not, of course, be large, but their value viewed from the scientific point of view will be all out of proportion to their size.

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SAND-STORM ELECTRICITY

THE discussions on atmospheric electricity in SCIENCE[1] called to mind an electrical display which accompanied a sand-storm which I witnessed in 1902.

I was on the White Mountain Apache reservation, in Arizona, on the day in question, when an ordinary desert whirlwind whirled into view from just around a southerly projecting point of land north of White River from the now abandoned Fort Apache. I had just crossed a flat area among the hills where an ancient lava flow once spread out, forming a "lava lake," an area probably six miles across from the afore-mentioned point to the mountainous hills to the northwestward, up which I was then ascending. In a moment it began to gain momentum on entering the level country and in a minute more it was a roaring funnel that was hurling immense quantities of dirt and sand skyward so that they formed an umbrella-like cloud around the apex of the whirling center.

As the twister was coming directly in my direction, I shifted southward over a gulch to another ridge to escape its fury. On it came. It entered the canyon in which I had been only a minute before. Here as the canyon both wedged-in and ascended toward the mountains in the direction it was going, the rushing whirl became "angry," as it were. The day had been perfectly clear. Yet in a moment there were chain lightning and ripping thunder on every side, while at the same time the whirler uprooted trees and tore large-sized boulders from their places on the canyon walls, finally destroying itself in that canyon.

From my observations I am inclined to believe that the electrical display that accompanied this whirl was due to the friction caused by the whirling débris.

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"SOUR SAP" IN TREES OF THE GENUS PRUNUS

ANNUALLY there occurs in stone fruits in the deciduous-fruit-growing sections of California a considerable loss of trees from a disease which is locally known as "sour sap." In certain seasons sporadic epidemics of this trouble occur when thousands of trees, usually from about three to ten or twelve years of age, die suddenly in an unaccountable manner and with no previous warning. The disease is primarily one of winter or early spring. Trees which appeared to be in perfect condition at the end of the season either fail entirely to start the following spring, lose one or more of the main limbs or linger along into the summer only to die before the end of the season. Various climatic combinations have in the past been held responsible for sour sap, although it has never been definitely known at just what time of the winter the initial injury actually develops. The name refers to a condition of the bark or cortex region of affected trees which is attended by decided souring and death of this portion of the host. The disease has been known for many years, and although many attempts have been made to discover the cause or causes of this mysterious trouble, only of late has its true nature been understood.

We have found that there are two distinct souring diseases of trees of the genus Prunus, one caused by bacteria and one due to the presence of stagnant soil water which affects the roots during the early growing period of the host.

The disease caused by bacteria is the more common of the two and is entirely distinct from the other. The bacterial organisms usually attack the host through wounds, such as pruning or grafting cuts, during the winter months and cause a progressive disease of the cortical bark region, usually in the trunk above the bud union or in the main crotches but sometimes killing only certain limbs or one side of the tree. The roots are rarely affected, in fact, an infection in the trunk usually stops its extension abruptly at the surface of the ground and the tree then sends up a mass of suckers from the root. The parenchymatous tissues, including the cambium, are invaded, producing a highly discolored, plasmolyzed appearance with a water-soaked, very sour advance, in which bacteria can be seen in the cells and in the intercellular spaces. The bacteria are usually present in zoogloeal masses but at times are quite free and motile. Extensive epidemics of this disease occur only in occasional seasons at irregular intervals, and it seems certain that some correlation must exist between certain seasonal climatic or soil moisture conditions and the development of sour sap. While many theories have existed in regard to this correlation we have really no definite information at all as to the nature of these conditions or even as to the specific time when they occur.

Our work covers a period of seven years of field observations and three years of inoculation experiments on a wide range of Prunus species and varieties, including peach, cherry, wild and cultivated plums, apricot and almond, with the result that the

[1] March 30, 1928; May 3, 1929; October 18, 1929, and January 24, 1930.