The Poisonous Plants of Indiana.

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It is the purpose in this paper to consider only those plants occurring within the limits of Indiana, which are said to be *contact poisons*. The list as assembled from various authorities is sufficiently extended to raise question as to the character of the facts upon which the forms were included among the contact poisons. The list, as I have been able to collate it, is as follows:

Alisma Plantago-aquatica L. Water plantain.

Arisaema triphyllum (L.) Torr. Jack in the Pulpit. Indian Turnip.

Arisaema Dracontium (L.) Schott. Green Dragon.

Spathyema fœtida (L.) Raf. Skunk Cabbage.

Veratrum viride Ait. Indian Poke. White Hellebore.

Cypripedium hirsutum Mill. Yellow Lady's Slipper.

Urtica gracilis Ait. Slender Nettle.

Urtica dioica L. Stinging Nettle.

Urticastrum divaricatum (L.) Kuntze. Wood Nettle.

Polygonum hydropiper L. Smartweed. Water Pepper.

Polygonum punctatum Ell. Water Smartweed.

Phytolacca decandra L. Pokeberry.

Actæa rubra (Ait.) Willd. Red Baneberry.

Delphinium consolida L. Field Larkspur.

Anemone quinquefolia L. Wind flower. Wild Anemone.

Clematis Virginiana L. Virgin's Bower. Wild Clematis.

Ranunculus sceleratus L. Ditch Crowfoot. Cursed Crowfoot.

Ranunculus acris L. Tall or Meadow Buttercup.

Ranunculus bulbosus L. Bulbous Buttercup.

Podophyllum peltatum L. May Apple. Mandrake.

Sanguinaria Canadensis L. Bloodroot.

Cruciferae: Various genera, including the mustards, pepper-grass and horseradish.

Drosera rotundifolia L. Round-leaved Sundew.

Ailanthus glandulosa Desf. Tree of Heaven.

Euphorbia: Not only all of the fourteen species reported from Indiana, but all of the hundred of more species occurring in the United States.

Rhus Vernix L. Poison Elder. Poison Ash. Poison Dogwood.

Rhus radicans L. Poison Ivy. Poison Oak.

Dirca palustris L. Leatherwood. Moose-wood.

Aralia spinosa L. Angelica Tree. Hercules Club.

Solanum Dulcamara L. Poison Nightshade.

Datura Stramonium L. Jamestown or Jimson-weed. Thorn Apple.

Datura Tatula L. Purple-stemmed Jimson.

Verbascum Thapsus L. Common Mullein.

Catalpa Catalpa (L.) Karst. Catalpa. Indian Bean.

Lobelia inflata L. Indian Tobacco.

Xanthium strumarium L. Cocklebur. Burthistle.

Solidago: All species to be regarded with suspicion by persons with sensitive skins. Solidago odora Ait., said to be particularly dangerous because of a "volatile oil that is an irritant and rubefacient."

Leptilon Canadense (L.) Britton. Horse-weed. Flea Bane.

Bidens frondosa L. Common Beggarticks. Spanish Needles.

Anthemis Cotula L. Common Dog-fennel.

Arctium Lappa L. Burdock.

To these may be added the commonly cultivated—

Tropaeolum majus L. Nasturtium.

Nerium Oleander L. Oleander.

Primula obconica Hance. Primrose.

This is a rather startling array of dangerous plants, especially to the field botanist who has been handling most of them with perfect impunity for years. It occurred to me some years ago that it would be interesting to examine the list carefully and so far as possible to conduct a series of experiments confirming or disproving the correctness of the inclusion of the above forms in the list. This I have been able to do with the aid of a number of students who offered themselves as subjects for the experiments. In the last five years I have been able to secure twenty-two persons to aid me in the work.

The most cursory examination breaks the preceding list into two sharply separate groups. In the one the skin irritation is due to the action of some specific substance of the plant, as in the case of Rhus; in the

other the skin irritation is plainly due to mechanical causes, as in the case of Arctium and Xanthium. There seems to be no good reason why any plant with piercing surface outgrowths, such as Bur-grass (Cenchrus tribuloides L.), should not be included in the latter group and the list almost indefinitely extended. Very little was done experimentally with such plants, for though persistent and sometimes festering sores may result from handling them, the irritation is due to traumatic, not to toxic, causes.

