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NOTES ON THE INTERNAL LAMELLAE OF
CARYCHIUM

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It became evident during systematic work on some of the smaller land snails of Michigan that the two common forms of *Carychium*, *C. exiguum* and *C. exile*, approached each other so closely in some cases that characters other than those already used were desirable in order to separate the two species more conclusively. It was suggested by Dr. George H. Clapp and Dr. Bryant Walker that the internal lamellae might be investigated, and accordingly shells of both species were opened, with the results stated below. The difference in the size and shape of the lamellae of *exile* and *exiguum* seemed so marked that other forms were opened to see whether the folds bore out the external differences of the shell upon which the species have hitherto been differentiated. Some doubtful forms were discovered, and some peculiarities, all of which are noted in the descriptions below. All figures were drawn

with the aid of a camera lucida, and all are magnified approximately thirty-three diameters, except figure 8, which is magnified 16 times.

It would be interesting to make an opening in each whorl of the shell and trace the lamellae to the apex, but the delicacy of the operation and the small number of specimens available, except in the case of *C. exiguum*, have made it inadvisable to attempt this at present.

I wish to express appreciation of the interest of Dr. Clapp and Dr. Walker, who have loaned and given specimens and offered helpful advice and criticism.

It may be stated in general that the lamellae of *Carychium* are two in number, the lower one arising as a tubercle on the columellar margin of the aperture, the upper appearing as a more conspicuous projection upon the parietal wall. The lower fold is the smaller and revolves about the columella beneath the upper lamella, which attains its greatest development within the body whorl of the shell. The edge of each lamella is thickened, cord-like. The degree of development of the lamellae is undoubtedly correlated with the age of the shell. In fresh young specimens they are well developed but not so heavily corded; in old shells they seem to be smaller, probably somewhat worn. There is also considerable variation in the degree of sinuosity of the lamellae, although within such limits that they remain specifically distinct. Clapp has pointed out (*Nautilus*, XIX, p. 138, 1906) that the shells of each species vary considerably in size, and it is to be expected that the lamellae will also vary accordingly, although it will be seen from the following notes that there are differences between species so marked as to be of importance.

Carychium exiguum Say.

In the examination of large series of this species two rather distinct forms were noted. The smaller is narrow, glistening, and is probably often mistaken for *exile* because of its small size, and because of the striations which often become quite regular just back of the aperture. Clapp writes that "there is one character which at once distinguishes *exiguum* from *exile*—that is, the swollen body whorl, giving to *exiguum* a 'bellied' appearance when viewed from the side." Besides this, however, the lamellae as seen through the shell of fresh specimens will conclusively distinguish it from *exile*. The lamellae may be described as follows: upper fold small in proportion to the diameter of the last whorl, somewhat sinuate, but never deflected sharply downward. Lower fold evenly sinuate, in well-developed specimens shelf-like for a short distance beneath the upper fold in the last whorl of the shell. The larger form of *exiguum* is more distinctly "bellied" and the striation, when it occurs, is very indistinct and irregular.

Carychium exile H. C. Lea.

The upper columellar fold is very large in proportion to the diameter of the last whorl, almost touching the wall of the whorl at the upper angle of the aperture. Typically it is bent sharply downward at its widest part, the edge turning toward the columella. The lower fold is leaf-like, curling at its edge, wider than in *exiguum* and conspicuously projecting from the columella beneath the upper fold. Both lamellae are more persistent in the penultimate whorl than is the case in *exiguum*, becoming wider in that whorl before disappearing in the upper whorls.

The distinct differences in shape and size that these lamellae show should serve to distinguish *exile* from *exiguum*, in case.

the *very regular* sculpture and flat-sidedness of the body whorl are not sufficient to do so. The deflection downward of the upper fold is a very marked characteristic, and if it cannot be seen through the shell the last whorl may be opened with a needle, from the left side, from which a good profile view may be obtained. A specimen from Kent, Ohio, opened by Mr. Clapp, is figured in a view from the back.

Carychium exile canadense Clapp.

Folds similar to those of *exile*, but the downward bend occurs farther from the aperture—*i. e.*, after about one and one-quarter turns of the lamella around the columella. In the figure the bend is too far dorsad to be shown in the front view.

Carychium occidentalis Pilsbry.

Upper fold evenly curved, small in proportion to the diameter of the last whorl. Lower fold small, about half as wide as the upper, projecting, evenly curved. Both are remarkably small for so large a shell, especially when compared with the lamellae of *exile*.

Carychium nannodes Clapp.

Upper fold small in proportion to the size of the last whorl, evenly sinuate. Lower fold scarcely more than a cord, becoming somewhat flattened and slightly projecting during the course of the first turn. Only one cotype was opened, but lamellae of others were examined through the shell.

