A MUTANT OF LITHOCARPUS DENSIFLORUS

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A peculiar, low, shrubby, oak-like plant was discovered by Dale Hall in January, 1962, on the Challenge Experimental Forest (which is maintained by the Pacific Southwest Forest and Range Experiment Station, Berkeley) approximately one mile north of Challenge, Yuba Co., California. It was quite unlike any species known to the senior author and did not appear to be a hybrid of any California oak.

About 25 more were found a few weeks later. They were about 1 to 1½ feet tall and were located in a strip 100 feet long and 50 feet wide. Many of these new seedlings had germinated in squirrels' seed caches. There was about one "odd oak" in each group of five to 15 seedlings, the others being tanoak. About half of the "odd oak" seedlings in these caches eventually died.

Some of the remaining plants were transplanted to pots. One was brought to Davis; however, it soon died. Another, in a container with its native soil, was brought to Davis in February, 1964. This one survived, although its growth has been extremely slow. Altogether, there are about 20 of these plants living that we know of. They have been found in several different places, about 2 miles apart (fig. 1). All were in close proximity to *Lithocarpus densiflorus*. A brief note, and a photograph of one of them, appeared in the Sacramento Bee (p. 10, County Life Section), July 21, 1963 (by Melvin Gagnon, at that time a staff writer for the Bee).

Still another occurrence came to our attention recently (after this manuscript had been submitted for publication). Two individuals—one reportedly 8 feet tall (*Smith No. 91,* DAV), which is larger than any we have seen—were noted at 2150 feet elevation, center of Sec. 10, T. 18 N., R. 7 E., in Yuba Co., by B. F. Smith, Sept. 20, 1968.

Close inspection in the field with regard to possible parent trees, and re-examination of fine morphological details, led us to suspect that these peculiar little plants must be odd forms of *Lithocarpus densiflorus*. Although radically different from typical arborescent forms of this species in size, stature, and leaf form (fig. 2), they are very similar in certain other characters such as leaf pubescence and form of the stipules.

The several sites where these plants have been discovered so far lie between 2,150 and 3,425 feet elevation in the ponderosa pine belt (Transition Zone). Here the dominant vegetation is a forest of *Pinus ponderosa, Pinus lambertiana, Pseudotsuga menziesii, Abies concolor, Libocedrus decurrens, Arbutus menziesii, Quercus kelloggii, Lithocarpus densiflorus, Acer macrophyllum, Cornus nuttallii,* and occasionally other woody species.

At first, it was considered that these plants might be monosomics or trisomics. Squash preparations were made on several occasions in a search for visible chromosomal aberrations. All such attempts were unsuccessful.

