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Illustrations of Transient Fern Forms

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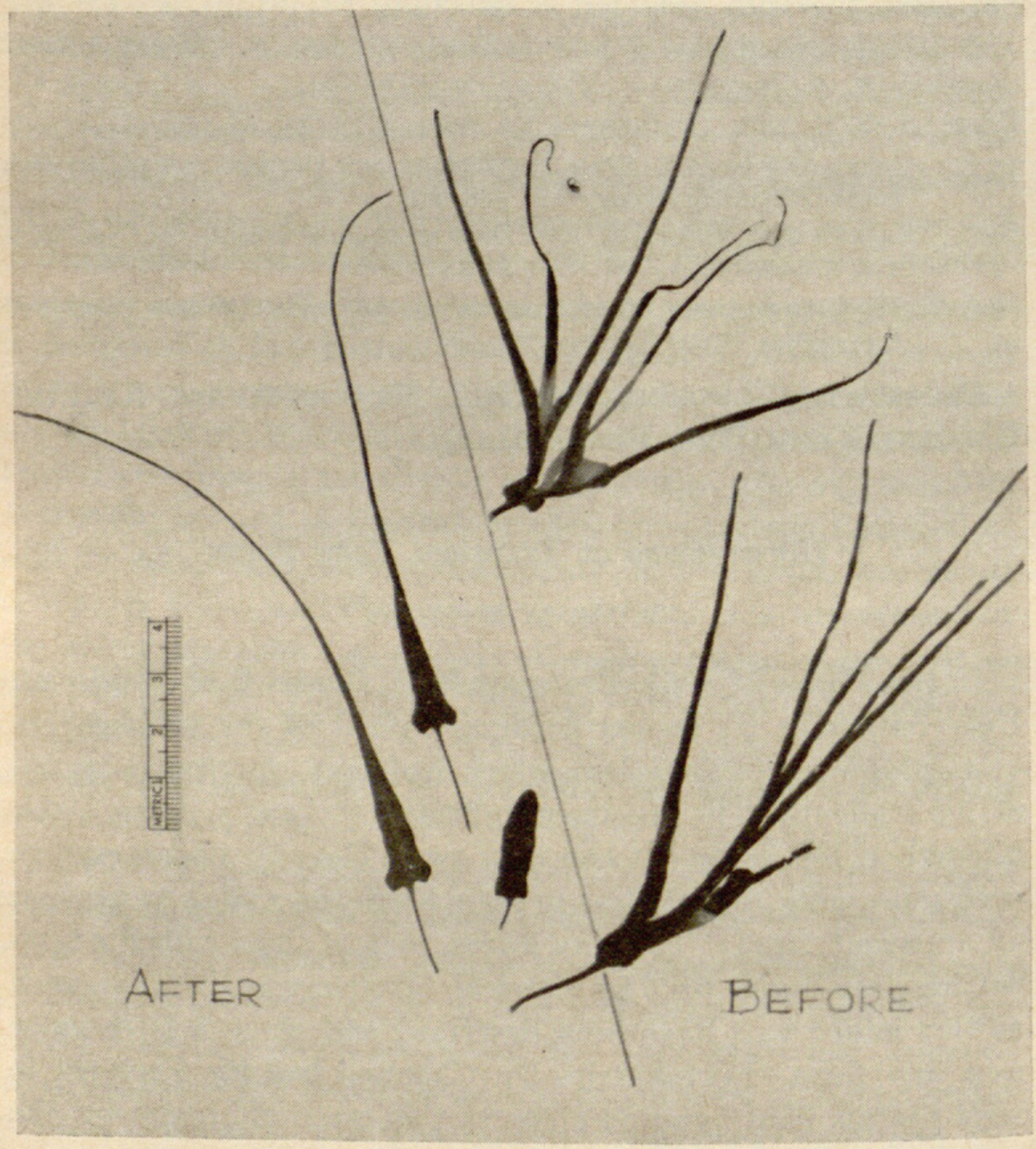
In the winter of 1964, Professor R. B. Channell of Vanderbilt University sent me an extraordinary plant of the walking-fern (*Camptosorus rhizophyllus*) which had been discovered by one of his students. The specimen appeared to have a dozen leaves altogether, but in fact it had only two. The pair of leaves were each repeatedly forked close to their blade bases so as to produce an apparent "spray" of many leaves, each of them with the typical long-attenuate tip. In classical taxonomy such a specimen as this might well have been described and given a latin name as a new form. Fortunately, Dr. Channell had the foresight to send the plant in question alive, so that we could carry out the experiment to be described below.

