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LONDON:

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AND

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1912.



Freshwater Rhizopoda and Heliozoa from the States of New York, New Jersey, and Georgia, U.S.A.; with Supplemental Note on Seychelles Species. By G. H. WAILES, F.L.S.

(PLATE 12.)

[Read 18th April, 1912.]

THE Freshwater Rhizopoda of the States of New York and New Jersey have received little attention since the publication of Leidy's work in 1879, and I am not aware of any records from the State of Georgia. Since 1879 the number of described species of Rhizopoda has been more than doubled, and an investigation at the present time of the localities in which Leidy worked cannot fail to give fruitful results.

The records here given were obtained from gatherings made in the autumn of 1911 from the following localities :—

(1) Georgia.—Augusta, gathering of water-plants collected by D. K. Dalgish, Sept. 30th.

(2) New Jersey.—Lakehurst, gatherings from dry and submerged sphagnum and from the Lake, Sept. 18th; also dried sphagnum purchased from New York florists, exact locality unknown.

(3) New York District.—Mainland. Split Rock Lake, N.J., Sept. 9th; Boonton, N.J., Canal and River, Sept. 9th; Van Cortlandt and Bronx Parks, N. York City, Sept. and Oct.

(4) New York State.—Long Island, gathering from Good Ground per R. Wendell Squires, Dec. 5th. Gathering made by myself, Dec. 16th to 19th, at Good Ground from Penney's Pond, Trout Pond, Old House Pond, and a small pond at the head of Smith's Creek *.

* Penney's Pond is about 3 miles N. of Good Ground; Trout Pond is about 5 miles N.W. of Good Ground on the Riverhead Road; Old House Pond is about 2 miles W. of Penney's Pond. All these ponds are about one-eighth of a mile in diameter.

Of Rhizopoda 161 species and varieties are recorded from the above localities, including five new species and ten new varieties; about forty are, I believe, now for the first time recorded from the United States. Four species of Heliozoa are also recorded.

In addition *Nebela tropica*, sp. nov., from Borneo, and *Euglyphu cristata* var. *acicularis*, var. nov., from the British Isles, are also described, as they illustrate the affinities of some United States species.

The general results regarding distribution may be briefly summed up: the Rhizopod fauna was rich both in number of species and individuals, the majority of the species (say 80 per cent.) were similar to those found in Europe; the remainder consisted of: (1) species not uncommon in North America but more or less rare in Europe; (2) species or varieties which, so far as we know at present, are peculiar to America; (3) species in which considerable "local" variation or peculiarities occurred.

Some species of Rhizopoda may be peculiar to Europe, or common there and rare in America, but sufficient American data are lacking to enable any definite pronouncement to be made on this subject.

Slides containing specimens of the new species and varieties described in this paper have been given to the New York Museum of Natural History, where they are available for inspection.

The dimensions given ($\mu = .001$ mm.) are of the specimens from the above-named localities, except in the tabulated list of the genus *Euglyphu*.

I have to thank Dr. E. Penard for his assistance and for his kindness in sending me mounted specimens from portions of some of the gatherings which were sent to him.

	Augusta, Georgia.	New Jersey.	New York District (mainland).	Long Island, N.Y.
	1	2	3	4
Class SARCODINA.				
Sub-Class RHIZOPODA.				
Order AMŒBINA.				
Family LOBOSA.				
<i>Amœba fluida</i> , Gruber	..	×	..	..
" <i>guttula</i> , Duj.	..	..	×	..
" <i>limax</i> , Duj.	..	×	×	×
" <i>proteus</i> (<i>Pallas</i>), Leidy	×	×	×	×
" <i>striata</i> , Penard	×	..	..	×
" <i>verrucosa</i> , Ehrenb.	..	×	..	×
" <i>vespertilio</i> , Pen.	×	..	×	×
<i>Dactylosphaerium radium</i> , Bütschli	×	..	×	..
Order CONCHULINA.				
Family ARCELLIDA.				
<i>Arcella angulosa</i> , Perty	..	×	×	..
" <i>arenaria</i> , Greeff	..	..	..	×
" <i>artocrea</i> , Leidy	×	×	..	×
" <i>dentata</i> , Ehrenb.	..	..	..	×
" <i>discoides</i> , Ehrenb.	×	×	×	×
" <i>hemisphaerica</i> , Perty	..	×	..	×
" <i>mitrata</i> , Leidy	..	×	..	×
" <i>polypora</i> , Pen.	?	..	×	..
" <i>vulgaris</i> , Ehrenb.	..	×	×	×
" <i>var. compressa</i> , Cash	..	×	×	×
" <i>var. gibbosa</i> (Pen.), West	..	×	×	×
<i>Pseudochlamys patella</i> , Clap. et Lachm.	..	×	×	..
<i>Corycia flava</i> , Greeff, sp.	×	×	×	..
<i>Bullinula indica</i> , Pen.	..	×	..	×
<i>Centropyxis aculeata</i> (Ehrenb.), Stein	×	×	×	×
" <i>var. discoides</i> , Ehrenb.	..	..	×	..
" <i>var. ecornis</i> (Ehrenb.), Leidy	..	..	×	×
" <i>var. spinosa</i> , Cash	..	×	×	×
" <i>laevigata</i> , Pen.	..	×	×	×
<i>Plagiopyxis callida</i> , Pen.	..	×	×	..
Family DIFFLUGINA.				
<i>Diffugia acuminata</i> , Ehrenb.	..	..	..	×
" <i>var. inflata</i> , Pen.	..	..	×	×
" <i>amphoralis</i> , Hopk.	×	×	×	..
" <i>arcula</i> , Leidy	..	×	..	×
" <i>bacillarium</i> , Perty	×	×	..	..
" <i>var. elegans</i> (Pen.), Cash	..	×	..	..
" <i>var. teres</i> (Pen.), Cash	..	..	..	×

