White (J. C.)

ON THE ACTION

OF

RHUS VENENATA AND RHUS TOXICODENDRON

UPON THE HUMAN SKIN.

BY

JAMES C. WHITE, M. D.,

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ON THE ACTION OF RHUS VENENATA AND RHUS TOXICODENDRON UPON THE HUMAN SKIN.[1]

THERE are two species of plants growing abundantly in the United States, which have long been known to produce a so-called poisonous action upon the skin of persons touching or approaching them. These are *Rhus toxicodendron* and *Rhus venenata*, a genus familiar to every one in the form of our common sumach, belonging to the family *Anacardiaceæ*. The former, *R. toxicodendron*, by earlier botanists called *R. radicans*, is a vine of very common occurrence, running over stone fences and along way-sides, or climbing trees to a considerable height, and attaching itself to these surfaces by lateral rootlets. It is popularly called poison-ivy, poison-vine, poison-oak, mercury. The other species, *R. venenata*, *Rhus vernix* of Linnæus, commonly known as poison-sumach, poison-dogwood, poison-elder, poison-ash, is a tree growing mostly in swampy places, and reaching the height of twenty feet or thereabout. The botanical characters of both may be found in all works on our native sylva and flora, but, as these descriptions are

[1] Read before the Boston Society of Medical Sciences, November 26, 1872.

often very brief, and not sufficiently explicit to present a characteristic picture of the plants to the general reader,[1] and inasmuch as cases of poisoning by them are often the result of ignorance of their appearance, and many perfectly harmless plants are, moreover, avoided on suspicion that they are either one or the other of these, I prefer to give in this connection, in brief, the more graphic and popular descriptions to be found in the second edition of Bigelow's "Florula Bostoniensis," published in 1824, and long out of print, a book as fresh and charming still to lovers of wild-flowers, as when its gifted author, some sixty years ago, first gathered and painted them.

"*Rhus vernix.* L. Poisonous Sumach or Dogwood.—This species grows in swamps, where its fine smooth leaves give it the air of a tropical shrub or tree. The trunk is from one to five inches in diameter, branching at top, and covered with a pale grayish bark. The wood is light and brittle, and contains much pith. The ends of the young shoots and the petioles are usually of a fine red color, which contributes much to the beauty of the shrub. The leaves are pinnate, the leaflets oblong or oval, entire, or sometimes slightly sinuate, acuminate, smooth, paler underneath, nearly sessile, except the terminal one, from seven to thirteen in number. The flowers, which appear in June, are very small, green, in loose axillary panicles. The barren and fertile flowers grow on different trees. The fruit is a bunch of dried berries, or rather drupes of a greenish white, sometimes marked with slight purple veins, and becoming wrinkled when old. They are roundish, a little broadest at the upper end, and compressed, containing one white, hard, furrowed seed.

"*Rhus radicans.* Poison-Ivy.—A hardy climber, frequently seen running up trees to a great height, supporting itself by lateral roots, and becoming nearly buried in their bark. The leaves are ternate, and grow on long, semicylindrical petioles. Leaflets (3), ovate or rhomboidal, acute, smooth, and shining on both sides, the veins sometimes a little hairy beneath. The margin is sometimes entire, and sometimes variously toothed and lobed, in the same plant. The flowers are small and greenish white. They grow in panicles or compound racemes on the sides of the new shoots, and are chiefly axillary. The berries are roundish, and of a pale green color, approaching to white. Common about the borders of fields.—*June.*"

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[1] Extract from Gray's Manual:

"4. *R. venenata*, D C. (Poison S. or dogwood). Smooth or nearly so; leaflets 7–13, obovate-oblong, entire. Swamps. June.—Shrub 6°–18° high.

"5. *R. toxicodendron*, L. Climbing by rootlets over rocks, etc., or ascending trees; leaflets 3, rhombic-ovate, mostly pointed, and rather downy beneath, variously notched, sinuate or cut-lobed—or else entire, then it is R. radicans.—*June.*"

I have prepared for illustration specimens of the foliage of both species, as well as of those plants for which they are sometimes mistaken, and to which in the popular mind, as their common names suggest, they bear the strongest resemblance. Purposely picked, as some of them were, while undergoing their autumnal change of color, it will be easily understood how many unwary gatherers of the painted foliage of this season may be enticed by the gorgeousness of their tints into a grievous acquaintance with their subtile virulence.

Rhus toxicodendron, or the poison-ivy, might readily be taken to be our common woodbine, or Virginia creeper (*Ampelopsis quinquefolia*,) both from the manner of its growth, locality, and brightness of its tints in the fall. It will be seen, however, at a glance, as its specific name implies, that the number of leaflets in the latter is five, while in the poison vine there are but three. This will always serve as a distinguishing mark between them, even if the difference in the shape of the leaflets be not observed, though the very great variation in form in those of *R. toxicodendron* should be carefully borne in mind.

Rhus venenata, the shrub or tree, bears some resemblance, as will be seen on comparison, in the shape of its pinnate leaves to those of the elder (*Sambucus*) or sumach (*R. typhina*, or *R. glabra*). The serrate edges of these, as well as their more pointed tips, would be sufficient to distinguish them from this dangerous associate even for persons not observant of less conspicuous details. At a little distance, however, the common sumach might readily be confounded with small-leaved specimens, and considerable variation in the size and breadth of the leaves of the poisonous species, as will be seen, prevails. It may be safely said, however, that several common and harmless shrubs and trees are feared and shunned for this a hundred times where the true poisonous sumach is once mistaken for other and innocuous plants by persons unacquainted with it; for, although by far the more virulent of the two, it is of far less common occurrence and grows in less frequented localities than *R. toxicodendron*.