The specimen was originally discovered by Mr. Paul Weatherby on 27 November 1964, growing on a bluff about two miles south of Ashland City on River Road, across the Cumberland River from Marrowbone Creek, Cheatham County, Tennessee. Examples of the original leaves and those which resulted from the procedures of growing the plant will be deposited in the



Forms of Camptosorus leaves from the same plant. "Before" = leaves of the plant as received from Dr. Channell. "After" = leaves from the plant and one of its proliferations after cultivation at Ann Arbor.

University of Michigan Herbarium.

We carefully planted the specimen on mossy rocks in a large, glass-covered terrarium. Each of the tips was bent down into contact with the moist surface, so that it would proliferate a new plant. Not only did the tips produce new, healthy individuals, but the original rhizome itself also continued to grow, and we soon had a "family" of plants. We had hoped in this way perhaps to establish a clone of this bizarre "form" which we could distribute to those members of the Fern Society devoted to growing unusual and attractive cultivars of ferns. Surely this form would make an excellent addition to any collection of living fern variations.

Our experiment was successful in the sense that the original plant grew very well and it produced the hoped-for new progeny by proliferations from the tips of the leaves. Unfortunately, however, the plants themselves did not cooperate—every leaf produced was like that of the ordinary walking-fern, simple and undivided. In fact, other normal plants were later introduced into the terrarium, and even after months of growth the new fronds of the novel "form" never did develop the crested condition and could not be distinguished from the normal specimens *(Plate 10)*.

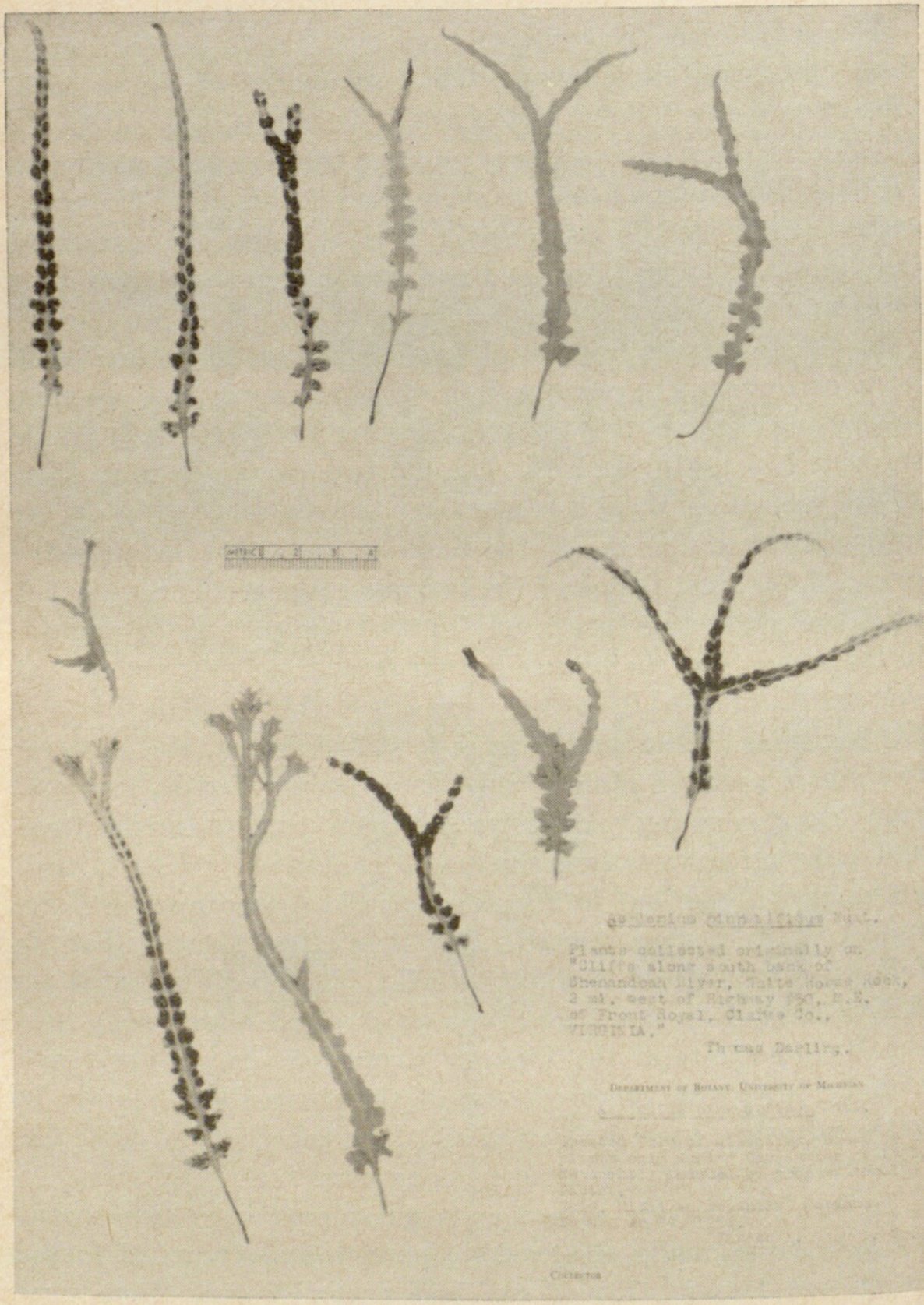
In some ways our efforts to maintain the remarkable walking-fern were not entirely in vain, however. At least, the experiment did illustrate the dangers of naming "forms" without culture studies. The phenomenon of transient leaf forms in ferns is well known. Many of the designated forms of ferns are now known to be merely the result of temporary growth conditions that are brought on by abnormal factors. For example, a perfectly ordinary colony of sensitive fern *(Onoclea sensibilis)* growing in the Saginaw Forest near Ann Arbor was mowed down a couple of years ago, and dozens of fronds of the so-called forma *obtusilobata* (Schkuhr) Gilbert appeared, making it possible for me to obtain a complete series for demonstration purposes showing the transitions between the sterile leaves and the fertile leaves in this extremely dimorphic species.