	Augusta, Georgia.	New Jersey.	New York District (mainland).	Long Island, N. Y.
	1	2	3	4
Family DIFFLUGINA (<i>cont.</i>).				
<i>Diffflugia</i> bacillifera, <i>Pen.</i>	..	×	..	..
" brevicolla, <i>Cash</i>	..	×	..	×
" constricta (<i>Ehrenb.</i>), <i>Leidy</i>	×	×	×	×
" corona, <i>Wallich</i>	..	..	×	×
" globulus (<i>Ehrenb.</i>), <i>Hopk.</i>	×	×	×	×
" gramen, <i>Pen.</i>	..	..	×	×
" Leidyi, sp. nov.	..	×	..	..
" lunnetica, <i>Levander</i>	..	..	×	×
" lobostoma, <i>Leidy</i>	×	..	×	×
" lucida, <i>Pen.</i>	..	×	×	..
" oblonga, <i>Ehrenb.</i>	..	×	×	×
" <i>var. cornuta, Leidy</i>	..	×	..	..
" <i>var. lacustris (Pen.)</i> , <i>Cash</i>	..	×	×	×
" <i>var. nodosa, Leidy</i>	..	×	..	..
" <i>var. venusta (Pen.)</i> , <i>Cash</i>	..	×	..	..
" oviformis, <i>Cash</i>	×	..	×	×
" Penardi, <i>Hopk.</i>	..	×	..	..
" pristin, <i>Pen.</i>	×	..	×	×
" pulex, <i>Pen.</i>	×	×	..	..
" rubescens, <i>Pen.</i>	..	×	..	×
" tuberculata (<i>Wallich</i>), <i>Archer</i>	×	..	×	×
" <i>var. minor, Pen.</i>	×	..	×	×
" urceolata, <i>Carter</i>	..	..	..	×
<i>Cucurbitella</i> mespiliformis, <i>Pen.</i>	..	..	×	..
<i>Pontigulasia</i> compressa (<i>Carter</i>), <i>Cash</i>	..	..	×	..
" <i>var. (Leidy)</i> , <i>Schout.</i>	..	..	..	×
<i>Lesquereusia</i> modesta, <i>Rhomb.</i>	×	×	×	×
" <i>spiralis, Bütschli</i>	×	×	..	×
<i>Phryganella</i> hemispherica, <i>Pen.</i>	..	×	×	×
" <i>nidulus, Pen.</i>	..	×	..	×
<i>Trigonopyxis</i> arcula (<i>Leidy</i>), <i>Pen.</i> , <i>vide Diffflugia arcula</i>	..	..	..	..
<i>Cryptodiffflugia</i> compressa, <i>Pen.</i>	..	..	..	×
" <i>eboracensis, Wailes</i>	..	..	..	×
" <i>oviformis, Pen.</i>	..	×	..	×
Family NEBELINA.				
<i>Hyalosphenia</i> elegans, <i>Leidy</i>	..	×	..	×
" <i>papilio, Leidy</i>	..	×	..	×
" <i>subflava, Cash</i>	..	×	..	×
<i>Nebela</i> americana, <i>Tardnek</i>	..	×	..	×
" <i>var. falcata, var. nov.</i>	..	..	..	×
" <i>ansata, Leidy</i>	..	×	..	..
" <i>barbata, Leidy</i>	..	×	..	×
" <i>carinata (Archer), Leidy</i>	..	×	..	×
" <i>caudata, Leidy</i>	..	..	..	×
" <i>collaris (Ehrenb.)</i> , <i>Leidy</i>	..	×	×	×
" <i>var. retorta, Leidy</i>	..	..	..	×
" <i>cratera, sp. nov.</i>	..	×	..	..
" <i>dentistoma, Pen.</i>	×	×	..	×