In the first group of plants an additional separation may be made into those poisonous by mere handling and those whose poisonous properties seem to be liberated only as the result of dry trituration or grinding, the well known irritant effects of the dust arising from the dried roots of Podophyllum being a case in point.

It will thus be found that the number of plants which are really contact poisons, under ordinary handling is very much reduced and the long continued immunity of those of us who have collected widely is not after all as wonderful as it might at first seem. As a matter of fact it would seem that any plant, which in any way and under any conditions however extraordinary produced a skin irritation had been promptly placed among the contact poisons. There is also to be considered the personal idiosyncrasy. Some persons are peculiarly susceptible to plant poisons, either because of an especially sensitive skin or of some constitutional condition which makes them remarkably non-resistant to the sequelae of skin lesions of any sort. As a result of this consideration of the personal equation the list of plants poisonous by contact is still further reduced.

A rather careful experimental study of the plants in the above list has been made with the following results:

In all cases the procedure was simple but was deemed sufficient to demonstrate the poisonous or non-poisonous character of the plant. The plant was first handled freely in the way of collecting and making herbarium specimens. If after some days no results were apparent, the part of the plant said to contain the poisonous element was rubbed upon the back of the forearm until serum, and at times blood, exuded, the juice of the plant and the serum being allowed to dry upon the arm. If no results followed, it was considered safe to infer that the form was not a contact poison.

Water plantain (Alisma Plantago-aquatica L), common throughout the state in mud and shallow waters, is said by the National Dispensatory to

contain in the leaves "an acrid principle strong enough to irritate the skin." No one of the twenty-two subjects showed the slightest trace of skin irritation as the result of treatment as indicated in the preceding paragraph. The leaves were taken at different dates, but no results confirming the above statement were secured.

The Indian Turnip and Green Dragon (Arisæma triphyllum (L.) Torr., and A. Dracontium (L.) Schott) are said to be "violently acrid and almost caustic in every part, frequently producing intolerable itching and inflammation of the skin." None of the twenty-two subjects showed the slightest unpleasant results from the free handling of the above species. As a result of the more vigorous treatment five showed a vesicular inflammation lasting for three or four days. The inflammation was accompanied by considerable itching, which, however, was not so violent as to merit the term "intolerable." Of the five showing unpleasant effects, two were young ladies, who proved so susceptible to almost any type of skin lesions that they were unable to continue the work.

The Skunk Cabbage (Spathyema fœtida (L.) Raf.) is said to be "harmless as to the leaves, but with root so acrid as to produce intolerable itching and inflammation." No results were secured from frequent and rather rough handling of the roots. Later the juice was expressed by pressure and allowed to dry upon the arms, rubbed to extreme redness, of five subjects. Neither itching nor inflammation resulted. The latter test was repeated in April, May, June and September, four additional subjects being used, but in every case failing to confirm the reputation of the plant as a skin irritant.

Indian Poke (Veratrum viride Ait.), sparingly found in many localities, growing in swamps and wet woods, will, it is alleged, if "applied to the skin in moist condition cause redness and burning." The plant is so occasional in its occurrence that it need scarcely be taken into account. Two experiments upon myself gave absolutely no redness or burning. It is, however, fair to state that these experiments should not be regarded as determinative, since not even the poison ivy (Rhus radicans L.) produces any skin irritation, except when the skin has been rubbed to redness with the crushed leaves and the juice allowed to dry upon the surface.

Cypripedium hirsutum Mill., the Yellow Lady's Slipper or Moccasin flower, is said to be "irritating to the skin, in some cases poisoning as severely as Rhus." Eleven out of the twenty-two persons experimented

upon showed unpleasant effects from the mere handling of this species in collection and determination. Six others were poisoned as a result of the rubbing process, only five escaping entirely. In almost every class I have numerous cases of poisoning easily referable to this form. The poisonous property seems most active during the flowering season, the plant being practically innocuous after seed maturation. The effect shows first as a hyperæmia, later becoming vesicular and even pustular if untreated. It yields readily, however, to ordinary emollient treatment and can be fairly limited in its spread by frequently bathing the adjacent parts with alcohol. My attention was first called to the poisonous character of the plant by Dr. D. T. MacDougal and continued observation but serves to confirm the view that many cases of poisoning attributed to the poison ivy should be referred to this species. The attractiveness of the flower serves to lead many persons to collect it in large masses and if the results reported above are at all indicative, it is doubtless chargeable with many cases of poisoning occurring in the early spring.

