gesellsch., 1899, 20, p. 210.

⁷ Med. Brief, 1904, 32, p. 884.

the night with her sister, whose husband was obliged to be absent on business. The husband had been poisoned about the head and neck with ivy a few days before leaving home. The pillow case on which he slept was not changed, and his sister-in-law, using it, became poisoned about the face and neck in consequence.⁸ Other instances of indirect contact with the poison might be cited; for example, handling of cordwood which has some of the poisonous sap on its surface, or handling of tools which have been used in digging up the plant. It is evident that in such cases we deal with results of actual contact through an intermediary agent with the resinous sap of the plant.

CONCLUSION

The poison of *Rhus diversiloba* is not carried normally by the wind, for it is neither bacterial nor volatile, and the pollen, the plant hairs, and the cork cells are nontoxic.

Poisoning may occur as the result of direct contact with the unfiltered smoke from the plant, direct contact with the resinous sap, or indirect contact with the resinous sap on clothing, cord wood, tools, etc.

⁸ Walker: Med. News, 1891, 59, p. 556.