	1	2	3	4
Family NEBELINA (<i>cont.</i>).				
Nebela dentistoma, <i>var. lacustris</i> , <i>var. nov.</i>	×	×	×	..
" equicalceus, <i>Leidy</i>	..	..	..	×
" flabellulum, <i>Leidy</i>	..	×	..	..
" galeata, <i>Pen.</i>	..	×	..	×
" gracilis, <i>Pen.</i>	..	×	..	×
" griseola, <i>Pen.</i>	..	×	..	..
" longicollis, <i>Pen.</i>	..	×	..	×
" marginata, <i>Pen.</i>	..	×	..	..
" militaris, <i>Pen.</i>	..	×	×	×
" minor, <i>Pen.</i>	..	×	..	..
" parvula, <i>Cash</i>	..	×	×	..
" scutellata, <i>sp. nov.</i>	..	×	..	..
" tenella, <i>Pen.</i>	..	×	..	×
" tincta (<i>Leidy</i>), <i>Aver.</i>	..	×	×	×
" tubulata, <i>Brown</i>	..	×	..	×
" tubulosa, <i>Pen.</i>	..	×	..	×
" vitrea, <i>Pen.</i>	..	×	..	..
" " <i>var. sphagni</i> (<i>v. note</i>)	..	×	..	×
Quadrula symmetrica (<i>Wallich</i>), <i>F. E. Schulze</i>	..	×	..	×
" " <i>var. irregularis</i> , <i>Pen.</i>	..	×	..	×
" " <i>var. curvata</i> , <i>var. nov.</i>	..	×	..	×
Heleopera nodosa, <i>sp. nov.</i>	..	×	..	..
" petricola, <i>Leidy</i>	..	×	..	×
" " <i>var. major</i> , <i>Cash</i>	..	×	..	..
" " <i>var. amethystea</i> , <i>Pen.</i>	..	×	..	×
" rosea, <i>Pen.</i>	..	×	..	×
" sordida, <i>Pen.</i>	..	×	..	..
" sphagni (<i>Leidy</i>), <i>Hopk.</i>	..	×	..	×
" " <i>var. lævis</i> , <i>var. nov.</i>	..	×	..	..
" sylvatica, <i>Pen.</i>	..	×	×	..
Averinzewia cyclostoma (<i>Pen.</i>), <i>Schouteden</i>	..	..	..	×
Cochliopodium bilimbosum (<i>Greeff</i>), <i>Calkins</i>	..	×	..	..
Family EUGLYPHINA.				
Euglypha alveolata, <i>Duj.</i>	×	×	×	×
" " <i>var. cirrata</i> , <i>var. nov.</i>	..	×	×	..
" armata, <i>Wailes</i>	×	×	×	×
" " <i>var. brevispina</i> , <i>Pen.</i>	×	..	×	..
" " <i>var. flexuosa</i> , <i>Pen.</i>	×	..	×	..
" brachiata, <i>Leidy</i>	..	×	..	..
" " <i>var. librata</i> , <i>var. nov.</i>	..	×	..	..
" ciliata, <i>Ehrenb.</i>	..	×	×	×
" " <i>f. glabra</i>	..	..	×	..
" " <i>f. heterospina</i>	..	×	..	..
" compressa, <i>Carter</i>	..	×	..	×
" " <i>f. glabra</i>	..	×	×	×
" cristata, <i>Leidy</i>	..	×	×	×
" " <i>var. major</i> , <i>Wailes</i>	..	×	..	×
" crenulata, <i>sp. nov.</i>	×	×	×	×
" " <i>var. minor</i> , <i>var. nov.</i>	..	..	..	×
" filifera, <i>Pen.</i>	..	×	..	×
" " <i>var. spinosa</i> , <i>var. nov.</i>	..	×	..	..
" lævis, <i>Perty</i>	..	×	×	×
" mucronata, <i>Leidy</i>	..	×	..	..
" strigosa (<i>Ehrenb.</i>), <i>Leidy</i>	..	×	×	×
" " <i>f. glabra</i>	..	×	×	×
" " <i>f. heterospina</i>	..	×	..	..
" " <i>var. muscorum</i> , <i>Wailes</i>	..	×	×	..
" rotunda, <i>Wailes</i>	..	×	×	×