The peculiar action of these plants upon the human skin has long been known and dreaded, but very few accurate de-

scriptions of its effects are to be found either in books of medicine or botany. Writers have generally regarded the inflammatory affection of the skin provoked by contact with the plants, or their emanations, as of an erysipelatous nature, an opinion quite as erroneous as many of the fanciful notions prevalent concerning its character. Bazin, for instance, in his "Affections cutanées artificielles," says: "Je dois enfin vous dire quelques mots des singuliers effets produits par deux plantes qui croissent en Amérique, le Rhus radicans et le Rhus toxicodendrum. De ces arbustes se dégagent incessamment, si l'on en croit les auteurs, des émanations irritantes et toxiques au plus haut degré; malheur à l'imprudent qui s'abandonne au sommeil sous leurs ombrages! son corps se couvre presque aussitôt d'un exanthème vésiculeux, avec gonflement énorme, et en même temps se déclarent des symptômes généraux qui prennent la forme d'un véritable empoisonnement aigu, et dont la violence peut entraîner la mort dans un temps très court."

After that there should be no doubt either as to the existence or habitat of the fabled upas-tree.

Van Hasselt, in his "Giftlehre," speaks of the effects of the poison as a painful dermatitis, either in the form of an urticaria, erythema, or erysipelas bullosum, which may terminate in an extensive and protracted suppuration.

Observation of a few cases, as they present themselves in the practice of every physician, will satisfactorily establish the changes in the skin to be simply of an eczematous nature, although of so severe a type, in some cases, as to produce quite as marked deformity of parts as true erysipelas. As the character of these changes can be best studied by daily observation throughout their *whole* course, and as such opportunities are not often afforded, I preferred to create one for my purpose. In the study of botany and ornithology I have spent a good deal of leisure time in woods and fields during the past twenty years, and have always collected without gloves. I had never, however, been poisoned by ivy, although I had never specially shunned or sought contact with it.

Case I.—On September 28th, of this year, I picked a large bunch of the gorgeously-tinted leaves of *Rhus venenata* from a tree some ten feet high, growing in a swamp in Dedham. It

was a warm and sunny afternoon, and, my botanical box being filled with other specimens, I brought them home in my hand, from the palm of which the epidermis had been torn in several places a few minutes before by falling upon the uncut, splintered portion of a stump. They were carried in this hand at least an hour and a half, and during the evening were repeatedly handled while arranging them for the herbarium. Some of the still green and unchanged leaves were also picked. The conditions were thus as favorable as possible for the absorption or action of the poison. Not the slightest effect was produced upon the skin, however. I thought I felt during the evening, while working over them, directly beneath the heat of an argand gas-burner, a sensation of irritation, or acridity about the eyes and throat. They were subsequently handled freely for ten days every morning, while changing the driers in the press.

October 6th.—I picked at Fresh Pond a large quantity of *R. toxicodendron*, specimens changed to autumn tints, and others still of a glossy green, from plants running over stone-walls and climbing high trees. Both leaves and stems were collected. These, too, were handled freely on a warm afternoon, and repeatedly afterward in the press. It was absolutely inactive upon my skin.

October 10th.—I again visited the swamp where the poison-sumach or dogwood grows in abundance, after specimens of the fruit, but failed to obtain them. I picked many of the brilliant leaves, however, and twigs, and branches, with foliage still unchanged in color. The juice, which exuded freely from the broken wood, was rubbed upon my hands in several places and allowed to dry there, and the leaves touched my face repeatedly while gathering them. I again thought I perceived in my air-passages and eyes, at the time, and later in the evening again while pressing the specimens, the same impression of acridity. Nothing was noticed upon the skin indicating any action upon its tissues until, two days later (October 12th), a single vesicle, with the peculiar thick cover and somewhat dark look so often seen, appeared upon the back of a finger, but accompanied by no sensation.

October 13th.—The third day, a single and similar, though

somewhat larger, vesicle appeared upon my left wrist, to which two others joined themselves on the following or fourth day, thus making a very small group. At the same time, that is the 14th, a single additional vesicle showed itself some three-quarters of an inch from the first-comers upon the finger and wrist.

October 17*th.*—One of the vesicles, which appeared last upon the knuckle, without any external irritation, increased to three times its original size, with burning and itching sensations. The other efflorescences quiescent, or receding.

October 19*th* (no specimens having been handled for a week), a new and very large vesicle of irregular shape appeared on the back of the last phalanx of the right thumb, covered with so thick a roof as to appear untransparent, as if the effusion had taken place in the lowest layer of the rete mucosum.

October 21*st.*—Two new vesicles, one on the back of the left forefinger, the other on the thumb near the base.

October 23*d.*—All the groups, old and new, have become enlarged by the appearance of new vesicles at the peripheries (excepting those upon the wrists, which had been opened for the purpose of an experiment described below), and one new cluster appeared on the back of the right middle-finger. All itch and burn extremely.

October 26*th.*—The original vesicles and papules have, in many of the clusters, resolved themselves apparently into two or three times their number of smaller efflorescences, the whole patch flattening down and assuming a darker brown tinge.

October 27*th.*—A large, single vesicle, with the thick and opaque covering peculiar to its seat, has struggled up into distinct prominence in the palm of the right hand, near its ulnar border; a fresh one also at the base of the nail of the left thumb. At this date there are seven single or groups of efflorescences, on different parts of the hands in all stages of development or involution.

November 1*st.*—Another small vesicle has appeared in the right palm, half an inch from that of October 27th. The earlier vesicles have nearly all flattened down to the level of the general surface.