Carychium minimum Müller.

Upper fold large, widest and deflected rather sharply upward after about a half turn. Lower fold sinuate, projecting most prominently after a half turn, under the widest part of the upper lamella.

Both folds are more strongly indicated in the aperture than in the case of the United States species, and they reach their greatest development correspondingly earlier in the course of the turn about the columella.

Carychium exiguum var.?

The six shells figured under this name were collected near Harbert, Berrien County, Michigan, on the moist ground and debris of a wooded ravine between sand dunes, near the Lake Michigan beach. In size and smoothness they closely resemble *C. nannodes*, and the internal lamellae in shape and size seem to bear out the similarity. They were submitted to Dr. Clapp, who writes that he thinks the "aperture is proportionately narrower" in *nannodes* than in the Michigan shells, and that the latter should be considered a "dwarfed, narrow form of *exiguum*." The difference in aperture is not evident upon comparison of the six shells with cotypes of *nannodes* (loaned by Dr. Walker) and the flatness of the body whorl is not like the obeseness of *exiguum*, though this may be one evidence of dwarfedness. It seems fairly possible that both *nannodes* and the Michigan shells are depauperate forms, arising from the same stock or converging from different stocks, the southern form having become stabilized, while the northern one still appears only sporadically. *Nannodes* was found in numbers in company with "a coarsely ribbed *exile*," while the *exiguum* var.? was collected with *exiguum*, and a few *exile* and *exile canadense*, seeming to make the probability greater that the Michigan shells are depauperate individuals of the common form (*exiguum*) rather than an apparently distinct race like *nannodes*.

The lamellae are almost identical in the two forms, as may

be seen in the figures (22 and 23); in fact, they do not vary as much as in different individuals of *exiguum*.

The discovery of other individuals as small and distinctive in characteristics will be awaited before naming this peculiar form.

Carychium exile?

A single specimen collected by the writer at Harriman, Tennessee, in wet grass at the foot of Walden Ridge, combined characters of *exile* and *exiguum* in a striking way. It is a very coarsely ribbed, small shell, having, however, the obese body whorl, and relatively small lamellae of *exiguum*. It is figured before and after opening, in order to show the profile contour. Clapp, in his description of *C. nannodes*, mentions a coarsely ribbed *exile* found with that species, and it seems possible that this is that form, but the internal lamellae are so distinctly those of *exiguum* that it is placed with *exile* only tentatively. Further southern material should be examined in order to clear up this apparently anomalous combination of characters.

It would probably be interesting to examine the lamellae of the remaining United States species of *Carychium*, and determine whether varietal differences are borne out in other cases as they seem to be in the case of *exile* and *exile canadense*. The varieties *jamaicensis*, *floridanum* and *mexicanum* of *exiguum* and the Kentucky *C. stygium* might be examined with profit.

The following short list is published as an aid in finding the original descriptions and figures of the species discussed in the above paper:

PILSBRY, H. A. Forms of American *Carychium*. *Nautilus*, IV, pp. 109-110. 1891.

PILSBRY, H. A. The American Species of *Carychium*. Nautilus, VIII, pp. 61-63. 1894. (Contains short descriptions and figures of *C. exiguum*, *exiguum mexicanum*, *occidentalis*, *exile*, *exile jamaicensis*.)

CALL, R. E. Some Notes on the Flora and Fauna of Mammoth Cave, Ky. American Naturalist, XXXI, p. 387, fig. 1897. (*C. stygium*.)

CLAPP, GEO. H. *Carychium nannodes*, n.sp. Nautilus, XIX, p. 91, Pl. III, figs. 7-9. 1905.

CLAPP, GEO. H. Notes on *Carychium* and Description of a New Variety. Nautilus, XIX, pp. 138-140, Pl. VIII. 1906. (*C. exile canadense*, and notes on variation in size of *exiguum* and *exile*. A number of figures of *exile*, *e. canadense*, and *exiguum* are given, and one of a cotype of *C. stygium*.)

CLAPP, GEO. H. New Southern Forms of *Carychium* and Thysanophora. Nautilus, XXXI, pp. 73-76, Pl. VIII, figs. 1, 2, 6, 7. 1918. (*C. exiguum floridanum*.)

PLATE I

Carychium.

Figure 1. *C. exile* H. C. Lea. Side view.

Figures 2 and 3. *C. exile*. Hudson County, Ohio. G. H. Clapp.

Figures 4 and 5. *C. exile*. Forest Hill, Gratiot County, Michigan.
B. Walker Collection No. 24193.