	Augusta, Georgia.	New Jersey.	New York District (mainland).	Long Island, N.Y.
	1	2	3	4
Family EUGLYPHINA (<i>cont.</i>).				
<i>Placocysta spinosa</i> , <i>Leidy</i>	..	×	..	..
" " <i>var. setigera</i> , <i>var. nov.</i>	..	×	..	..
<i>Assulina muscorum</i> , <i>Greeff</i>	..	×	×	×
" <i>seminulum</i> , <i>Leidy</i>	..	×	..	..
<i>Cyphoderia ampulla</i> (<i>Ehrenb.</i>), <i>Leidy</i>	..	..	×	..
" <i>trochus</i> , <i>var. amphoralis</i> , <i>Wailes</i>	..	..	×	×
<i>Trinema complanatum</i> , <i>Pen.</i>	..	×	×	×
" <i>enchelys</i> (<i>Ehrenb.</i>), <i>Leidy</i>	×	×	×	×
" <i>lineare</i> , <i>Pen.</i>	×	×	×	×
<i>Corythion dubium</i> , <i>Tardnek</i>	..	×	×	×
" <i>pulchellum</i> , <i>Pen.</i>	..	×	..	..
<i>Sphenoderia dentata</i> , <i>Pen.</i>	×	×	×	×
" <i>lenta</i> , <i>Schlumb.</i>	..	×	×	×
" <i>macrolepis</i> , <i>Leidy</i>	..	×	..	×
<i>Campascus minutus</i> , <i>Pen.</i>	..	..	×	..
Family GROMIINA.				
<i>Pamphagus hyalinus</i> , <i>Ehrenb.</i> ? sp.	×	..	×	×
<i>Pseudodifflugia Archeri</i> , <i>Pen.</i> sp.	×	×	..	..
" <i>fulva</i> , <i>Archer</i>	×	×	..	..
" <i>gracilis</i> , <i>Schlumb.</i>	×	..	..	×
Family AMPHISTOMINA.				
<i>Amphitrema flavum</i> (<i>Archer</i>), <i>Pen.</i>	..	×	..	..
" <i>stenostoma</i> , <i>Nüsslin</i>	..	×	..	..
" <i>Wrightianum</i> , <i>Archer</i>	..	×	..	..
Sub-Class HELIOZOA.				
Order APHROTHORACA.				
Family ACTINOPHRYIDÆ.				
<i>Actinophrys sol</i> , <i>Ehrenb.</i>	..	×	×	×
Order CHALAROTHORACA.				
Family ACANTHOCYSTIDÆ.				
<i>Acanthocystis turfacea</i> , <i>Carter</i>	..	×	×	×
Order DESMOTHORACA.				
Family CLATHRULINIDÆ.				
<i>Clathrulina Cienkowskii</i> (<i>Meresch.</i>), <i>Pen.</i>	..	×	..	..
" <i>elegans</i> , <i>Cienk.</i>	..	×	×	..

List of Rhizopoda of which illustrations are given by Leidy (30)
which have since received specific names.

