far south as Alliance, which seems very probable, the Ohio might easily have first broken over here and have flowed westward.[3] The deep drift in this section makes it difficult to determine this point but the width of the Tuscarawas Valley, the narrowness of the present Ohio Valley and the occurrence of lacustrine deposits north of Alliance and mixed more or less with the drift in many parts of the Grand River Valley seem to strongly favor such an hypothesis.

It is generally believed by geologists that the preglacial divide of the Ohio drainage was near New Martinsville, West Virginia. A study of the direction of the streams along the Tuscarawas would seem to indicate that the preglacial divide along this stream was near Port Washington and that Big Stillwater, Conotton and Big Sandy Creeks flowed northwest, the former by Canal Dover along the present course of Sugar Creek reversed at least beyond Beach City. Whether this stream joined the other two near Justus or Navarre or flowed on northwest separately can not be stated definitely because of the drift and the changes brought about by the advance of the ice. Below Port Washington the drainage was probably westward into the Scioto Valley and old Kanawha system.

Upon the first advance of the ice southward of Lake Erie the drainage of all northward flowing streams was obstructed and it became necessary for their waters to seek other outlets. As the country to the west was in general lower the streams were dammed up until they finally ran over the lowest divide on the west. There was a tendency for them to follow in a general way the ice border, just as the Ohio and Missouri Rivers to-day follow rather closely around the southern extension of the ice.

In view of the above considerations it is believed that the Tuscarawas-Scioto Valley had its origin in an early advance of the ice and represents the principal drainage line during interglacial time, and that the advance of the ice farther southward during the later glaciations forced the Hocking, Muskingum and possibly the Upper Ohio to change to their present channels. Such a hypothesis makes it possible to explain many very peculiar connections between old valleys, which are very difficult to understand otherwise. If the time which elapsed between the different advances of the ice, had been estimated with any degree of approximation it can be easily understood how much larger valleys may have been formed during interglacial periods than since. The matter appears to deserve more consideration in the interpretation of changes of drainage than it has been given heretofore.

GEORGE N. COFFEY

[3] Since this article was written the writer has had an opportunity to make further observations in the country north of Alliance and has found further evidence, particularly an old valley near Ravenna, to substantiate the hypothesis that the Ohio River first broke over in this section and formed the Tuscarawas-Scioto Valley.

## THE POISONOUS NATURE OF THE STINGING HAIRS OF JATROPHA URENS

*Jatropha urens* is one of the most abundant Euphorbiaceous plants growing in or around the savannas of the Pacific coast of Central America. Its spread is favored by the fact that the cattle avoid it, and because it is not kept down by the too indolent owners of the pastures. Everywhere it has the reputation of being extremely dangerous, on account of its poisonous effects.

The plant is easily recognized: It is herbaceous, 0.5 to 1.5 meter high, regularly ramified, with large palmatilobate leaves, white flowers and small, 3-celled capsules. All parts, trunk, leaves, flowers and fruits are covered with long, hard and glossy, stinging hairs, which protect the plant as barbed wire protects the fortifications of to-day. It would seem as if the remarkable glossiness of the stinging hairs might warn the curious against approaching or touching. As a mater of fact, the animals either by instinct, or on account of the wisdom acquired through some previous experience, avoid contact with it.

The vernacular name of *Jatropha urens* is "ortiga" or "ortiga brava" (nettle) in Panama, and other parts of Central America, in-

dicating somewhat its noxious effects. Sometimes it is also called "chichicaste."

The stinging hairs of *Jatropha urens* show the same structure as those of the common nettle (Urticaceæ), though the two plants belong to different families. The poison is produced by a cell of the epidermis which, during the growth, swells up, forming a goblet-shaped bulb, set into the surrounding tissue. The hair then represents a long tube, the walls of which have incrustations of silicic acid in the upper part and are calcified in the lower parts, so that they are very brittle and break at the lightest touch. Near the top this cell expands a little, in the form of a miniature hat with very thin walls, so that when touched, it breaks in an oblique direction, forming the point of a cannula, which enters the skin of animal or man. At the same time the poisonous liquid of the cell is discharged into the wound, and produces instantly a local inflammation. The mechanism is, in fact, the same as that of the poison fang of the snakes, and it is also similar to the cannula of the surgeon.

To estimate the formidable effects of the hair and the intensity of its poisonous liquids, it has been calculated that about 10,000 hairs of the common nettle may produce one drop of poison (0.05 c.cm.). As in the case I am going to mention, about 10 hairs of the *Jatropha* were broken. It may be calculated on the same basis that about 0.00005 c.cm. of poison entered the wound. This is, however, a low estimate, because the hairs of our plant and their inner cavity are larger than those of the common nettle and the amount of poison introduced into the system in the following occurrence was probably much larger than it would have been in the case of an equal contact with *Urtica urens*.

On an excursion along the San Felix River, in eastern Chiriqui, with Dr. MacDonald, geologist of the Canal Commission, the writer became acquainted with *Jatropha urens* by unavoidable contact with a single specimen of the plant. All at once he felt an intense burning on the left hand, where about 10 of the stinging hairs had entered pretty deep into the skin. The inflammation produced by this touch was very similar to that produced by nettles, but the pain soon increased, the whole hand began to swell and inside of half an hour had assumed a monstrous shape. Then the arm commenced to swell also, the right hand and arm, without having been innoculated, yet showed the same abnormal symptoms, and a very strong itching sensation was felt all over the upper part of the body. At about the same time parts of the face, around the eyes and nose, swelled considerably. The itching sensation rapidly spread over the abdomen and the lower extremities and red pimples appeared everywhere. In less than an hour the poison had extended over the whole surface of the body, and its entrance into the blood current was indicated by the corresponding physiological reaction of the interior organs. The palpitation of the heart became extremely accelerated and the mind was soon overcome by an agonizing depression. The respiration seemed to be delayed as if under a great pressure, cold sweat broke out, and the patient gave way altogether, remaining unconscious for more than an hour, except for feverish dreams. After coming back to his senses, he had several fits of copious vomiting, from which it may be surmised that the poison was slowly eliminated from the organism. The weakness, however, remained for several days.

A case of such extreme effects, which might have killed a man of less strength than the writer, has never been recorded, as far as the literature on the subject shows. Undoubtedly the intensity of the intoxication was due to the rather strong contact with the plant, which caused a considerable amount of poison to be introduced into the blood circulation.

Many other tropical plants, among them some *Urticaceæ* and *Loasaceæ*, have such deadly stinging hairs, the poison of which is active enough to kill a man, even in a relatively small dose. The only way of allaying its effects would be to neutralize or precipitate it by means of a prompt application of chloride of lime, ammonia or sodium permanganate.

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