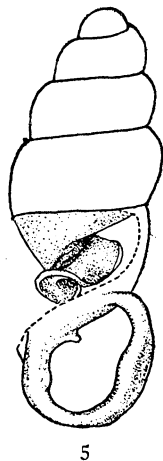
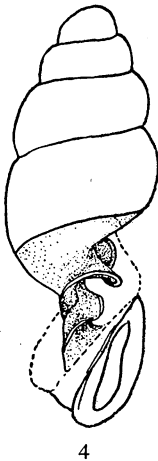
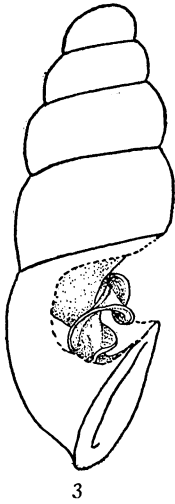
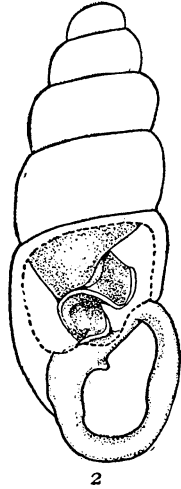
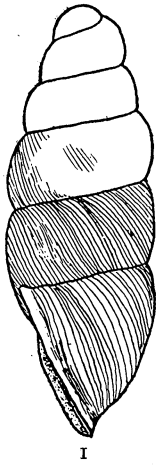


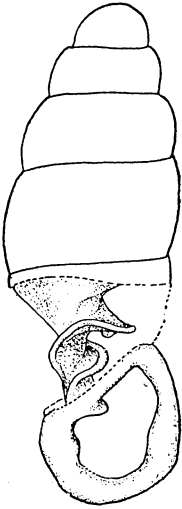
PLATE II

Figures 6 and 7. *C. exile canadense* Clapp. From type lot. G. H. Clapp.

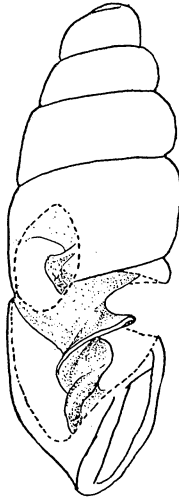
Figure 8. *C. exiguum* Say. Side view.

Figure 9. *C. exiguum*. Edgeworth, Pennsylvania. G. H. Clapp.

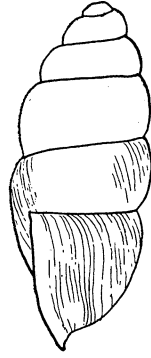
Figures 10 and 11. *C. exiguum*. Edgeworth, Pennsylvania. G. H. Clapp.



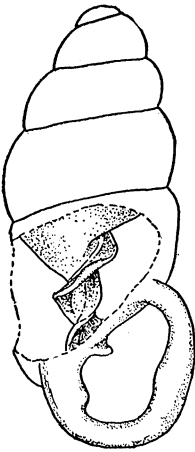
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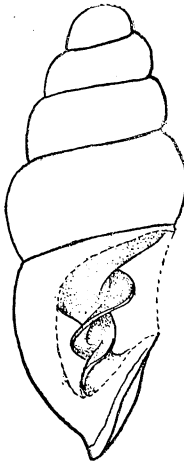
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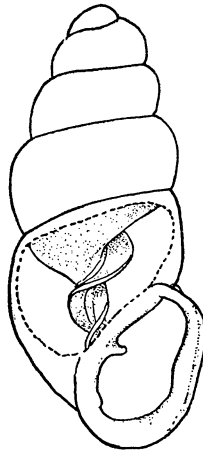
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PLATE III

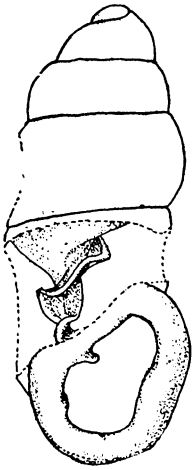
Figure 12. *C. exiguum*. Independence Lake, Washtenaw County, Michigan.

Figure 13. *C. exiguum*. Ann Arbor, Michigan. Very sinuate lamellae.

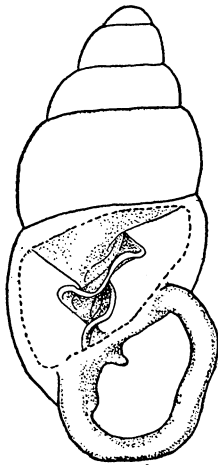
Figure 14. *C. exiguum*. Ann Arbor, Michigan.