	Plate.	Figures.
<i>Amœba striata</i> , Pen.	3.	37.
<i>Arcella hemisphaerica</i> , Perty	27.	4, 15.
" <i>polypora</i> , Pen.	28.	22.
" <i>vulgaris</i> var. <i>compressa</i> (Cash)	28.	4-7.
<i>Assulina muscorum</i> , Greeff	37.	15-17, 26.
<i>Centropyxis lævigata</i> , Pen.	18.	37-44.
<i>Corythion dubium</i> , Taránek	39.	12, 13.
<i>Cyphoderia ampulla</i> var. <i>papillata</i> , Wailes	34.	5-8.
<i>Diffugia acuminata</i> var. <i>inflata</i> , Pen.	12, 13.	24; 2, 5, 8, 10.
" <i>amphora</i> , Leidy	14, 16.	3, 4, 8; 34.
" <i>amphoralis</i> , Hopk.	16.	33.
" <i>bacillarium</i> var. <i>elegans</i> (Pen.), Cash.	13.	23-26.
" <i>gramen</i> , Pen.	15.	15.
" <i>hydrostatica</i> , Zuch. ?	15.	27, 28.
" <i>lanceolata</i> , Pen.	10.	17.
" <i>Leidyi</i> , sp. nov.	16.	36.
" <i>oblonga</i> var. <i>atricolor</i> , Pen.	10.	27.
" " var. <i>claviformis</i> , Pen.	10, 13.	16; 3, 4.
" <i>Penardi</i> , Hopk.	15.	25, 26.
" <i>rubescens</i> , Pen.	10.	24, 25.
" <i>tuberculata</i> (Wallich), Archer	15.	16-19, 21, 22.
" <i>vescicula</i> , Pen.	16.	37.
<i>Euglypha alveolata</i> var. <i>cirrata</i> , var. nov.	35.	5, 9.
" <i>armata</i> , Wailes	35.	7, 8, 10.
" <i>brachiata</i> var. <i>librata</i> , var. nov.	37.	7.
" <i>compressa</i> , Carter	36, 37.	1-6; 29.
" " f. <i>glabra</i>	36.	23.
" <i>crenulata</i> , sp. nov.	35.	2, 3, 4, 6, 15-18.
" <i>filifera</i> , Pen.	36, 37.	7, 11-14; 28.
" " var. <i>spinosa</i> , var. nov.	35.	19?
" <i>strigosa</i> var. <i>muscorum</i> , Wailes	36.	18.
<i>Heleopera nodosa</i> , sp. nov.	26.	12, 15, 20.
<i>Lesquereusia modesta</i> , Rhumbl.	19.	23.
<i>Nebela americana</i> , Taránek	23.	7.
" <i>dentistoma</i> , Pen.	24.	12.
" " ? var. <i>lacustris</i> , var. nov.	24.	11.
" <i>galeata</i> , Pen.	23.	2, 3.
" <i>gracilis</i> , Pen.	23.	4-6.
" <i>marginata</i> , Pen.	24.	6, 8.
" <i>militaris</i> , Pen.	20.	18.
" <i>minor</i> , Pen.	22.	11, 12, 16.
" <i>scutellata</i> , sp. nov.	24.	25.
" <i>tubulata</i> , Brown	24.	18.
<i>Phryganella hemispherica</i> , Pen.	16.	23, 24.
" <i>nidulus</i> , Pen.	16.	1-4.
<i>Pontigulasia vas</i> (Leidy), Schout.	12.	2-9.
<i>Trinema complanatum</i> , Pen.	39.	41, 47, 61-63, 67, 68.
" <i>lineare</i> , Pen.	39.	24, 38, 43, 55-59, 65.

List of the species recorded from New Jersey by Leidy (30) which were not found by the writer :—

RHIZOPODA.

Amœba nobilis, Pen. (Ouramœba).
Amphizonella violacea, Greeff.
Biomyxa vagans, Leidy.
Cochliopodium vestitum, Archer.
Dinamœba mirabilis, Leidy.
Gromia fluviatilis, Duj.

Hyalodiscus rubicundus, Hertw. & Less.
Pamphagus mutabilis, Bailey.
 „ *granulatus*, F. E. Sch.
Pellomyxa villosa, Leidy.
Vampyrella lateritia (Fres.), Leidy.

HELIOZOA.

Actinosphærium Eichorni, Ehrenb.
Eleorhanis cincta, Greeff.
Heterophrys myriapoda, Archer.

Pompholyxophrys punicea, Archer.
Raphidiophrys elegans, Hertw. & Less.
 „ *viridis*, Archer.

Synonyms for some of the species described by Leidy (30, 10, 36) :—

<i>Amœba radiosa</i> , Ehrenb.	now	<i>Dactylosphærium radiosum</i> , Bütschli.
<i>Diffugia compressa</i> , Carter.	„	<i>Diffugia oblonga</i> var. <i>nodosa</i> , Leidy.
„ <i>cornuta</i> , Leidy.	„	„ <i>oblonga</i> var. <i>cornuta</i> , Leidy.
„ <i>globularis</i> , Leidy.	„	„ <i>globulus</i> (Ehrenb.), Hopk.
„ <i>globulosa</i> , Leidy.	„	„ do. do.
„ <i>nodosa</i> , Leidy.	„	„ <i>oblonga</i> var. <i>nodosa</i> , Leidy.
„ <i>pyriformis</i> , Perty.	„	„ <i>oblonga</i> , Ehrenb. (10).
„ <i>spiralis</i> , Ehrenb.	„	<i>Lesquereusia spiralis</i> (Ehrenb.), Bütschli.
„ <i>vas</i> , Leidy.	„	<i>Pontigulasia vas</i> (Leidy), Schout.
<i>Hyalosphenia tincta</i> , Leidy.	„	<i>Nebela tincta</i> (Leidy), Awer.
<i>Pamphagus avidus</i> , Leidy.	„	<i>Pamphagus granulatus</i> , F. E. Sch.
„ <i>curvus</i> , Leidy.	„	do. do.