November 3d.—A single vesicle shows itself upon the internal lateral surface of the left thumb. This was the last to appear, and from this date all the efflorescences gradually subsided, and after a fortnight were no longer perceptible. At the present time, November 26th, their seats are still defined by the more glossy look of the new epidermis which covers them.

This may be taken as a description of the effects of the poison upon the human skin in its mildest form. The changes, however, as described, are typical of the peculiar efflorescence in all cases. In what respects it falls short of the manifestations in its severest forms may be learned by comparison with the histories of the following cases.

Case II.—Several years ago I was called to see a young lady, who, a few days previously, had come in contact with poison-ivy while gathering autumn leaves. Her whole head was greatly swollen, and the features so distorted that no one could recognize her. On closer inspection the skin of the face and neck was felt to be deeply œdematous and was largely covered with vesicles of all sizes, many of which were seated on an erythematous base, others being still in their papular stage of development. There were also numerous large excoriations, from which fluid was freely exuding, stiffening in places on drying, and forming soft crusts. The ears were much thickened, and were dripping with the escaping serous exudation. The hands were also affected, being thickly covered upon their backs with groups of small vesicles, while upon the palms numerous vesicular exudations were dimly seen beneath the thickened epidermal coverings, trying to push themselves above the level of the general surface. The other parts of the body were unaffected. The subjective symptoms were great itching and burning of the parts affected, with the feeling of local discomfort, consequent upon so great swelling of the features. The eyes were nearly closed. There was a slight general febrile action.

New efflorescences continued to appear for several days, but the course of all the cutaneous manifestations was abbreviated, and the œdema immediately reduced by the local treatment which was employed.

The following year the same patient, then nineteen years old, was bathing at the sea-shore in August, and, while climbing up from the water over the rocks, her bare knee and leg came in contact with the poisonous vine. I saw her a few days afterward. There was then a long strip of reddened skin, several inches in width, covered with vesicles and a few papules, running upward and downward from the knee. The chin was occupied by a large group of papules, a few of which had already advanced to the vesicular stage. The skin beneath one eye was also puffed and reddened. The further progress of the affection was quickly checked by local applications, and, as in the previous attack, the effects of the poison at the end of some two weeks had entirely disappeared.

Three years afterward, at New-Year's time, I was again called to see this young lady. Her face and hands were affected in a manner similar to that first described, though the inflammatory process was less severe. The parts were less swollen, but there was an abundant eruption of the vesicles and flow of serous exudation from the excoriated parts. The appearances were wholly characteristic of ivy-poisoning, yet she had not been out of the city, and it was mid-winter. On inquiry, I found that a box of Christmas green had been received from the country, which she had used in decorating the house. Among them were sprigs of poison-ivy leaves, the cause and explanation of the attack.

Case III.—Late in October, 1871, I was called to see a gentleman who, in cleaning up his grounds at the sea-shore a few days previously, had handled the poison-vine which grew upon the place in great abundance. His hands, especially the lateral surfaces of the fingers, were then thickly covered with vesicles, and his face and genitals were badly swollen. The following day the eruption appeared upon the arms and about the thighs and abdomen, and continued to spread for several days, until at last it presented the following appearances:

The face and ears were of a lurid-red color, greatly swollen, and dripping with fluid exudation. The neck, chest, and abdominal wall, were also reddened, and occupied by large patches of flattened papules and vesicles, and by moist excoriations. The genitals were enormously distended by œdema,

and the scrotum was running with serum. The arms and legs were also œdematous, and largely occupied by fields of the peculiarly characteristic vesicles of the affection. The patient was of a highly-nervous temperament, and suffered tortures from the severe itching which accompanied the eruption. The skin was so universally irritable that no clothes could be worn for forty-eight hours, when the affection was at its height, and a sheet or blanket was the only covering during this time. Sleep without powerful anodynes was impossible for several nights in succession. There was but little fever or constitutional disturbance, however. Applications were almost constantly made to the whole surface, and, after the seventh or eighth day from the first appearance of the eruption, there were no new manifestations, and the skin rapidly returned to its natural state.

These cases may be taken as representatives of the severer forms of poisoning, as they ordinarily occur, and they are the severest of my own experience. To what further development they might have extended without treatment it cannot be said. There are reports, however, of still graver effects. Dr. Bigelow, in his "Medical Botany," quotes Kalm as saying, in his travels, that he had known persons to be so swollen by the exhalations of *Rhus venenata* as to be as stiff as a log, and capable of being turned about only in sheets; and Dr. Thacher's report of a case, in which the head and body were swollen to a prodigious degree, so as to occasion loss of sight for some time, as well as the loss of the hair and nails. Dr. Bigelow adds that he had been told of cases in which death appeared to be the consequence of this poison, although he had never known a fatal case.[1]

[1] I am permitted to publish in this connection the following account of a case which occurred many years ago in the family of a professor in our university:

"My wife's brother, of Brookline, a child of six years, died of poison by ivy in the autumn of 1819, having been twice before poisoned during the previous summer. The circumstances were these:

"A servant-boy living in the family, being insusceptible of poison by ivy, had been employed in pulling up all the vines of that plant found growing in the grounds about the house. When his task was finished, he was made to wash his hands thoroughly with hot water and soap, and afterward with vinegar. Mrs. ———, who feared that the boy, notwith-

Whether these extraordinary results, thus mentioned by Dr. Bigelow, are to be referred to the legitimate action of the poison, or to some peculiar and exceptional condition of the persons when exposed to it, cannot now be determined. However, they in no way affect the conclusions to be drawn from the history of the cases I have cited in relation to the character of its cutaneous manifestations. In these, and in all the many I might quote from personal observation, the pathological changes of the skin are identical, differing only in degree of intensity and extent of distribution. In the mild case, a slight erythema surrounding a papule or vesicle, with a small underlying infiltration or exudation. These are all the phenomena observed, whether we have a single efflorescence or several individuals grouped together. Variations in the course and development of the different lesions do occur.