The nettles including Urtica dioica L., Urtica gracilis Ait. and Urticastrum divaricatum (L.) Kuntze, poison through the action of acrid constituents, producing an intolerable burning. The inflammation, however, yields so readily to treatment by cooling lotions and is so ephemeral in its character if untreated, that the plants are to be considered as annoying rather than poisonous. None of twenty-two subjects escaped the intense burning following the handling of these forms. The inflamed condition never persisted over two or three hours even after a rather vigorous whipping of the skin with the plants.

Of the Smartweeds, two, Polygonum hydropiper L., and P. punctatum Ell., it is said "cause itching and burning of the skin." In the experiments tried this proved true if the expressed juice was applied to mucous membranes, especially those of the eye. In no case was any irritation observable where the application was to the skin. In this case also, the irritation was but temporary and yielded readily to bathing the affected parts in cold water.

That Pokeberry (Phytolacca decandra L.) contains a principle which is an internal poison is well known. The claim, however, that the "green plant and root irritate the skin, affecting chiefly mucous membranes," does not seem to be so well made out. Only eight subjects were treated with this species and in no instance were any inflammatory symptoms ob-

servable. Later the dried root was ground and a very annoying and somewhat persistent irritation of the mucous membranes of the eye resulted, yielding only to treatment by an oculist. It is fair inference that no part of the Pokeberry is a contact poison in the ordinary acceptance of the term, although the plant does possess a poisonous principle which under exceptional conditions may produce an inflammation of a somewhat obstinate and therefore serious character.

The Baneberry (Actæa rubra (Ait.) Willd.) is said to contain a "vesicating principle." Experimentation upon fifteen subjects failed to verify this statement. In this case, as in all others where negative results were obtained, the experiments were repeated several times at different stages of the development of the plant.

The Field Larkspur (Delphinium consolida L.) is also claimed to be a skin irritant. "A specific element in the seeds produces in tincture great burning and inflammation of the skin." The experiments upon this form were unsatisfactory because of the small amount of material available. The tincture applied to the skin produced some slight burning and inflammation, although the latter was no greater than would be expected from a similar treatment with pure alcohol. Evidently, however, the Field Larkspur is in no sense to be considered a plant dangerous to handle.

The Wild Anemone or Wind flower (Anemone quinquefolia L.), said to be "irritating to the skin, producing redness and itching," was found, so far as the experiments went, to be perfectly innocuous, not even those who were most susceptible to skin irritations showing the slightest sign of inflammatory symptoms.

The Virgin's Bower or Wild Clematis (Clematis Virginiana L.), said to contain an "acrid irritant producing blisters", affected nine out of seventeen subjects; four by the mere handling, the other five as a result of rubbing the skin with the leaves and flowers. A marked hyperæmia preceded the vesicular stage of the inflammation, which in no case was of more than three days duration.

Three of the Crowfoots or Buttercups (Ranunculus sceleratus L., R. acris L., and R. bulbosus L.), it is alleged, "cause inflammation and ulcers, the root being especially rich in poisonous substances." Of these R. sceleratus and R. bulbosus are sufficiently occasional in our area to be neglected. R. acris, also, as at present delimited by systematists, is of relatively scant occurrence in Indiana. Seven subjects were used. None

showed any ill effects from treatment with aerial parts. Two showed sharp inflammation from rubbing the skin with the root, but neither showed any indication of ulcers although the inflammation was left untreated. Inflammatory symptoms disappeared at the end of the sixth day, in both cases.

