

30. *Strobilops labyrinthica* (Say). Swamp Creek; Talladega Mountains. Under beach logs.

31. *Strobilops aenea* Pilsbry. Hatchet Creek. Under ripe logs on rocky ground. Careful search failed to find this species under loose bark on logs (its customary habitat) although plenty of *Discus*, *Gastrodonta*, and *Zonitoides arboreus* were present.

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## COLOR VARIATION IN *OLIVELLA BIPLICATA*

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The following remarks are based upon a series of 2757 specimens of *Olivella biplicata* collected alive at Bolinas, Marin County, California, November 12 and December 12, 1940, and January 26, 1941. Of this series 94 are very young, the largest being only 12 mm. long, the smallest 7 mm. long.

Of the 2757, all but one (a xanthochroistic specimen) have varying amounts of bishop purple color (Maerz and Paul,<sup>1</sup> plate 44, H 10) about the aperture, especially near the base of the columella. Another division of the 2757 may be made on the basis of presence or absence of orange coloring within the aperture. 299 have varying amounts of orange, 2458 (including the 94 very young shells) lack it.

Normal external color in adults varies from pearl gray and moonbeam gray (Maerz and Paul, plate 44, A 1 and A 2) to grayish brown and brownish suffused with purple. The brownest individual matches more or less Maerz and Paul's blue fox color (plate 47, E 1). The darkest individual (not quite adult) matches approximately Maerz and Paul's plate 48, E 1 which is a grayish brown. The parietal callus is white or whitish in all. Many have a wash of "horn" color on the body whorl. This is true even of some of the albinos, which appear ivory in color (Maerz and Paul, plate 10, B 2). This "horn" color is ephemeral and disappears in beach-worn specimens.

All have bishop purple at base of columella and in the aperture except the xanthochroistic one mentioned. All normally colored

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<sup>1</sup> A. Maerz and M. Rea Paul, A Dictionary of Color. First Edition. McGraw-Hill Book Co., Inc., New York. 1930.



shells have purple on the inner edge of the lip, and traces of old lips are indicated by purple or maroon vertical lines of growth on the exterior surface of the body whorl. In the albinos the quantity of purple is reduced but never absent. Some of the albinos have the purple lip edge limited to the lower (anterior) end of the lip and the canal.

As already mentioned, in 299 specimens the aperture displays varying amounts and shades of orange or yellow. This is never on the lip, which is usually purple-edged, but always within the aperture, sometimes at about the limit of visibility. It occurs on the columellar side of the aperture, in the canal, and on the inner surface of the body whorl. A very few have it slightly on the parietal callus. Of the 299 specimens with orange, 37 (12.4 per cent) are albinos. Some have the orange coloring denoted by Maerz and Paul as "orange-peel" (plate 10, L 10). Others have only a bare trace of orange or yellow and appear to correspond to *Olivella biplicata lapillus* described<sup>2</sup> as having the "interior of the aperture cream-colored."

It would seem that the unique xanthochroistic specimen, which is orange both inside and outside, is a recessive in which both purple and gray completely disappeared, leaving only orange, whereas in the albinos only gray disappears, the purple always remaining in some measure. From this point of view the orange specimen is perhaps comparable to red-haired human beings in whom lipochrome has replaced the dominant melanin. The orange specimen is really an orange-yellow, matching Maerz and Paul color plate 10, C 5. The base of the columella and the folds are pure white, as is the fasciole region and the parietal callus. The second whorl is white, but the body whorl is orange. The transition from orange to white is gradual. The suture edge is orange throughout. In the aperture the inner surface of the body whorl is deeper orange than the exterior.

Of the 2458 specimens without trace of orange within the aperture, one is orange externally and not wholly, as the lip portion of the body-whorl is pearl gray. This specimen has purple within the aperture, both on the columellar side and on the inner surface of the body-whorl, where it is wild iris color (Maerz and Paul,

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<sup>2</sup> E. G. Vanatta, Notes on *Oliva*, THE NAUTILUS, vol. 29, p. 71, 1915.



plate 44, B 5). It is obviously not in the same category as the preceding xanthochroistic specimen. It is, however, notable. The occurrence of orange externally is thus seen to be limited to two specimens in the series of 2757. The animals inhabiting these two shells did not differ in appearance from the others.

Of the 2458 specimens without trace of orange within the aperture, 177 (7.2 per cent) are albinos (this includes 9 very young ones), and 2280 are in the range of normal color. The animals inhabiting albino shells look like those in normally colored shells. It should be noted that albinism is more frequent in the shells with orange within the aperture than in shells without orange. The respective frequencies were 12.4 per cent and 7.2 per cent.

The ventral side of the spire of most of the adults is pitted and gray because of the ravages of a parasite, a sponge identified by Professor B. L. Clark as a species of *Cliona*. There is no trace of this parasite in the young shells.

The youngest of the normally colored shells are normal in color on dorsal side, but streaked vertically with wavy brown (Maerz and Paul, plate 7, A 12) lines on the ventral face of the main whorl, suggesting the description of a similar character in *Olivella pycna*,<sup>3</sup> for which Bolinas is the type locality. In young albinos this appears merely as a slight brown suffusion. This juvenile characteristic disappears as the shell grows older. Also in these very young specimens the white parietal callus appears prominently.

Some of the young shells have a whitish band below the suture separating the body whorl from the second whorl. In some near adults this banded character is still retained, but assumes a buffish color. In the full adult it disappears.

In regard to Mendelian inheritance of color characters, Professor R. E. Clausen was kind enough to look over our counts, but informed us that, although Mendelian laws might be operative, it would be difficult to establish their presence except by controlled breeding.

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<sup>3</sup> S. Stillman Berry, An Undescribed Californian *Olivella*, Proc. Malacological Society of London, vol. 21, p. 262, 1935.



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