Taking the simple vesicle with scarcely any erythema surrounding it, or any very perceptible infiltration of the underlying tissues as the type of the eruption, whether occurring singly or in groups, we may have in a small percentage an abortive attempt at vesiculation, and an arrest of development at the papular stage (a failure, that is, of the free exudation to force apart the layers of epithelial cells); or a considerable infiltration into the papillary layer may elevate a cluster of the vesicles noticeably above the general surface; or they may be surrounded by a well-defined erythema or congestion of the tissues immediately surrounding them, in consequence mainly

standing his supposed invulnerability, might possibly be injured by so much handling of the poisonous stuff, stood by to enforce the operation. In the afternoon, at his own request, he was allowed to take little R. to Jamaica Pond for a bath. Having stripped the child, he immersed him, holding him with his hands under the armpits, and afterward rubbed his back with his open palm.

"After two or three days the child was taken ill, and grew rapidly worse. Deep ulcers made their appearance under the armpits, and the skin of the back exhibited, in aggravated form, the usual marks of poisoning by ivy. He died at the end of the third week of his sickness. The attending family physician was the late Dr. Wild.

"The child had been healthy, although not robust. Perhaps the two previous poisonings, from which, however, he seemed to have perfectly recovered, had weakened the power of resistance in the constitution, and so contributed to the fatal result of the last attack. He died on the 6th of October.

"CAMBRIDGE, *December* 24, 1872."

of the scratching provoked by the local burning and itching, the only subjective symptoms present.

In the severe cases we have multiplication of the number of vesicles, either single or massed in close contiguity, and covering large surfaces, or by fusion forming blebs; a greater infiltration into the underlying corium with proportionate distention of the capillaries and external redness; and a free exudation of serum into the cutis. The overfilling of the vesicles causes a rupture of some of their epidermal coverings and the discharge of their fluid contents upon the surface, forming moist excoriated surfaces, covered in part with crusts.

These, it will be seen, are the well-recognized lesions which characterize the inflammatory process of the skin we call eczema, and, if opportunity were afforded for fine dissection, we should no doubt find the same pathological changes of tissue which constitute the infiltration, papule and vesicle formation of the progressive stage of idiopathic eczema. It may be that there are skins so peculiarly constituted, or conditions of such intense virulence of the poison, that a true dermatitis or erysipelatous inflammation may be excited under its influence, but I have never seen them, and doubt their occurrence. The constancy of type in the tissue-changes, in every case and of all grades observed by me, is satisfactory evidence to my reason that the affection is always of an eczematous, never of an erysipelatous nature.

If, then, the cutaneous manifestations of ivy-poisoning are those of eczema, have they no individuality, no characteristic marks by which they may be distinguished from those of the idiopathic affection? There are differences to be recognized by the practised eye, but they are more easily detected than described. First, with regard to peculiarities in the seat of the eruption upon the hands, the parts naturally the most frequently affected. It appears most easily, one may say, and therefore generally first upon the lateral surfaces of the fingers, or along their edges, later upon the dorsal surfaces, and latest upon the thickened palms. It is more scattered, more irregular in its distribution, than the eruption in ordinary eczema. The character of the efflorescence, too, is strikingly peculiar, though indescribable. It is more uniformly vesicular

than vesicular eczema. The vesicles seem to be born vesicles without having gone through an intermediate papular stage of development. They appear somewhat less transparent, as if the effusion had taken place in the lowest cells of the rete Malpighii, and have generally a peculiar tinge of color, which can only be called lurid. Upon the palmar surface their epidermal coverings are so dense that they look and feel more like papules, but the fluid character of their contents may yet be dimly seen and brought to the surface by puncture with a needle. These are some of the differences, minute it is true, but still sufficiently characteristic to an experienced observer, by which a case of rhus-poisoning may be recognized and distinguished from idiopathic eczema.

In its later stages, those of retrogression as they may be called, the skin returns to its natural state without any marked change in the character of the eruption. In the mild cases the process of inflammation is seldom carried so far as to transform the vesicle into a pustule, and after reaching its height its serous contents are slowly absorbed, and it flattens down, leaving a fugitive, dull-colored stain to mark its seat at times. In the severer forms the œdema and erythema rapidly subside under treatment, and the excoriations, crusts, and infiltration, disappear in the same manner as in an ordinary case of acute eczema.

The duration of these alterations of the skin, according to their severity, varies less than would be believed without close observation. In my own case (one of the mildest of cases and untreated), vesicles continued to appear from October 12th up to November 3d, and the whole period of development and involution was from five to six weeks. In the severest attacks, where the changes of tissue reach their highest possible development, and affect large surfaces of the body, the duration is seldom, if ever, more protracted than this, and the individual efflorescences run as rapid a course as those of the same degree of development in the former. The duration of an attack depends largely upon the protraction of the period during which fresh efflorescences manifest themselves. Under local treatment constantly applied, this period, without reference to what may be called the sequelæ, and which will be spoken of

below, according to my own experience, generally lasts from ten to fourteen days from the appearance of the eruption. To this is to be added the necessary time for the natural involution of the efflorescences last to appear, according to the degree of development to which they severally attain, from ten to fourteen days more, and we have for the ordinary course of the affection a period of from three to four weeks. How long it might continue without treatment in severe cases, I have no means of knowing except the observation of my own very mild case, in which fresh vesicles were developed for twenty-two days.

