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## "Frost-flower" plants in Alabama

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In a brief symposium on "frost-flowers," by the writer and two others, in TORREYA for August, 1931, it was pointed out that comparatively few species of plants are known to have the property of producing wings or ribbons of ice on the lower parts of their stems during cold nights. The three papers published at that time, and others there referred to, cited only four genera, *Helianthemum*, *Cunila*, *Pluchea* and *Verbesina*, in three families. Another genus and family can now be added to the list.

Late in November, 1936, I was spending a week-end at a country home in the eastern part of Dallas County, in the black belt of Alabama. About sunrise on the 22nd, a cold frosty morning, my host went out to the lot to attend to his animals, and when he came back to the house he reported that some of the weeds in the garden had ice on them; something he had never noticed before, though he had lived there since 1920.

As soon as possible I went out to investigate, and found the ice formation to be confined to a single species, *Richardia scabra* St.Hil., a member of the Rubiaceae, said to be a native of tropical America, and known in this country as "Florida pusley" or "Mexican clover." It is rather common in sandy cultivated fields in the southern parts of Georgia and Alabama and the northern part of Florida, and less so in neighboring states.

Ice formations of this sort previously reported have usually been wavy ribbons about as long as wide, within a few inches of the ground. But those on the *Richardia* were wings, opposite or approximately so, about half an inch wide but extending several inches along the stem and branches. However, if nearness to the ground is essential, the *Richardia* has the advantage of being a depressed or decumbent plant, and the ice wings extended practically the whole length of the stems, while the species previously reported are erect or nearly so, and seem to exude ice

only near the ground. When I arrived on the scene the sun was nearly an hour high, and the ice had already begun to melt, which made a more detailed study out of the question. The wings may have been a little larger before sunrise than they were when I saw them.

The previously recorded frost plants are supposed to be natives where they were found, at various places from New York to Minnesota and Florida (and perhaps the European cases too, though I have not had access to the European literature on the subject). But the *Richardia* is supposed to have come from the tropics, where one would suppose that it would never have learned to make ice, so to speak; though details of its native haunts are lacking, and it may have come from some comparatively cool and elevated portions of the tropics.

More information about the geographical distribution of this phenomenon, and the weather conditions that produce it, would be interesting, though the matter perhaps has no great physiological or ecological significance. The fact that it is rather rare in the experience of any one person would seem to indicate that it occurs only with some exceptional combination of weather conditions. The case I noticed in Florida a few years ago occurred on a freezing night after a long rainy spell, and that suggested that the dead or dying plant stems were pretty well saturated with water just before the freeze. But in this latest Alabama case there had been no rain for a week or more, as far as I know.

In the fall of 1934 a citizen of Albertville, Alabama, wrote to the professor of chemistry at the University of Alabama about having observed the phenomenon near there, and he seemed to have visions of a new process for making ice. Evidently it was something new to him; but if he identified the plant or discussed the weather conditions I do not now remember the details.

It seems that most of the recorded observations of this phenomenon have been made in late fall, by persons who had encountered it but once in their lives; and that would seem to suggest that an individual plant can produce ice crystals only once. However, in TORREYA (**35**:57–59) for June, 1935, Dr. L. M. Dickerson reports a group of plants (tentatively identified as *Pluchea*) at Lebanon, Tennessee, that exuded ice three or four

times in one winter, but the crystals were successively smaller and closer to the ground each time.

At the time my last paper on this subject was written I was sojourning temporarily in Florida, and did not have access to the literature of the subject, but Dr. A. H. Graves, who was then editing TORREYA temporarily, kindly supplied some references that I remembered only vaguely, and a few others. Three more papers can be cited now, two by Dr. K. M. Wiegand, in the *Plant World*, Vol. 9, 1906. The first is "The occurrence of ice in plant tissues," on pages 25–39 of the February number, and the second "The passage of water from the plant cell in freezing," on pages 107–118 of the May number. (The last, it happens, immediately follows the paper in which I reported "frost flowers" on *Verbesina occidentalis* in Tuscaloosa County, Alabama.) Another is by W. W. Coblentz, "The exudation of ice from stems of plants," in the Scientific Monthly **2**: 334–349, *figs. 1–14.* "April" (March), 1916. This deals mostly with *Cunila*, and refers to some previous literature on the subject.

SUPPLEMENTARY NOTE. While the foregoing was awaiting publication I learned of two additional cases of "frost-flowers" in Alabama, through Mr. R. L. James, a farmer of near Russellville, Franklin County, who has been sending me plants for identification for about three years past.

On Sept. 14, 1937, he sent me a specimen of *Verbesina virginica*, with the remark that "large crusts of ice form about the base of the stalk when the first freezes come in the fall." On looking up the plant in Small's Manual of the Southeastern Flora (1933), to make sure of the identification, I noticed that one of the common names given there is "frost-weed." (But no such name for it appears in his Flora of the Southeastern United States, 1903.) So evidently the same phenomenon in that species had been noticed by others, though I am not at present acquainted with any specific mention of the fact in botanical literature.

Later in the fall Mr. James sent me a specimen of *Lespedeza hirta*, with the observation that it too sometimes produced ice crystals. When I expressed some surprise he assured me on Dec. 14 that he had seen the ice on a great many plants of that species on Nov. 20, 21 and 22, and had subsequently seen many

other specimens with the bark split at the base, evidently by ice. He also stated that he had not seen much ice on it since the dates mentioned, though the phenomenon continued to be manifested by the *Verbesina*, but with diminishing intensity (as observed by Dr. Dickerson in the case of *Pluchea* in Tennessee).

The interesting thing about the *Lespedeza* record is that this is the first report of this phenomenon from the large and widely distributed family of Leguminosae (using the name in the old sense) that has come to my notice. That particular species is common and widely distributed, in dry woods, nearly throughout the eastern United States, and it is strange that no one had noticed ice crystals on it before. But probably most botanists do not get out in the country early enough on frosty mornings to keep up with what is going on in nature.

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