HELIOZOA.

<i>Acanthocystis chætopora</i> , Leidy	now	<i>A. turfacea</i> , Archer.
<i>Hyalolampe fenestrata</i> , Greeff.	„	<i>Pompholyxophrys punicea</i> , Archer.

(Penard, Les Héliozoaires, 1904.)

According to Penard *Diplophrys Archeri*, pl. 45. figs. 7, 8, should be identified as *Eleorhanis cincta*, Greeff. Also *Ouramœba butulicanda* and *O. vorax* are no doubt *Amœba nobilis*, Penard (36. Les Héliozoaires, 1904.)

List of Rhizopoda and Heliozoa found in New York City drinking-water, supplied from the Croton Reservoir during the autumn of 1911 :—

RHIZOPODA.

Arcella discoides.
 „ *vulgaris*.
 „ *vulgaris* var. *gibbosa*.
Assulina seminulum.
Centropyxis aculeata.
 „ *aculeata* var. *discoides*.
Campascus minutus.
Corythion pulchellum.
Cyphoderia ampulla.
 „ *trochus* var. *amphoralis*.
Diffugia acuminata.
 „ *constricta*.

Diffugia elegans.
 „ *gramen*.
Euglypha alveolata.
 „ *ciliata*.
Nebela collaris.
Plagiopyxis callida.
Phyganella hemispherica.
Trinema lineare.

HELIOZOA.

Acanthocystis turfacea.
Actinophrys sol.

Order AMŒBINA.

The species recorded belonging to this Order consist almost entirely of the genus *Amœba*: they are local in their occurrence, in some places plentiful, in others scarce, but this may be in part due to the method of collection, which was not directed particularly to insure their capture; no very large individuals were seen, and many of the small ones had the appearance of being immature and their identity was doubtful.

[Cockerell (12, 1911) records this genus as *Amiba*-(*vide* Stiles & Hassall, Bureau of Animal Industr., U.S. Dept. Agric., Bull. 79, 1905, p. 38).]

Order CONCHULINA.

Genus ARCELLA, *Ehrenberg*.

Nine species and two varieties are recorded in this genus; the limits of some of the species are somewhat vague and may include forms which are entitled to specific or varietal names. The life-histories of some of the forms are required to clear up doubtful points. A general tendency for the apertures to become crenulate was observed.

ARCELLA ANGULOSA, *Perty*.

A. vulgaris var. *angulosa*, Leidy, pl. 28. figs. 8-13 (30).

A. costata (Ehrenb.), Penard (36).

Not common, and sometimes closely approaching forms of *A. mitrata*. Diameter 84-100 μ ; aperture about $\frac{1}{3}$ diameter.

A. ARENARIA, *Greeff*.

A. microstoma, Pen.

A. aureola, Maggi.

Recorded from Good Ground only: diameter about 80 μ ; aperture $\frac{1}{3}$ diameter.

Distribution. Long Island, N.Y.; Canada (39); Colorado (35).

A. ARTOCREA, *Leidy*.

(30) pl. 30. figs. 1-9.

Often numerous: in one individual the pores around the aperture were occupied by nodules or buttons 2.5 μ in diameter and projecting internally 1.75 μ (Pl. 12. fig. 1).

Diameter 120-230 μ ; aperture 23-47 μ ; height 50-63 μ .

Two individuals from Augusta, Ga., had apertures 65 μ diameter.

A. DENTATA, *Ehrenberg*.

A. stellaris, Perty.

Leidy, pl. 30. figs. 10-19 (30).

This is a scarce species and is recorded only from Good Ground, where it occurs in a small pond at the head of Smith's Creek.

The processes are usually nine in number, occasionally twelve; the various forms depicted by Leidy were found, except those with a flattened crown.

Diameter 120–135 μ ; aperture 35–40 μ .

Distribution. Long Island, N.Y.; New Jersey (30); Pennsylvania (30); Michigan (41); Ohio (28).

ARCELLA DISCOIDES, *Ehrenberg*.

Leidy, pl. 28. figs. 14–21, 23–29 (30).

Generally distributed but not very numerous.

Size variable, but usually 130–160 μ in diameter: aperture 60–80 μ ; height about one-third of the diameter.

An individual from Lakehurst was similar to Leidy's fig. 21: diameter 52 μ ; height 17 μ .

A. HEMISPHERICA, *Perty* (36).

A. vulgaris, Ehrenb. pars, Cash (10).

Not common; diameter 42–50 μ .

