

The Germination of the Seed and Development of the Seedling of *Calopogon pulchellus* (SW.)

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Since Knudsen's (1, 2) success in germinating seeds of *Cattleya* spp. on a sterilized nutrient medium, and in growing plants to maturity without the presence of a mycorrhizal fungus, the writer has been interested in trying to grow native members of the Orchidaceae in like manner.

Seeds of a number of species of several genera were planted on Knudsen's nutrient medium. Only those of *Calopogon pulchellus* (grass pink) grew. Further germination and viability tests will be made when next summer's seeds are available, but in the meantime the development of *Calopogon* plants has been studied.

The seed consists of an ellipsoidal embryo, composed of a mass of parenchymatous cells, and is enclosed in a loose-fitting membranous seed coat made up of a single layer of elongated, thick-walled cells (Fig. 1).

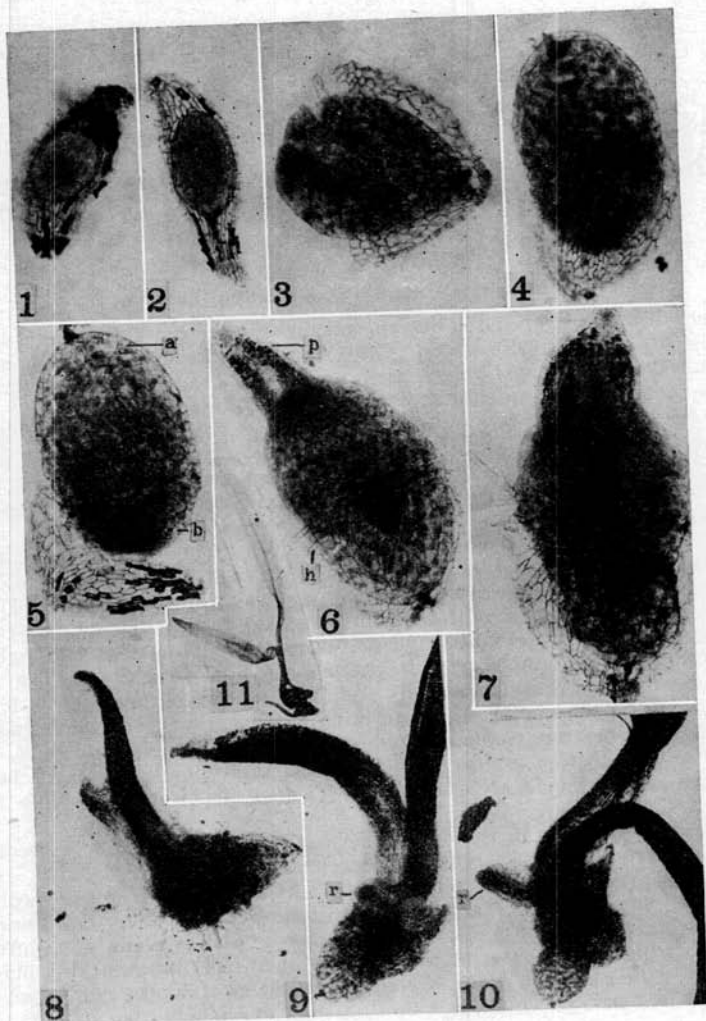
The embryo enlarges, still retaining its oval form (Fig. 2), and soon ruptures the seed coat (Figs. 3 and 4). The cells in the posterior half of the embryo continue to enlarge and become vacuolated (Fig. 5, a). The cells in the anterior region divide actively and form a stem-meristem (Fig. 5, b). A ridge, a leaf primordium, arises forming a ring around the meristematic tip. This primordium elongates and becomes the first leaf (Fig. 6, p). Certain cells, and often groups of adjacent cells, of the surface layer begin to elongate and produce absorbing hairs (Fig. 6, h) which resemble root hairs.

Chloroplasts appear in the outer layers of cells and the embryo becomes green very early. Later, starch grains accumulate in the basal half.

A greater increase in diameter occurs in the upper half of the seedling than in the lower part (Fig. 7). A second circular leaf primordium is formed within the first (Fig. 7). These primordia elongate and differentiate into leaves which are tubular at the base but open out into sheathing blades toward the tip. Figure 8 shows a seedling, about two months old, in which the second leaf has grown beyond the first and has not yet opened out into its flattened tip. The third leaf is seen just pushing up into the sheath of the second. The seed coat, the original basal part of the embryo, the enlarged upper part ("tuber") of the seedling, and the elongated absorbing hairs are also visible in this figure.

A root now forms (Fig. 9, r) in the outer part of the stem just above the attachment of the first leaf. The root digests its way through the base of the leaf and emerges. The elongating root is seen in figures 10, r and 11. The third leaf (curved downward) has emerged from the sheath of the second in figure 10, and in figure 11 the third and the fourth, or final, leaf of the first season's growth are visible.

Finally, the internodes of the stem elongate and enlarge in diameter, forming a new "tuber" which is larger than the former one (Fig. 11). A bud, or stem tip, differentiates at some point on the surface. Then the leaves die down and their bases become scale-like coverings of the new "tuber." After a period of dormancy this "tuber" develops much as did the smaller embryo of the year before.



Photomicrographs of seeds and young plants of *Calopogon pulchellus* (Sw.) R. Br. taken with Leica camera.

1. Seed, with oval embryo and membranous seed coat.
 2. Germination seed.
 3. Enlarging embryo has burst seed coat.
 - 4, 5. Seedlings differentiating into posterior (a) and anterior (b) ends; emerging from seed coat.
 6. First tubular leaf (p) and absorbing hairs (h) developing.
 7. Second leaf forming inside first; upper half of seedling enlarging.
 8. Plant about two months old, showing two leaves and beginning of third.
 9. Older plant, root (r) just emerging.
 10. Still older plant with three leaves and elongating root (r); new "tuber" forming; a seed at left shows relative sizes.
 11. Plant about 6 months old; third and fourth leaves mature; root elongated; new "tuber" with bud at right, surrounded by tubular bases of leaves.
1. KNUDSON, L., Physiological study of the symbiotic germination of orchid seeds. Bot. Gaz. 79:345-379. 1925.
 2. Flower production by orchid grown non-symbiotically. Bot. Gaz. 89:192-199. 1930.