The familiar May Apple (Podophyllum peltatum L.) has been included in the lists of plants poisonous by contact from the earliest times. Both leaves and roots are said to be "poisonous and drastic" by some authors; others content themselves with the statement "rather poisonous"; still others attribute the "poisonous principle chiefly to the root, the powder of which affects the mucous membranes." Of the truth of the last statement there can be no doubt, as scores of careless or ignorant workers in the laboratories of manufacturing pharmacists can testify. Concerning the other two, there is at least room for reasonable doubt. No record has come to my notice of any case of poisoning from the mere handling, and I have in the past few years directed the work of classes in such a way as to secure the maximum amount of handling of every part of the plant. Twenty subjects submitted to the rubbing process, using aerial parts of the plant, and nineteen showed no signs of inflammation. One was a subject referred to in a previous paragraph as peculiarly susceptible to inflammation after skin lesions of any sort. In this case a rather persistent inflammation followed the experiment, requiring between two and three weeks' treatment before it was completely reduced. Five submitted to the rubbing process with fresh roots with no untoward results. The irritating effect of the dry powder of the root upon mucous membranes was considered too well established to need verification. It is a safe inference that any part of the May Apple may be handled with safety, even the dry root being apparently harmless, and only irritating when in the form of a finely comminuted powder.

The common Bloodroot (Sanguinaria Canadensis L.) is another plant regarded with suspicion by some authors. It is said that the "dust of the dried root is irritating and that frequently the handling of the root poisons." No experiments were made as to the effect of the dust produced by the grinding of dried roots, but both dried and fresh roots were persistently handled without record of poisoning in a single case out of seventeen. Seven showed no ill effects from rubbing the arm with the fresh root.

The Cruciferæ named are such well known irritants as to need no special discussion, although in none of the forms did any irritation arise from a free and rather rough handling of the plants.

The round leaved Sundew (Drosera rotundifolia L.) is classed as a skin irritant. It is so rare in our area that it scarcely deserves mention. Experiments were possible only with dried specimens. Of the five subjects selected none showed any signs of skin irritation as a result of either treatment. The material used was collected in August, the experiments were made the following February, the plants having been subjected to the usual drying.

The Tree of Heaven (Ailanthus glandulosa Desf.), it is said, "should be regarded with suspicion." No experiments were tried with this form and a somewhat extended examination fails to reveal any instance in which poisoning resulted from its handling. Personally I have handled it for years, and have rather encouraged classes to handle it but have failed utterly to find the form at all poisonous or even irritating.

Of the Spurges (Euphorbias) more than one hundred species occur in the United States. Loudon says of them, "Every one is so acrid as to corrode and ulcerate the body wherever applied." This somewhat vigorous arraignment of the genus does not seem fully justified by the behavior of the local forms. In the experiments upon ten subjects E. maculata L., E. humistrata Engelm., E. nutans Lag. and E. commutata Engelm., produced no ill effects from handling. Rubbing the arm vigorously with the crushed plants and allowing the latex to dry produced a marked irritation in five of the ten subjects and a light vesicular inflammation in another. The inflammation was somewhat obstinate, in two cases requiring the attention of a physician. In the case of the flowering Spurge (Euphorbia corollata L.) six out of ten subjects were distinctly poisoned by merely handling the plant in its flowering condition. In this case the plant was gathered in masses as for decorative purposes, thus attempting to imitate the manner in which this attractive form is usually handled. Allowing the latex to dy upon the arm caused evident poisoning in nine of the ten cases. The experience with the other species named above led to the prompt treatment of the inflammations, so that nothing can be said as to the persistence or ultimate character of the irritation. The inference may be drawn that the majority of our native spurges are not such virulent contact poisons that they can not be handled in the ordinary way without danger. Euphorbia corollata is, however, to be regarded as dangerous,

especially in the flowering period, and, as that extends from April to October, it is probably to be avoided at all times. Apart from the results of these experiments I have records of twenty-three cases of poisoning unmistakably chargeable to this form. In my opinion many cases of poisoning attributed to Rhus are to be referred to this species.