Sequelæ.—The question of duration leads us naturally to consider that of other possible effects of the poison upon the skin or general economy, subsequent to what we may call its primary action, above described. There are several popular beliefs bearing on this point, which have perhaps some foundation in facts improperly observed and illogically used. An opinion prevails, for instance, that in a year after the first attack there will be a repetition of the original manifestations upon the skin, which may be repeated for several seasons. Another is entertained that a variety of cutaneous affections are developed in consequence of its action at indefinite and even long periods after the first attack. If there be any apparent ground for the former, it is mere coincidence in point of time, misapplied to circumstances which have given rise to the latter, for no elements of periodicity in any subsequent possible manifestations of the poison have been established, so far as I know. There may be some reasons, however, for the belief that certain diseases of the skin sometimes follow rhus-poisoning. I have had many patients who have ascribed the development of various of these affections to such cause. They say, "I always had a healthy skin until I was poisoned by ivy, and afterward it was affected in this way," after an interval of weeks, months, or it may be years. In the existing impossibility of determining the cause of diseases of the skin only in highly-exceptional instances, it is not strange that people should refer subsequent affections of its tissues to the continued or intermittent action of an agent capable of producing at first so striking and severe changes as they have

once experienced, and that they in many such instances should ascribe as a cause what is only an irrelevant preceding event. Yet there are, I think, good grounds for the belief that certain affections of the skin do follow poisoning by rhus in some cases, which would not otherwise have occurred. This, however, by no means authorizes the conclusion that they are immediately caused by its action, or are in any way specific in their character. There is no evidence, I think, of a continuance or renewal of the operation of the poison, after its primary impression upon the skin has exhausted itself. The characteristic features of the cutaneous manifestations of this period do not repeat themselves in the subsequent affections, which, I think, may be fairly referred to the prior poisoning as an indirect cause. They are forms of ordinary eczema, and, in rarer instances, of acne only, so far as my observation teaches. I have already referred to the many patients with these common diseases of the skin who have ascribed them to having been at some previous time poisoned by ivy. I prefer to use in this connection, however, for confirmation, another class of cases, those, namely, in which I have seen these affections develop subsequent to such attacks of poisoning as have also occurred under my personal observation.

1. A young lady, after being badly poisoned in October upon the face, after a rapid recovery, had in the following January an attack of facial eczema.

2. Another young lady, after severe poisoning of the face and hands, had in a few months an outbreak of facial acne.

3. An old gentleman, whose hands had been a short time previously poisoned, had, immediately following his recovery, an eruption of eczema covering his arms.

4. A young man, after being severely poisoned in the face, was immediately attacked by acne of the part, which lasted a long time.

5. A gentleman of middle age was poisoned upon the hands and forearms. A few months afterward he had an obstinate subacute eczema of the legs.[1]

[1] Dr. Bigelow, in his "Medical Botany," states that Dr. Pierson, who was badly poisoned while assisting him in the experiments with the juice of *Rhus venenata*, had eczema of his hands for a year afterward.

In all these cases, it is to be understood, the secondary affection mentioned occurred for the first time in the patient's history, and after the specific primary manifestations of the poisoning had disappeared. It is impossible to say that just the same affections might not have appeared at just these times, even if the subjects of them had not been previously poisoned, because they are of such frequent idiopathic occurrence; but, considering that eczema and acne are pathological conditions of the skin of such a nature as might readily follow the disturbance in its tissues and glands necessarily consequent upon severe poisoning by rhus, it should not be considered illogical to refer their appearance under such circumstances to the morbid impression it made. These, however, are the only possible sequelæ in my experience that might be so interpreted.

Susceptibility to its action seems never to diminish in the same individual, however often affected by the poison.

Chemical Nature of the Poison.—What the real nature of the poisonous principle contained in these plants, capable of producing such peculiar and severe effects upon the human skin, might be, was largely a matter of conjecture, in spite of many attempts to reach it by chemical processes, until a few years ago. Knowledge that its emanations were often as active as contact with the plant of course suggested its volatile nature, but all attempts to isolate and fix it were in vain. The yellowish, milky juice, which exudes from the broken or bruised parts of the plant, possesses, as is well known, the property of changing to a brilliant black after a short exposure to the air, and of producing an indelible black stain upon cellulose. The beautiful lacquer of the Japanese is made from the juice of a species of rhus closely allied to our native plant. Prof. Gray, in his recent interesting address on "The Sequoia and its History," to the American Association for the Advancement of Science, says: "Our *Rhus toxicodendron*, or poison-ivy, is very exactly repeated in Japan, but is found in no other part of the world, although a species much like it abounds in California. Our other poisonous rhus (*Rhus venenata*) is in no way represented in Western America, but has so close an analogue in Japan that the two were taken for the same by

Thunberg and Linnæus, who called them both *Rhus vernix*." Of the history of the preparation of this celebrated varnish of Japan, and its effects upon the workmen engaged in its manufacture and use, very little is known. The juice is taken from trees three years old, and is prepared for use as a varnish only by a "tedious process." When first caught it is of a lightish color, and of the consistence of cream, but it grows thick and black on exposure to the air. The finest sorts of firs and cedars are selected, and the varnish is so transparent that, when laid on pure and unmixed, every vein of these woods is clearly seen. The process of applying it is extremely slow, five coats at least being laid on and ground down. Generally, a dark ground is spread underneath beforehand, "recourse being frequently had to the fine smudge which is caught in the trough under a grinding-stone." Native cinnabar, sulphate of iron, finely-powdered charcoal, and other substances, are also employed for coloring the wood before varnishing, and sometimes gold-leaf ground very fine is mixed with the lacquer.