Figures 14 and 15. *C. exiguum*. Edgeworth, Pennsylvania. G. H. Clapp. Very short, stumpy shell.

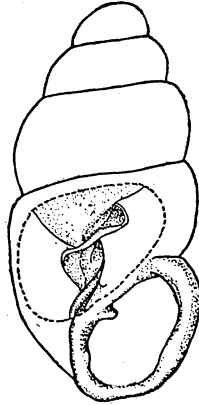
Figures 16 and 17. *C. occidentalis* Pils. Seattle, Washington. G. H. Clapp.



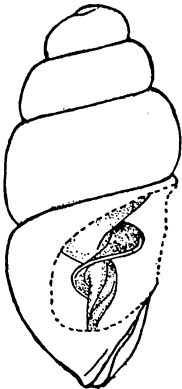
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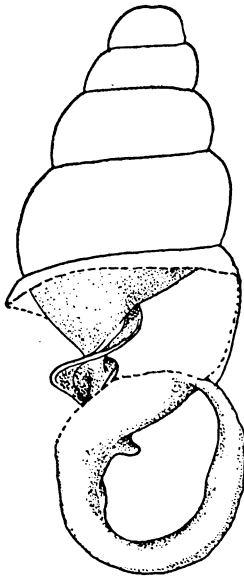
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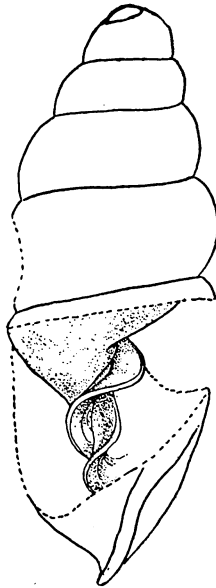
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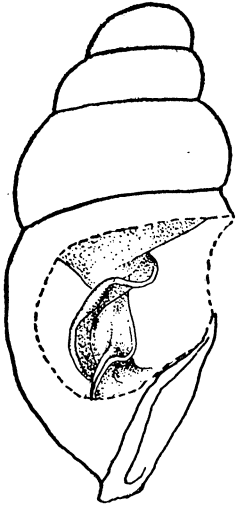
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PLATE IV

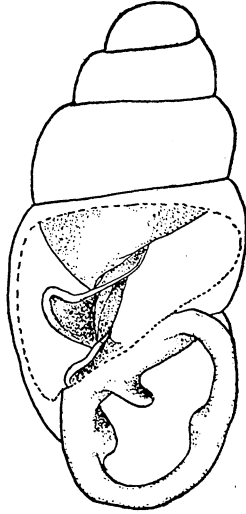
Figures 18 and 19. *C. minimum* Müller. Greenhouse at Norfolk Downs, Massachusetts. G. H. Clapp.

Figures 20 and 21. *C. exiguum* var.? Harbert, Berrien County, Michigan. Museum of Zoology No. 13326.

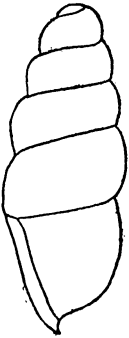
Figure 22. *C. exiguum* var.? Harbert, Berrien County, Michigan. Museum of Zoology No. 13331.



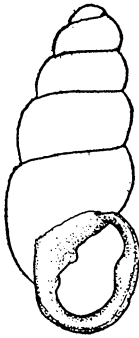
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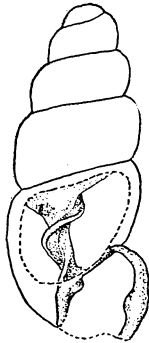
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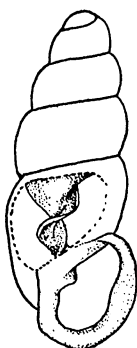


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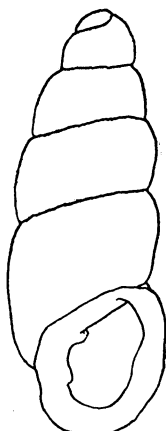
PLATE V

Figure 23. *C. nannodes* Clapp. Cotype. From B. Walker Collection, No. 24907.

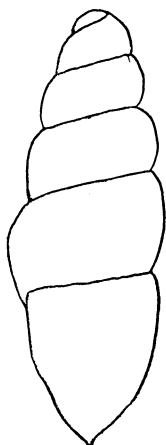
Figures 24, 25, and 26. *C. exile?* Harriman, Tennessee.



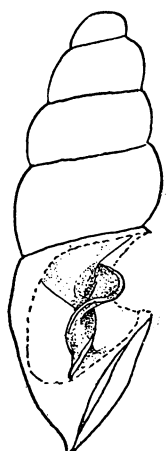
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