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THE SLIME MOULDS OF NEW MEXICO.

BY T. H. MACBRIDE.

No flora of the world has lately so much occupied the attention of botanists as that which they term xerophytic, the flora of the desert. This, for several reasons. In the first place, all deserts are now more easily accessible. The rush of commercial enterprise has at last penetrated every corner of the globe; even the deserts have been exploited and the way of the naturalist is made plain as never before. In the second place, this very circumstance makes possible now the study of desert-life as a whole, a thing hitherto impossible. True, in the days gone by, thanks to Parry, Pringle and others of the type, the flora of desert regions was not without representation more or less complete in the herbaria of the world, but even where most complete the several species were viewed as isolated specimens, strange enough no doubt; but no closet-student of such things had any idea of their profound meaning, of their wondrous association with each other in the land of their native habitat, of the significance of ten thousand minor adaptations which make a land and its flora kin, perfectly unintelligible and unmeaning unless seen together and in mass.

To one who thus attempts the flora of the North American deserts, a surprise will come, first perhaps in the profuse variety which marks a land of apparent inhospitable sameness. Every form of vegetable life that finds expression anywhere has a place, too, by some representative or other in the desert. There are trees, there are shrubs; there are vines, there are herbs; there are mosses

and ferns, fungi and slime moulds; so that one is quickly impressed with the thought that the flora of the desert is but a transformation, a replica, in miniature sometimes, of that with which we are all familiar in happier or, as we think, perchance, more normal fields.

It was, therefore, not without surprise that we found slime moulds in the desert. The filmy plasmic sheets and streams that creep in apparently aimless channels about our northern world would seem impossible in the hard conditions of the desert air where rains sometimes fail for months or even years together and even the dew is not infrequently forgotten.

The New Mexican and Arizona deserts are, however, very varied in just this particular. These deserts are generally all high, three or four thousand feet above the sea, and are by no means level; they offer plains and hills, they are broken by mesas and ridges and mountains, mountains where we have an altitude of ten or twelve thousand feet. These high points, for reasons that the meteorologist must explain, gather the scanty clouds. Here also stands a limited coniferous forest whose perennial foliage gathers the showers of summer and in winter sifts the snows and so holds on the tops of the mountains in wide scattered isolated groves, tufts of forest rising like islands over the far-spreading gray waste of the common Sahara.

Now it is on these mountain-tops that all the species here listed are collected. Here fallen trees afford the necessary amount of decaying organic matter for abundant food, and once wet either by the melting snows of spring or the showers of summer, hold for months together in their rotten bulk the moisture that makes possible plasmodic life. In other words, although in the midst of the desert, a desert extending for hundreds of miles in every direction, we have, nevertheless, here true forest conditions and all the children of the forest here find place; here are oases and these afford conditions suited to the phase of vegetal life with which we are all familiar.

The list of species that here follows exhibits, accordingly, many familiar types:

1. *Fuligo ovata* (Shaeff) Macbr. One specimen; very small.

2. *Physarum nefroideum* Rost. Common; but specimens all immature.

3. *Tilmadoche alba* (Bull.) Macbr. Common; typical.

4. *Tilmadoche viridis* (Bull.) Sacc. Common; typical.

5. *Leocarpus fragilis* (Dicks) R. Abundant; typical.

6. *Reticularia lycoperdon* Bull. Only one specimen; typical.

7. *Cribraria aurantiaca.* Immature; scarce.

8. *Dictydium cancellatum* (Batsch) Macbr. Rare; small.

9. *Lamproderma arcyrionema* Rost.. Rare; variable.

10. *Stemonitis maxima* Schw. Rare; the tufts short and small, but the spores typical.

11. *Stemonitis axifera* (Bull.) Macbr. Rare; a single tuft collected; the specimens typical except that the spores are nearly smooth. This may yet be *S. ferruginea* Ehrenburg.

12. *Stemonitis smithii* Macbr. Sporangia rather large; spores smooth and small as usual.

13. *Stemonitis webberi* Rex. The specimens here referred agree in many particulars with Rex's type but differ in the symmetry, beauty and uniformity of the capillitial meshes. These are not quite so large, but are fine, open and persistent. Some free tips appear rather more prominent than is usual in Stemonitis. The spores are minutely roughened; under the lens purplish or violaceous brown. The tufts are small, about eight or ten mm. high; the stipe short and hypothallus well developed. A New Mexican variety.