A. MITRATA, *Leidy*.

Leidy, pl. 29. figs. 1–24 (30).

Abundant in sphagnum, especially at Lakehurst. The structure of the test is similar to that of *A. vulgaris*, but the alveoli (0.8 μ diam.) are surrounded by six small pores (?) making a pattern similar to that on one form of *Cyphoderia* (vide 45. pl. ii. fig. 10 b); Cushman & Henderson (18) give microphotographs of it.

Diameter 70–176 μ ; aperture 22–50 μ ; base 50–120 μ ; height 55–150 μ .

The test may be circular or polygonal; the aperture may be with or without a secondary invagination and it may be circular or crenulate; there appears to be no interdependence among these variations.

A. POLYPORA, *Penard* (36).

Leidy, pl. 28. fig. 22 (30).

Not uncommon in Split Rock Lake and Van Cortlandt Park; the largest individuals probably belong to a distinct species.

Diameter 230–340 μ ; aperture 126–190 μ .

A. VULGARIS, *Ehrenberg*.

Leidy, pl. 27. figs. 1–3, 5–14, 17, 20–22 (30).

This species is not very plentiful; the test consists of a chitinous envelope stiffened externally by bars 0.8 μ apart, disposed in three parallel rows inclined at 60° from each other. This structure is described by Penard (36); Cushman & Henderson (18) give microphotographs of it. As in the case of

A. mitrata, there is a superficial resemblance to the pattern on the tests of some forms of *Cyphoderia ampulla* (vide 45. pl. ii. fig. 10 d).

Diameter 80–157 μ ; aperture 18–35 μ .

Var. GIBBOSA (*Pen.*), *West.*

A. vulgaris pars, Leidy, pl. 27. figs. 16, 23–35 (30).

Generally distributed but never numerous. Diameter 50–82 μ .

Var. COMPRESSA, *Cash* (10).

A. artocrea, Penard (36).

A. vulgaris pars, Leidy, pl. 28. figs. 4–7 (30).

Not common, but of normal size ; about 120 μ in diameter.

Genus PSEUDOCHLAMYS, *Clap. & Lachm.*

Cockerell (12, 1911) names this genus *Microchlamys*, the name *Pseudochlamys* having been previously used for a beetle (Zool. Anzeiger, xxxviii. Nr. 5/6, 15. 8. 1911).

Genus CORYCIA, *Dujardin.*

CORYCIA FLAVA, *Greeff.*

Not numerous but generally distributed ; usually found in mosses. Diameter 60–80 μ .

Distribution. Georgia ; New Jersey ; New York ; Canada (39).

[Cockerell puts forward "*Microcoryia*" as a name for this genus for reasons stated in Zool. Anzeiger, Bd. xxxviii. Nr. 5/6, 15. 8. 1911.]

Genus BULLINULA, *Penard.*

BULLINULA INDICA, *Pen.* (emend.) J. Roy. Micr. Soc. 1907.

Found in sphagnum but not common.

Diameter usually about 160 μ ; an individual at Lakehurst measured : length 225 μ , breadth 190 μ , aperture 87 μ .

Distribution. New Jersey ; Long Island, N.Y. : Canada (39).

Genus PLAGIOPYXIS, *Penard.*

PLAGIOPYXIS CALLIDA, *Pen.* (37, 1910).

This species has a world-wide distribution, but is easily overlooked owing to its having the appearance of a spheroidal form of *Diffugia constricta* or some other species with a similarly shaped test, but a careful examination of the aperture, which is often difficult to locate, will reveal its identity. Diameter 90–110 μ .

Distribution. Switzerland (*Penard*) ; British Isles (45) ; New Zealand ; Australia ; British Columbia (39) ; Borneo,

Genus DIFFLUGIA, *Leclerc*.

This genus is well represented both in species and numbers of individuals; one new species, *D. Leidyi*, is recorded.

DIFFLUGIA ARCUA, *Leidy*.

Leidy, pl. 15. figs. 34-37; pl. 16. figs. 30, 31 (30).

This species, which is in an anomalous position among the *Diffugiæ*, has been removed by Penard to the genus *Trigonopyxis*, gen. nov.; in future it should be known as *T. arcua* (Leidy), Penard (Rev. Suisse Zool. 1912).

It is abundant in sphagnum and damp mosses.

Diameter 70-140 μ .

D. BACILLARIARUM, *Perty*. Var. ELEGANS (*Pen.*), *Cash* (10).

D. acuminata pars, Leidy, pl. 13. figs. 23-26 (30).

On Pl. 12. figs. 2 & 3 is shown a form which is abundant at Lakehurst. The test is almost entirely composed of diatom frustules; in broad view it is two-horned, in narrow side view it appears normal.