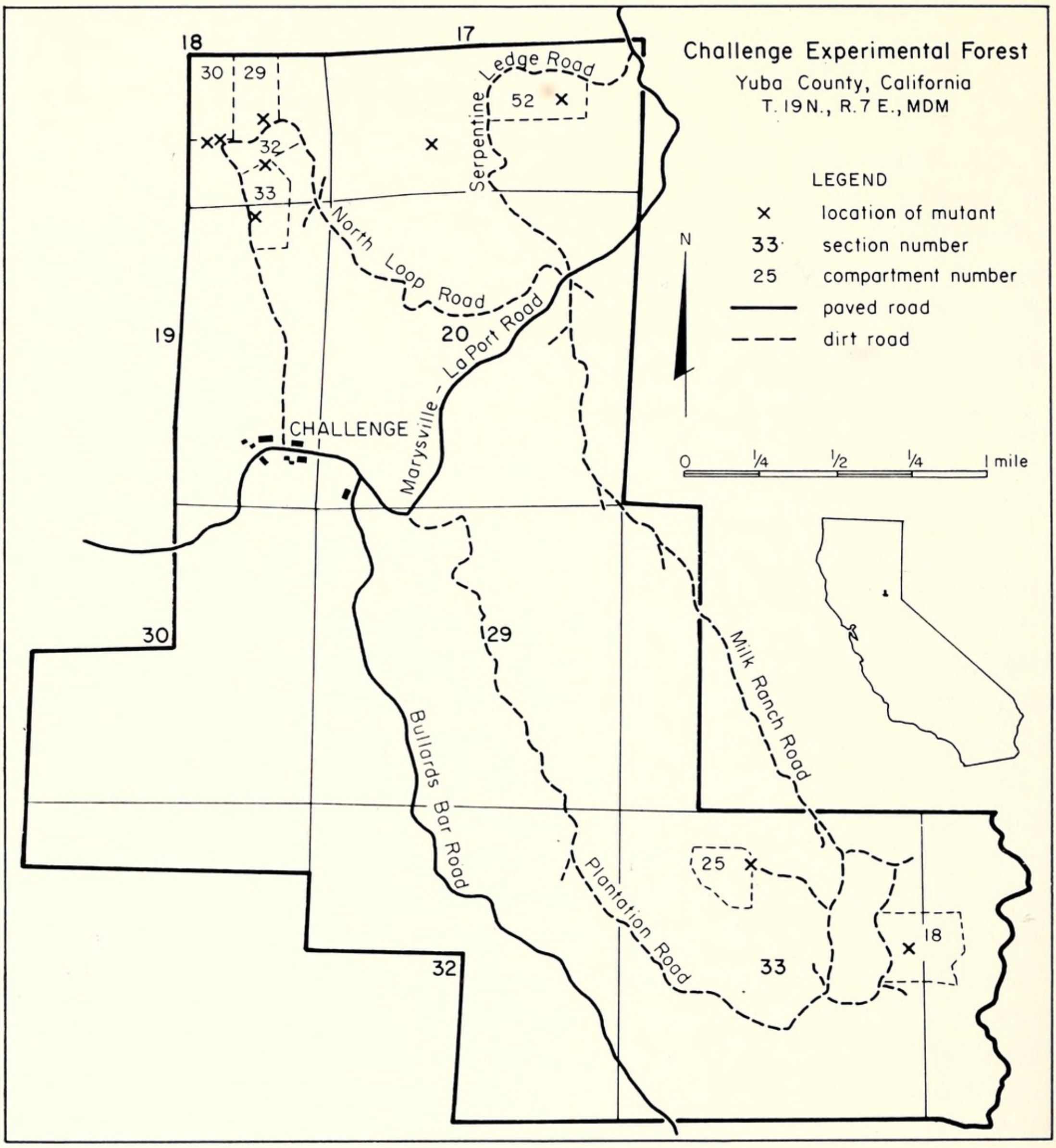

FIG. 1. Location of tanoak mutants.

A more likely hypothesis was advanced by Robert M. Echols, Geneticist, Pacific Southwest Forest and Range Experiment Station. He suggested that we are dealing with a sublethal recessive mutation. If this is true, the rather frequent occurrence of these odd plants over an area more than two miles in extent indicates that this mutation spread, and at present, occurs with a fairly high frequency in the heterozygous condition. A tree heterozygous for the mutation would appear to be a normal tanoak, yet could be expected to produce an occasional homozygous recessive acorn due to pollination by some other heterozygous tree nearby, or possibly by selfing. With this thought in mind, acorns were collected from several normal-appearing trees in the vicinity of the mutants, and germinated at Davis during the fall of 1965.

From a total of 45 acorns that germinated (which represents the progeny of five different trees), it was apparent that one seedling was a mutant

FIG. 2. A large shrubby mutant of *Lithocarpus densiflorus.*

(fig. 3). This was in the progeny of tree number 0-5. There can be no doubt, therefore, that these peculiar little plants are forms of *Lithocarpus densiflorus,* and, provided the hypothesis is correct, it is thus established that tree number 0-5 is heterozygous.

FIG. 3. Progeny from *Lithocarpus densiflorus* parent tree 0-5—a normal-appearing seedling (left), and the mutant (right).

A program of experimental self-pollination may well be attempted. If a sizeable number of experimentally-produced acorns can thus be obtained, we would be in an excellent position to test our hypothesis that the aberrant forms are the result of a single gene mutation. If, on germination, approximately ¼ of them proved to be mutant forms and ¾ normal, the hypothesis would be confirmed. A strikingly different ratio would require some other explanation.

If the tree proves to be completely self-incompatible, an attempt could be made to locate a second heterozygous tanoak by progeny tests similar to those already carried out. A series of controlled crosses, using the two trees as parents, would then be attempted. In this way we may make a small contribution to the knowledge available for the genus *Lithocarpus*.

Since this distinctive mutant is so different from typical *L. densiflorus*, a formal taxonomic designation is justified. Although this case does not seem to be adequately accommodated by the present International Code of Botanical Nomenclature, it seems logical to us to accord it the status of forma.

Lithocarpus densiflorus f. **attenuato-dentatus** Tucker, Sundahl, and Hall, f. nov. A Lithocarpo densifloro tipico foliis lineari-oblongis apicibus anguste, acuminatis, ad basem versus cuneatis, marginibus attenuato-dentatis, dentibus exilibus discedit.

Small woody plants, the largest to ca. 8 feet in height; although commonly with a single stem or trunk from the base, tending to become branched, spreading, and shrub-like; twigs slender and persistently gray hirsute-tomentose; buds hirsute; leaves to 13 cm long and 1.5 cm wide, linear-oblong, apex narrowly acuminate, sub-aristate, base narrowly cuneate, margins minutely and irregularly revolute, attenuate-dentate, the teeth narrow, sub-aristate, and directed forward; upper surface glabrous, dark green and slightly glossy, lower surface pale green, dull, and sparsely stellate-pubescent; secondary veins 6–9 on a side; petiole 10–15 mm long, sparsely stellate to glabrate, the petiole and midrib (especially on the under side of the leaf) yellowish; stipules caducous, linear, 7–8 mm long, lightly hirsute. No flowers or fruit have been observed.

Holotype: California, Yuba Co., Challenge Experimental Forest, ca. 1 mile N of Challenge, elevation 2675 ft., *J. M. Tucker* s. n., May 22, 1963 (DAV).

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CHROMOSOME NUMBERS IN SOME NORTH AMERICAN SPECIES OF THE GENUS CIRSIUM. II. WESTERN UNITED STATES

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As was suggested in the previous paper of this series (Ownbey and Hsi, 1963), chromosome numbers in the North American species of *Cirsium* may contribute substantially to an understanding of the taxonomy and evolution of the genus. At the very least they will be of significant value in the initial arrangement of the species into alliances which will with certain reservations represent natural groups. Our experience to date indicates that morphologically similar species now grouped together frequently have the same or only slightly varying chromosome numbers.

Due to the small and intergrading sizes of the chromosomes of *Cirsium,* i.e., 0.6–3.0 microns in length when fully contracted in the species discussed here, it has not been possible adequately to characterize the karyotypes of the species examined. It is safe to assume that at least one pair of satellite chromosomes can be observed in all species and frequently one or two additional satellite chromosomes are seen. Karyotype evolution in *Cirsium* may lead either to a loss or gain in numbers, but reduction in numbers seems to be the rule. It is usually assumed that 17 is the primitive number in the genome as the preponderance of living species have retained this number. Accessory chromosomes, when present, cannot be identified morphologically in our preparations and for this reason it has been concluded that they are intact or nearly so. A few examples of chromosomal fragments have also been seen.