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### WINTER-BUDS OF SPIRODELA POLYRHIZA (L.).

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Last summer and fall, I brought home several kinds of "duckweeds," and kept them in aquaria, some of the latter being small tumblers. During September and October it was noticed that there were numerous small disks, or links, partly free, partly connected with *Spirodela* plants. They were flat, short-elliptical or oblong, or nearly circular, of about one to two mm. diameter, of a deep green color (darker than the *spirodela* disks), always rootless, without any visible venation and with a small, sharply defined, crescent-shaped, whitish to brownish hilum at the margin. Microscopic examination, made in February, showed them to have stomata on the upper surface and a slight but distinct purplish hue on the lower, inside of the epidermis.

With the approach of winter, the *Spirodela* plants faded and died, but these small bodies kept fresh and green, and most of them sank to the bottom. Some, however, were kept floating by the dead disks, now little more than skeletons. Some were seen as late as February, each being held between the two epidermal layers of its parent disk, near the hilum, partly emerging from the margin. Several score were in a small tumbler aquarium, near a window but not reached by direct sunlight until the end of winter. During the latter part of January, and up to the present it was noticed that each had a small gas bubble on its upper surface, probably oxygen, and some were raised to the surface by the same and kept floating. Many of them are now sprouting, at the hilum, while others are still at the bottom, unchanged. Another such small aquarium, with *Lemna tri-*

sulea, etc., was kept close to the window, where the sun had access for an hour or two on clear mornings. In that, the plants developed earlier, and at the present writing, several of them are fully developed, unmistakable *Spirodela polyrhiza*, with two disks several times the size of the bud, bright green, with distinct nervation, several roots and with the inferior side around the hilum purplish. On one of them, the bud is now fading and withering.

Thus the cycle is complete. The small bodies described were seen developing on the *Spirodela* plants, in late summer and fall, then detached or held only mechanically, surviving the winter at the bottom, rising to the surface in spring (premature indoors), producing new plants, and then dying. The observations are complete so far as they go; but more details and further investigations will be in place. It has not been ascertained whether one *Spirodela* disk produces only one bud or several, how early in the season they are produced and eventually whether some of them grow out into new plants in the same season; also the microscopic structure especially of the hilum when dormant and at the time of sprouting will be of interest. The buds should also be taken up from the bottom of ponds and pools in early spring and their development observed.

When the little bodies were first noticed, last fall, it was supposed that they might be "winter-buds," having the function of buds or bulbs, and the result sustained the diagnosis. Since the plant is rarely found blossoming and fruiting these buds are evidently the means of propagation of the species. But the term "bud" is not adequate. They may be compared with the bulblets of some Pteridophyta. Their significance is possibly nearest to that of tubers, like those of the Dahlia and potato, but the fact that they are provided with chlorophyl and stomata again sets them apart. Their configuration is in accordance with the simple structure of the plant itself.

It may be mentioned that a *Lemna (trinervis* Austin?) brought in and kept with the *Spirodela* showed nothing of the kind described; but it may have been overlooked; most of them died earlier than the *Spirodela*. *Lemna trisulca* L. keeps well and grows luxuriantly over winter, indoors, and is a very satisfactory plant for small aquaria.

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