This account, by far the fullest I could find, is taken from a book of travels published one hundred years ago; while only in Kaempfer, "*Amœnitatum Exoticarum*" (1712), do I find, through the kindness of Prof. Gray, an allusion to the action of the varnish upon those engaged in its use, as follows: "Vernix exsperat halitum, ex quo labia tumescunt, et caput dolet; unde in deliniendo artifices strophiolo os et nares obligant."

I have heard of a person who had been poisoned by the presence of imported lacquered-ware in apartments, but I report the case only on "hearsay" evidence.

In 1865, Prof. John M. Maisch published the first satisfactory account of the chemical nature of this poison in the proceedings of the American Pharmaceutical Association. As the results of his important investigations have never been fully introduced to the profession, I do not hesitate in this connection to offer a brief account of them.

In 1857, Dr. Khittel made an analysis of the constituents of *Rhus toxicodendron*, a translation of which appeared in the *American Journal of Pharmacy*, 1858. He came to the conclusion that its active principle depended on a volatile alkaloid, obtained by distilling an infusion of the dried leaves.

As the leaves are so volatile that they give up a large part of their poison while drying, it is evident that boiling down an infusion of them would, as Prof. Maisch says, be the best method for obtaining the least possible quantity of the poisonous principle, if, indeed, it could be obtained by this process at all.

Prof. M. began his investigations by attempting to extract and preserve this alkaloid, but satisfactorily demonstrated that it does not exist, even in the fresh plant. He then enclosed some fresh leaves in a tin box and introduced some moistened test-papers. The next morning the curcuma and red litmus-papers were unaffected, but the blue litmus-papers had been colored strongly red, proving that the exhalations contained a volatile acid. This acid was extracted by two different processes, which it is unnecessary to repeat here. It was colorless, strongly affected blue litmus, and neutralized bases, the salts with the stronger bases giving a distinct alkaline reaction. With a great variety of reagents it gave reactions identical with those of formic and acetic acids, but its behavior with oxide of silver, nitrate of silver, oxide of mercury, and corrosive sublimate, proved its individuality, and established its character as a new organic acid, for which Prof. M. proposed the name of toxicodendric acid.

"That it is the principle to which the poison-oak owes its effects on the human system was proved to my entire satisfaction," he says, "by the copious eruption and the formation of numerous vesicles on the back of my hand, on the fingers, wrists, and bare arms, while I was distilling and operating with it . . . . I may state here," he tells us in the early part of his communication, "that I have frequently collected the leaves, flowers, and fruit of *Rhus toxicodendron* without ever experiencing any ill effects. I have handled all parts of the plant with impunity, and have even spread the juice over my hands, without feeling more than a slight itching upon the upper side of the hand, which immediately disappeared on washing the hands with water. In a word, I considered myself so little subject to its influence that I collected the leaves for all these experiments myself. I could hardly expect to try the efficacy of the poisonous principle, when isolated, upon

my own person; the result, however, proved to be very different. Several persons, coming into the room while I was engaged with it, were more or less poisoned by the vapors diffused in the room; and I even transferred the poisonous effects to some other persons, merely by shaking hands with them." (Whether after washing hands?) "The dilute acid, as obtained by me, and stronger solutions of its salts, were applied to several persons, and eruptions were produced in several instances, probably by the former, though not always, which was most likely owing to the dilute state of the acid. Whenever this was boiled, I always felt the same itching sensation in the face and on the bare arms which I experience on continual exposure of my hands to the juice of the plant. . . . Whether the toxicodendric acid is, to a greater or less extent, lost in drying, I am as yet unable to say." As regards its isolation it is easily effected, and the expressed juice, preserved by alcohol, he believes to be the best preparation. Prof. M. closes his interesting communication with the promise that, if time permits, he may attempt to prepare the acid in more concentrated form, and to determine its composition. It is to be regretted that, as he states in a letter to me, he has thus far been unable to make further researches concerning it.

There can be little doubt, I think, of the correctness of Prof. Maisch's views with regard to the chemical nature of the poison, and they are entirely consistent with our knowledge of its action upon the human system.

How far this volatile principle may be carried in the air in a sufficiently concentrated form to produce its peculiar effects upon the skin cannot be exactly stated, but it must vary with the degree of individual susceptibility. I have been assured by persons well acquainted with the plant, and so easily acted upon as to have been repeatedly poisoned by it, that they have been affected by driving along a narrow road, the stone-walls on either side of which were covered with the flowering vines of *Rhus toxicodendron*. Many persons who carefully shun contact with it are frequently poisoned when they approach it even. That very slight contact is sufficient to produce very severe action upon the skin at times is certain. The only measure of the extent of its power can be learned by experi-

ence alone; some persons being entirely unaffected by ordinary handling of specimens, who are yet susceptible in some degree to its action in a concentrated form. My own case, and the experiments of Prof. Maisch, above quoted, illustrate this.

The two species differ only in the degree of their action—*Rhus venenata*, the tree, being much more powerful than the creeping *R. toxicodendron*—and many persons are able to handle the latter with impunity, who are readily poisoned by contact with the former. It is evident, then, that cases of poisoning would be much more frequent and severe were poison-sumach of as common occurrence about dwellings as the poison-ivy, for the majority of persons are, no doubt, unaffected by the latter.

