studied previously with trout. New groups are being established to be continued for a series of years, since the rate of growth is one of the factors in the economy of producing fish for food.

During the past summer, experiments were started in the Animal Nutrition Laboratory at Cornell University upon fish to learn more of their digestive processes. This involved the use of aerated aquaria with fish taking oxygen from the same water for periods of several days. An aquarium was discovered which operates very satisfactorily when aerated by the ordinary inexpensive suction pump that can be attached to any water faucet. The aquarium in this case was an earthenware jar with a lid of special design and ground to fit.

HENRY O'MALLEY
U. S. Commissioner of Fisheries

PARTHENOCARPY AND SEEDLESSNESS IN VITIS VINIFERA

SEEDLESSNESS in *Vitis vinifera* has been reported on by Muller-Thurgau in 1898 and 1908 and by Y. Oinoue in 1926, but no thorough microscopical investigation of this subject has hitherto been undertaken. This report deals only with the two most important commercial varieties of seedless grapes, Sultanina, or Thompson's Seedless, and Black Corinth. Muller Thurgau states that Sultanina ovules are incapable of being fertilized, although the pollen tubes enter the ovules, and that the Black Corinth ovules are also incapable of being fertilized, but that their pollen tubes do not enter their ovules. Oinoue reports that in both of these varieties one male nucleus fertilizes the egg, but that the secondary nucleus of the embryo sac is never fertilized and gradually disintegrates. The author finds, however, that a high percentage of Sultanina embryo sacs are perfectly normal at anthesis and are fertilized normally. At the time of anthesis the polar nuclei have already fused and the antipodals completely disappeared. According to A. N. Berlese, and the author's own investigations, this is the normal condition in seeded varieties of *Vitis vinifera*. Even in seeded varieties, a high percentage of abnormal embryo sacs occurs.

Within two or three days the pollen tubes can be seen traversing the nucellar cap and entering the egg apparatus.

Almost immediately after the entrance of the pollen tube the secondary nucleus, instead of degenerating, as reported by Oinoue, divides and redivides. When pollen tubes could not be found in several cases examined in which the stigma had apparently been injured, the secondary nucleus remained undivided.

Development beyond this stage varies greatly. In normal grape seeds the endosperm does not encroach much upon the nucellus until the seed has reached approximately its full size, and the embryo hardly begins its development for perhaps several weeks after fertilization. Sultanina seeds frequently develop some endosperm tissue, and embryos of over a hundred cells have sometimes been observed.

However, the abnormal conditions which are correlated with the final degeneration in Sultanina seeds can always or nearly always be readily detected even at the time of anthesis. In the region of the micropyle, among other abnormalities, the inner integument is much exserted beyond the outer and often curved back up the side of the ovule. In a normal *Vitis vinifera* ovule the outer integument at least equals the inner. Within two weeks after fertilization the entire seed coat development has very obviously gone astray.

It is not claimed that the abnormal physiological conditions in the Sultanina ovule never prevent the formation of a perfect embryo sac, but the author believes that as a rule, at least one normal embryo sac has been developed and fertilized in each normal Sultanina berry.

In the Black Corinth, on the other hand, there are, as a rule, no normal embryo sacs. Occasionally a seeded berry sets, and in the course of an examination of thirty or forty berries two or three embryo sacs appeared to be normal. But ordinarily all four embryo sacs are in various stages of disintegration at the time of anthesis. The polar nuclei have almost never fused. The egg apparatus may be missing entirely or in various stages of degeneration. Often the only nuclei in the sac are three or four clumped together in the center of the sac. The pollen tubes enter the locules in the great profusion characteristic of seeded varieties of grapes, but they seldom enter the micropyle and only rarely penetrate the nucellar cap.

Further details will be published later.

HELEN M. PEARSON
UNIVERSITY FARM
DAVIS, CALIFORNIA

PHOTOPERIODISM AND CHRYSANTHEMUM PRODUCTION

THE production of flowers early in the season when prices are usually highest is one of the problems of the present-day florist. This end is quite often obtained by early planting, heavy feeding and correct pinching of buds.

With chrysanthemums in Colorado these practices do not produce flowers early enough to be of material value economically. Chrysanthemums yield readily to shortening of the daylight period and earlier flowering results from shading. While this fact has been