14. *Comatricha stemonitis* (Scop.) Sheld. Rare: typical; only one gathering.

15. *Lycogola epidendrum* (Bux.) L. One typical specimen so far collected.

16. *Arcyria nutans* (Bull.) Grev. Typical: not common.

17. *Arcyria incarnata* Pers. Typical, the colonies, however, very small and scattered.

18. *Lachnobolus occidentalis* Macbr.

19. *Hemitrichia stipitata* Massee. Typical; rare.

20. *Hemitrichia clavata* (Pers.) Rost. Rare. The common Mississippi valley form collected.

21 *Hemitrichia stipata* (Schw.) Rost. Typical and fine: collected abundantly on fallen Populus. In fine condition in the last week of August.

22. *Physarum flavicomum* Berk.

23. *Trichia decipiens* Pers. Typical, save that the spores are roughened and not reticulate as in the Mississippi valley. The spores correspond to those of European gatherings.

24. *Trichia persimilis* Karst. Not common.

25. *Perichaena corticalis* (Batsch) R. Typical on the inside of the bark of fallen trunks.

The Myxomycetes or slime moulds are of world-wide distribution. As we regard them, they are an ancient group which, notwithstanding extreme simplicity of structure, has broken into all sorts of species and forms. There are some four or five hundred of these curious organisms known, and it is safe to say that no other group of equal size could easily be selected in which the species are as a whole more definitely limited or defined. They are variable, it is true, but not more so than lichens or asters or oaks; the difficulty lies in the fact that their variations all lie on the stage of our microscopes and are recognizable only under the best lens that our factories may supply.

Notwithstanding this world-wide distribution it still appears that species have their individual range; not all, by any means, are cosmopolitan. The continents have their characteristic species, even genera as we now reckon them. There are forms in the Maine woods that have not yet been seen on our Iowa prairies nor in the forests of our valley; there are types in Oregon and Washington elsewhere unknown and many there which correspond to those of western Europe more closely than to those of the eastern

United States. Colorado and Southern California have characteristic species.

It is, therefore, with surprise that I present here a list of species in nearly all respects such as might be gathered in almost any grove in eastern Iowa.

This is the more remarkable when we discover that the phenogamous species of the locality in question are nearly all western or southwestern; scarcely one, unless, perchance, some introduced weeds or possibly some of the grasses or composites, is characteristic of the flora of the northwestern United States or of the upper Mississippi valley. We have *Pinus ponderosa*, *Pinus edulis*, *Pseudotsuga douglasii*, *Abies concolor;* we have southwestern or western oaks, junipers, barberries; among the trees, only the quaking asp is familiar to our northern eyes.

Now it must be further said that the quaking aspen, with its soft, rapidly decaying wood, affords here in Iowa a favorite habitat for many of our slime-mould species, and the same thing is true on desert mountain-tops. I found fallen trunks of Populus wet throughout, the rotten wood enclosed by the unbroken bark and supporting abundant and varied plasmodia. The fallen trunks of Pseudotsuga and Abies were also covered with traces of the minute organisms.

The conclusion to be drawn is perhaps this: the Myxomycetes being reproduced by minute spores are distributed by the prevailing currents of the air. During the season when the spores are exposed for distribution easterly and southeasterly winds prevail; in the winter, when northern and northwest winds obtain the species of Oregon and Washington are deep buried in snow. This might account for what we find on the assumption that the distribution is comparatively recent.

It seems to me, however, that we must take a wider view. The forests of the desert mountains are remnants: they are the survivors of a forest probably at one time continuous, possibly both east and west. Perhaps at one time the meteoric conditions that support the forests of the

northwest also obtained in New Mexico, and at that time the forms of slime-moulds common now in Oregon, were to be seen on the Sacramento Mountains. Probably at that time the species now found in Iowa ranged also farther west, as they do at present farther south. With the drying up of the desert, owing to causes that we are beginning to know and understand, the species of slime-moulds tolerant of the less humid climate, survived, and so where the climate of the mountain top resembles that of Iowa we have the same myxomycetan flora, although the phenogamous flora, under the same modifying agencies has followed different lines. The conditions for the higher plants are in any case different and the response has been different accordingly.

In conclusion, let me say that these most interesting organisms are easy of collection. They should be more abundantly brought in. August and September are the most likely months in which to obtain material suitable for study, although on the mountains of New Mexico good material may be sought in October and later. The fruiting follows the rains of August.