With regard to the influence of season upon the virulence of the poison, there is an impression that it is most active in the flowering-season, and the emanations at such times may be especially so, while the skin on hot days, and when perspiring, may be most ready to absorb it. This may be correct; it is, however, sufficiently powerful at all seasons. At least, one-half the cases I have seen occurred in the fall, after the change in the foliage, and in persons who, collecting autumn leaves, had been attracted by the gorgeous coloring both species then exhibit. No leaves approach in variety and brilliancy of tints those of *Rhus venenata*. But later still in the season the venomous properties of these plants manifest themselves. In winter even, cases of poisoning occur, and are no doubt sometimes unrecognized. In the case of the young lady, quoted in illustration of the severer form of poisoning, one of the attacks, it will be remembered, was caused by handling twigs and dried foliage of *Rhus toxicodendron* at Christmas-time. Other cases might be reported at length, but it will be enough for the purpose simply to mention them.

Some years ago, in December, I was called to a gentleman who had a severe attack upon his hands, who had handled some of the branches while chopping wood.

Last February, I treated a gentleman for quite a severe attack upon the hands, who handled wood entwined by poison-ivy out-of-doors, and whose farmer at the same time was very badly poisoned while chopping the same wood.

Dr. Bigelow states, in his "Medical Botany," that he has known persons to be poisoned in the winter, when the wood of *Rhus venenata* was burned upon the fire. Whether in these cases the poisoning was produced by the exhalations of the burning wood or by contact while handling it by the fireside, he cannot positively say.

I was curious to know how long dried specimens in the herbarium might retain their poisonous properties, and, for this purpose, wrote to Prof. Gray, who very kindly replies as follows:

"Botanic Garden, Cambridge, Mass.,
October 21, 1872.

"Dear Doctor: My personal knowledge that rhus dried specimens are harmless amounts merely to this: I handle over and over dried specimens with impunity, but am very sensitive to the fresh plant. Then the poison is volatile, as shown by its affecting persons who do not touch it actually; that of the leaves, I should say, must escape and dry out in the drying process, or in the course of time. In a stem it would not volatilize so soon, but I should not expect to be poisoned from any *old* herbarium specimen, either from twigs or leaves . . . "

Thus not only the leaves, but the wood and bark, contain the virulent principle at all seasons, and the fruit also possesses poisonous properties when swallowed.

The time required for the development of the visible manifestations of the poison upon the skin, after contact with the plant or its emanations, or its period of apparent latency, seems to vary greatly. In his "Genera," Gray says, "The symptoms begin several hours after exposure." Dr. Bigelow, in his remarks on *R. venenata*, says, "The effects show themselves upon the skin generally within eight hours." My own observations do not agree with these as to the rapidity of its action. In my own case, above recorded, at least forty-eight hours passed before any thing was felt or seen upon the parts to which *R. venenata* was applied. It may be properly suggested, in explanation of such delay, that my skin is not easily acted upon by the poison. This is true, but my other observations concern patients, that is, persons especially susceptible to its action, and I find on reference to my record-book that three days, four days, and five days, are repeatedly given by them as the interval between contact and the appearance of an erup-

tion sufficiently marked to attract their attention. Such length of interval seems to be the rule rather than the exception in my experience, although this, of course, does not invalidate the correctness of their statements that, under some circumstances, a few hours may be sufficient for the development of the eruption. That new efflorescences may continue to appear, after the first manifestations, for a much longer period, we have already seen.

But how shall we explain some of the peculiar phenomena connected with the action of this poison, as recorded in my own case, for instance? The first vesicle appeared on the second day following that of contact with the juice. From that time for twenty-two days these characteristic efflorescences continued to be occasionally developed, singly toward the last, and on parts of the hands more or less remote from one another. Where had the active principle, which on November 3d gave rise to the solitary vesicle on my left thumb at a distance of two inches from the single and only other eruption on that member, been since the contact on October 10th? Had it been originally absorbed at that particular point, and been lying dormant for three weeks before sufficiently impressing the tissues to recognize its presence by such excessive vitality of action; or was the poison borne thither at that late period from some other focus of activity; or had the spot been freshly poisoned by contact with parts similarly affected? Strange as it may seem, the first of the three suppositions is the least improbable, and must, therefore, for want of better explanation, be accepted as the solution of this mysterious action.

With regard to the latter point, that of *contagion*, a definite opinion may be expressed. The question is often asked, "Is ivy-poisoning contagious? Will contact with the eruption, or the fluid discharges, produce the disease upon other parts of the same person or upon the skin of another individual?" It is not at all improbable that a person who had been handling specimens of rhus might, by immediately taking the hand of a person excessively sensitive to its action, and before the volatile principle had been dissipated, or washed away, or absorbed, convey the poison thus to the other, which would subsequently prove effective. That would be transferring the

poison, not the disease. Prof. Maisch shows the possibility of such an event in the account of his experiments. It is in this way that the penis is so often affected, no doubt, it being handled during micturition while out-of-doors, and while the poison is still fresh upon the hands. There are no grounds for believing that, the poison once absorbed, or removed by washing or volatilization, the disease is in any way contagious. The freest handling of parts affected in all stages of the efflorescence fails to transfer the disease to the hands of another, and I believe surface contact with other parts of the same individual entirely ineffectual in spreading the eruption. To determine the possibility of such communication, I undertook the following experiment in connection with my own case: On October 14th, both the vesicles upon my wrist, the one of twenty-four, the other of eight hours' duration, were opened, and their clear and colorless contents applied and scratched into the epidermis on the wrist of a gentleman who is especially sensitive to the poison of *Rhus toxicodendron*, having suffered twice during the present summer, and many times and severely in past seasons, from contact with it. The result was wholly negative. Dr. Bigelow reports that Dr. Pierson inoculated with the serum from vesicles on the second day in the case above referred to, and with the discharge from the later stage, but without effect.