Of the Sumach, the poison ivy (Rhus radicans L.) is perhaps the most familiar, although the poison elder (Rhus Vernix L.) is by far the more poisonous. According to Robert Hessler, M. D.,[1] "Many persons proof against the common poison ivy readily succumb to this species." Fortunately the restricted range of the species, it being confined to the swamp regions of the northern part of the state, its favorite location being tamarack swamps, prevents it from being as dangerous as its virulence would indicate. The poison ivy, however, because of its almost universal distribution through the state is perhaps the most dangerous of the plants in the list. In the experiments, seventeen out of twenty-two poisoned by merely handling the plant. The remaining five responded vigoriously to the rubbing process. The character of the inflammation is too well known to need description in this connection. One of the subjects, a young man of about twenty-two, who was poisoned as the result of "rubbing," allowed himself to go without treatment for three weeks, in order that he might determine whether or not he would in the future be more susceptible to ivy-poisoning. His case of poisoning was quite severe, involving the whole arm and spreading to the neck, being perhaps more serious than ordinary cases. He wrote me last summer that he had not since the experiment escaped with less than two or three poison attacks a year. I have heard from two others that they also have poisoned since that time by the slightest contact with poison ivy. On the other hand, the other two members of the group of five do not seem to poison any more readily than before the experiment. In the poison ivy, also, the poisonous principle seems most active during the flowering season. The statement that Rhus poisoning occurs from the handling of dried herbarium specimens has not proven true in my experience. Determinative material placed in the hands of class after class, has never caused a single case of poisoning. It is fair to conclude that two out of three persons will be more or less affected by simply handling poison ivy, and perhaps nine out of ten if the plant is handled at all roughly. No other one of our indigenous plants is so generally poisonous.

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[1] Proc. Ind. Acad. Sci., 1896, p. 21.

It is said of the Leatherwood (Dirca palustris L.) that the "fresh bark applied to the skin causes redness and vesication and sores, which are very difficult to heal." Eight subjects were treated by binding pieces of freshly stripped bark upon their arms, allowing them to remain for periods ranging from two to twenty-four hours. Six showed no evil effects of any kind, while in the cases of the other two a somewhat painful hyperaemia resulted, easily reduced by an application of vaseline. Somewhat strangely, the two affected represented the extremes of time, two and twenty-four hours. Three other students chewed the fresh bark for a few minutes and in each case an extremely painful blistering of the mouth resulted. In my own case, tried subsequently, the mucous membranes of the mouth did not become normal for nearly a month. In the ordinary use of the term, the leatherwood is not a contact poison, although in exceptional cases it may prove such.

Aralia spinosa L., Angelica Tree or Hercules Club, was found without irritating principle in three cases, the small amount of material available precluding more extended experimentation. It is claimed that "green bark from roots or small shrubs acts as an irritant." As far as the results go the statement is without foundation.

It is the popular belief that Solanum Dulcamara L., poison or purple-leaved nightshade is one of the most virulent contact poisons. By some authorities it is claimed to be an even more virulent skin poison than poison ivy, the symptoms being similar, but the poison much more difficult to eradicate from the system. Tests made upon fifteen subjects failed utterly to justify the popular view. The plants were used in all stages and at all seasons, but in every case without the slightest irritation. I have tried many times to poison myself with this species, frequently taking plants selected by persons who claimed an absolute knowledge of the poisonous character of the form and always without untoward results. The result of these experiments makes it almost certain that the purple-leaved nightshade should not be considered as one of our poisonous plants.

The "Jimson" weeds (Datura Stramonium L. and D. Tatula L.) also have a bad reputation. Fourteen subjects were tested and in no case was there any sign of inflammation. No experiment was made to verify the statement that the forms "occasionally cause a swelling of the eyelids." It is probable that none of our native species of Solanaceae are as poisonous as the foliage of the potato and tomato, to which frequent cases of skin poisoning may be definitely referred.

The common Mullein (Verbascum Thapsus L.) is irritating to the skin because of its wooly hairs, the leaves being often applied to the throat for the rubefacient effect. Its action is so evidently mechanical that no experiments were tried.

The flowers of the Catalpa (Catalpa Catalpa (L.) Karst.) are said to be irritant to many persons, causing "reddening of the skin." In experiments tried and often repeated upon twenty subjects, no such results were obtained, although in some cases the flowers were rubbed upon the cheeks vigorously, the juice being allowed to remain for several hours. I have also been unable to find any definite record confirming the statement.

Indian Tobacco (Lobelia inflata L.), "when applied to the skin is capable of producing irritation." Experiments upon fifteen persons failed to confirm this alleged fact.

The Cockleburs (Xanthium) are irritant on account of dust and hairs with which they are covered and not because of a toxic principle. No experiments were made with this form.