Forms of "fertile panicles" in Botrychium dissectum leaves from the large population near the Headquarters of Pinkney Recreation Area, Washtenaw County, Michigan.

The grapeferns *(Botrychium)* are well known for their transient abnormalities involving the development of the so-called "fertile panicles." Some of the small, deciduous species like the Mingan moonwort *(B. minganense)* and the Matricary grapefern *(B. matricariifolium)* tend to show much forking and disorganization of the fertile panicles in many of the old, over-sized individuals. The medium-sized and small specimens do not show these unusual fertile segments so often.

In the evergreen species of grapeferns, on the other hand, peculiarities are less common, but when they occur they are more interesting because they illustrate rather nicely how the fertile segment is actually derived. The top two leaves shown in *Plate 11* are normal. In these it is necessary to make anatomical studies to demonstrate that the fertile panicles are morphologically the result of the total fusion of the two basal pinnae. The lower left hand leaf shows this fusion only in the lower part of the panicle; in the upper part the pinnae become free. The lower middle leaf shows no fusion at all, so that there appear to be two distinct fertile segments. That on the right is still different, and it shows two whole pairs of pinnae which have become fertile, the basal pair being completely fused, the second pair unfused. These and many other variations can be expected in any colony of evergreen grapeferns, but in my experience the same plant will not repeat the following year. In fact it is often the case that the following year's leaf is wholly sterile. The ones illustrated are *Botrychium dissectum* taken from an excellent large colony near the Headquarters of the Pinkney Recreation Area, Washtenaw County, Michigan, where dozens of variations like these can be gathered every year in August and September. They make fine demonstrations for plant morphology classes.

In our cytogenetic experiments on spleenworts *(Asplenium)* we have occasionally observed the sudden appearance of forked or crested leaves. One of our best examples came from some individuals of lobed spleenwort *(Asplenium pinnatifidum)* which were originally collected by Mr. Thomas Darling along the cliffs beside the Shenandoah River, northeast of Front Royal, Clarke



Crested leaves from plants of Asplenium pinnatifidum. These were formed only during the summer of 1956, not before nor after.

County, Virginia. The plants were normal in every way when they arrived, and they remained so until the summer of 1956, when, for no obvious reason, they began producing weird leaves, some of them (especially like those shown on the lower left of *Plate 12)* divided so many times as to produce apical crests. Afterward, however, these plants again formed normal leaves.

In this case, and that of the odd specimen of walking-fern sent by Dr. Channell, it is plausible that some external factors brought on the crested condition. Some writers have considered the forked condition to represent an "atavism," a "throwback" to primitive conditions when ferns were alleged to have always had forked or dichotomous leaves. This conclusion, however, is purely speculative, and there is no strong evidence to support it. Indeed, all of the evidence we have now indicates just the opposite, namely that the immediate ancestor of the modern ferns had typical midribbed fronds. Furthermore, it is well known that forking can be artificially induced merely by carefully slicing a growing leaf tip with a sharp razor blade. Presumably when transient conditions of leaf forking occur in a plant, some factor operates which injures the growing leaf tip one or more times, thus producing two or more growing tips. In those rare cases where the forking of leaves is genetically fixed, there must be a hereditary tendency for the apical cells to abort and new leaf tips to be constituted.

With these examples of transient abnormalities before us, we are justified in cautioning the namers of "forms" to make sure that their "forms" are truly fixed and genetic. For that matter, there is a real question whether any scientific purposes are served by naming "forms" at all, even if they are genetically fixed. It would be far more to the point, scientifically, to find out what *causes* the abnormal growth. With the current focus of interest on the processes of plant development that is appearing in laboratories around the world, we may well expect increasing interest in the ferns from this standpoint.

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