On Animals.—I have been unable to find a single instance on record of the poisonous action of rhus on the lower animals. I have inquired of a great number of sportsmen with regard to their dogs, and published in the *Spirit of the Times*, through the courtesy of its editor, a similar inquiry. There seems to be no reason why short-haired pointers, considering the necessarily frequent contact with poison-ivy while hunting, should not sometimes exhibit the effects of its action, if their skins were at all susceptible. One gentleman, a physician, told me that his dog's eyes had been closed by swelling once or twice while hunting where ivy abounded, which he attributed to its action, but he had never seen any eruption upon the skin at the time.

The leaves of both species are found eaten by worms, and spiders attach their webs to them. Dr. Bigelow, on the other

hand, refers to an account, in the *New York Medical Repository*, of a swarm of bees alighting on the branches of *Rhus venenata*. The next day they were found dead, their bodies being black and swollen. He adds that in spring their flowers are sought by numerous insects. On the other hand, I find it stated that insects never attack the Japan tree.

Treatment.—A great many remedies have been recommended, in both medical and botanical books, for the treatment of persons poisoned by rhus, while others of a "domestic" character are used in various parts of the country. Among the former a solution of acetate of lead holds the most conspicuous place. Torrey, in his "Botany of New York," says one of the best applications is a solution of sugar of lead, after the use of saline cathartics. Dr. Bigelow ("Medical Botany") thinks the application of acetate of lead as useful as any external palliative, and that it should be used as cold as possible. Solutions of sulphate of copper and of other metallic salts have also been recommended by physicians. Among the domestic remedies, vinegar, and solutions of saleratus, and carbonate of soda, are widely and highly esteemed. A decoction of Virginia snakeroot (*serpentaria*) is also supposed to possess special power against the poison. In an old copy of Bigelow's "Florula Bostoniensis," picked up in a second-hand book-store, I find, in connection with *Rhus toxicodendron*, a marginal note by its former owners, stating that, if soft-soap be rubbed thoroughly into the hands after handling specimens, its poisonous action will be prevented.

It is evident from our knowledge of the nature of the poison and its effects, as above described, that two distinct questions are to be considered in connection with the treatment of rhus-poisoning, as in toxicological therapeutics generally, first, that of the necessity and selection of an antidote; second, that of the proper management of the changes in the tissues of the skin. So far as I know, these have never been sufficiently recognized by writers and practitioners, perhaps because we were so long ignorant of the true chemical nature of the poison; and the reputation which some of the above-mentioned remedies have, perhaps, justly acquired, rests upon their successful action in one or the other of these directions, according to the period in which they may have been used.

Whether or not we should resort to an antidote must, of course, be determined by the length of time since the parts affected were in contact with the plant, or its exhalations. As the poisonous principle is of a volatile character, it is questionable how much good can be done in this direction after the first day, or even then after the hands have been washed with simple water. How long the poison may retain its characteristic peculiarities after absorption by the skin, and how readily our antidote may follow and penetrate to it, are also matters of uncertainty. As to the nature of the remedies to be used at this stage and for this purpose, there can be, of course, no longer any question. We have to deal with an acid, and the antidote for an acid is an alkali—that is, provided the salts thus formed are not equally poisonous. In poisoning by oxalic acid, for instance, potash is not an antidote, because the combination formed is nearly as poisonous as the acid itself Whether the salts formed with toxicodendric acid by ammonia, potash, and soda, are likewise poisonous, Prof. Maisch leaves us somewhat in doubt as the result of experiment, but speaking clinically he leads us to believe they are not, for, he says that the application of solutions of ammonia seemed to be most effective in counteracting the action of the acid. This is consistent with the popular reputation of solutions of saleratus and soda as remedies, and will explain the action of the soft-soap above mentioned. These are true antidotes, but they can be of benefit only from their chemical action, and in this way. In the later stages, or, in other words, against the subsequent eczematous changes in the cutaneous tissues, they can do no good. The action of that most popular of all remedies in this affection, the solution of sugar of lead, is a mixed one, and seems to have been happily, though unwittingly, selected as an appropriate remedy in all stages. Toxicodendric acid precipitates from it an insoluble, and therefore harmless, salt, while its astringent action is well adapted, in many cases, to the relief of the inflammatory processes in the skin.

The treatment of the later stages of rhus-poisoning, that is, of the eruption it produces, need not be especially considered, for it is mainly that of the corresponding varieties of ordinary acute eczema. It is seldom that the physician is called upon before the inflammatory process is well developed, so

that there generally remains for him only the selection of the applications appropriate to a simple eczema of the same stage. In the great majority of cases I have found black-wash—calomel ʒj, lime-water Oj—by far the best application to the affected parts, used as an evaporating lotion upon thin and old linen or cotton cloth, for half an hour to one hour at a time, two or three times a day. I have used in connection with it, to moist or excoriated parts, a powder of oxide of zinc ʒj, starch ʒj, or plasters of oxide of zinc or diachylon-ointment, as in the management of ordinary eczema. In the black-wash we have, possibly, three elements at work in our favor: first, the alkali as antidote, if it is of any avail at such periods; second, the action of cold from evaporation upon the local hyperamy; and, third, the astringent effect of the mercurial powder upon the diseased tissues. In all cases of poisoning I have been entirely satisfied with its effects, however extensive in distribution or advanced in development the inflammatory condition of the skin. Only upon the thickened epidermal coverings of the efflorescences in the palms does it seem ineffectual. To these tardy and well-protected manifestations I apply solutions of corrosive sublimate, from one to two grains to the ounce of water, in the same way as the black-wash is used upon the other parts. By these means the eczematous process is checked and shortened, and the subjective symptoms greatly alleviated.

Of any internal treatment of direct bearing upon the affection, I have never seen the operation or need. A simple and restricted diet in severe cases is, of course, to be observed.

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