Of the Goldenrods (Solidago) the statement is made that the "whole family is to be regarded with suspicion by persons with sensitive skin. Solidago odora Ait. possesses a volatile oil that is an irritant and rubefacient." Twenty-two persons were subjected to tests with various species of goldenrod, but no results were obtained to indicate the presence of a toxic element in our native species. Solidago odora was used with five subjects without resulting inflammation. It is extremely doubtful whether any skin irritation is produced by species of this genus save through mechanical causes.

The common Fleabane (Leptilon Canadense (L.) Brit.) it is said "contains a volatile oil possessing irritating qualities to those handling." Eleven persons were used in experiments upon this form. Two had skin irritations following the free handling of this plant. Five others were poisoned by the "rubbing" process. Four were unaffected under either procedure. In this case also, the maximum point of the toxic principle seemed to be the flowering season.

Common Beggar Ticks or Spanish Needles (Bidens frondosa L.), it is alleged, "causes itching on handling." Out of fifteen persons this was found to be true in three cases, one of them being peculiarly susceptible to skin irritation, as mentioned in a preceding paragraph. Four others were affected by the "rubbing" process. The remaining eight reported no change in skin sensations.

Ordinary Dog-fennel (Anthemis Cotula L.) was found to affect seven out of twenty persons as the result of free handling. Seven others were poisoned following rubbing and six were unaffected. The statement that the "juice is sufficiently acrid to poison sensitive skins" seems borne out by the results.

Arctium Lappa L., or Burdock, is a skin irritant through mechanical action, the dry burs producing the most serious inflammations, although the leaves, because of their roughness, are also irritant. The resultant inflammations after handling were so evidently traumatic that no experiments were made.

It is claimed that the ordinary cultivated Nasturtium (Tropæolum majus L.) "in exceptional cases produces dermatitis." Repeated experiments with all parts of the plant upon twenty-two subjects failed to give any verification to this statement. After extended inquiry I have failed to find any person who knew of any case of poisoning due to this plant.

The Oleander (Nerium Oleander L.), so largely cultivated, is probably under certain conditions poisonous. "An acrid principle in the leaves affects some people as Rhus." Loudon contents himself with saying "it is poisonous." Figuier calls it a "formidable poison." Van Hasselt says it causes "an internal burning and itching when rubbed in the skin." Five persons were experimented upon in the manner indicated by Van Hasselt and all suffered a greater or less irritation accompanied by burning and itching. It is probable that the thick-walled epidermal cells prevent poisoning in the ordinary handling of the plant. The most painful case of skin poison I experienced was from the oleander. It was, however, of short duration and in none of the cases indicated the persistence or tendency to recurrence of Rhus.

Of the cultivated Primroses, one, Primula obconica Hance, is occasional irritant. The cause, however, is plainly enough traumatic. No experiments were undertaken, although I know of one case in which the handling of this species is invariably followed by an annoying skin irritation.

The results of these experiments may be summarized as follows:

1. The great majority of the plants included in the preceding list are harmless under ordinary handling.

2. Some of these may act as skin irritants as the result of prolonged application or unusually rough handling. Careful washing after handling any of the forms will reduce the danger to a minimum.

3. The following species are definitely contact poisons, arranged in order of their virulence.

Rhus Vernix L.

Rhus radicans.

Euphorbia corollata.

Cypripedium hirsutum.

Anthemis Cotula.

Leptilon Canadense.

Clematis Virginiana.

Bidens frondosa.

The nettles are not included in this list on account of the ephemeral character of the irritation they produce, nor are there included a number of forms which poison under unusual conditions, such as grinding or long continued applications.

4. Of the plants named, the two species of the genus Rhus are the only ones affecting all upon whom experiments were tried, if we except the nettles.

5. Sixteen plants included in the list proved absolutely harmless under the conditions of the experiments. Probably all in the list with the exception of the first three or four may be safely handled under ordinary conditions.

The data bearing upon conclusion 3 may be tabulated as follows:

	Number of Subjects in Experiment.	Affected by First Method.	Affected by Second Method, Additional.
Rhus Vernix	No	Experimen	ts.
Rhus radicans	22	17	5
Euphorbia corollata	10	6	3
Cypripedium hirsutum	22	11	6
Anthemis Cotula	20	7	7
Leptilon Canadense	11	2	5
Clematis Virginiana	17	4	5
Bidens frondosa	15	3	4