Length 110-130 μ ; breadth 95-105 μ ; aperture about 35 μ .

D. LEIDYI, sp. nov. (Pl. 12. figs. 4 & 5.)

Leidy, pl. 16. fig. 36 (30).

Test of medium size, composed of siliceous particles with an admixture of vegetable materials and sometimes of diatoms, circular or subcircular in transverse section: the fundus furnished with two (rarely three) horns arranged symmetrically in one plane; aperture circular, bordered by small siliceous grains. Plasma and pseudopodia normal.

Length, not including horns, 100-110 μ ; breadth of body 78-80 μ ; neck 35-40 μ in diameter; horns 30-40 μ in length.

Habitat. Submerged sphagnum.

Distribution. New Jersey.

Leidy (30) illustrates a test of typical form, the only one he observed; at Lakehurst it is not very rare.

D. OBLONGA var. CORNUTA, *Leidy*.

Leidy, pl. 12. figs. 17, 18 (30).

An individual of this variety found at Lakehurst measured: length (including horn) 240 μ , breadth 120 μ , aperture 32 μ , with a single horn 50 μ in length. Leidy's fig. 18 represents it very accurately, with the exception of the horn, which is smaller than on the Lakehurst specimen.

D. OVIFORMIS, *Cash* (10).

Numerous in Van Cortlandt Park and Long Island, with apertures evenly three- and four-lobed (45).

Habitat. Ponds and lakes.

Length 70–80 μ .

D. cratera, Leidy, represented by empty tests, is plentiful at Lakehurst and in New York City water-supply, but Leidy's supposition is undoubtedly correct that it is a *Ciliate* allied to the genus *Tintinnus*, probably *Codonella lacustris*, Entz.

Genus CUCURBITELLA, *Penard* (36).CUCURBITELLA MESPILIFORMIS, *Penard* (36).

D. lobostoma pars, Leidy, pl. 15. fig. 7 (30).

Occurs in Van Cortlandt Park, but is rare; this, however, may be due to the method of collecting; in a pond in Yorkshire it was not seen, although numerous gatherings had been made, until during a drought it was found plentifully in the muddy sediment.

Length about 100 μ ; diameter 80 μ .

It has been found in the Western States by Edmondson (private letter).

Genus CRYPTODIFFLUGIA, *Penard* (36).CRYPTODIFFLUGIA EBORACENSIS, *Wailes* (45).

Found only in Penney's and Trout Ponds, Good Ground, where it is not uncommon in sphagnum. Many were seen in an active state. Colour reddish brown.

Length 26–28 μ ; breadth 14–16 μ ; thickness 12–14 μ ; aperture 5–6 μ .

Distribution. Long Island, N.Y.; Alaska; Great Britain (45).

C. COMPRESSA, *Penard* (36).

Only two individuals were seen in sphagnum, and they were unusually small. The pseudopodia were not observed.

Length 13 μ ; breadth 9 μ ; thickness 5 μ .

Trout Pond, Good Ground.

C. OVIFORMIS, *Penard*.

Not common: some of the tests were noticeably compressed.

Length 14–20 μ ; breadth 10–14 μ ; aperture 3–4 μ ; nucleus 3.5 μ in diameter with a central nucleole.

Distribution. Lakehurst, N.J.; Good Ground, L.I.

Genus NEBELA, *Leidy*.

In the localities visited which were devoid of sphagnum few species or individuals of this genus are to be found, but in the Cedar Swamps of

Lakehurst, N.J., and around the ponds near Good Ground, L.I., the sphagnum is inhabited by many individuals and species; some species that are unknown or very rare in Europe are there quite numerous or not uncommon.

The following may be especially noted:—On Long Island are found *N. caudata* and *N. equicalceus*, the latter of a special form, also an interesting series of curved varieties of several species. At Lakehurst are found the three species with beaded apertures that form a compact group, viz. *N. tenella*, *N. griseola*, and *N. cratera*; also *N. ansata*; *N. vitrea* sp. ver., together with a variety having a test bearing curiously arranged angular plates, and *N. scutellata* inhabiting a test formed entirely of small quadrangular plates. In both localities are found *N. barbata*, *N. carinata*, *N. gracilis*, and *N. tubulata*.

Species which have been recorded from North America that were not observed were *N. bigibbosa*, *N. lageniformis*, and *N. ras* (39).

The numerous curved tests which are found at Penney's Pond, Good Ground, suggest many points of interest. In addition to *N. collaris* var. *retorta*, Leidy, two other species, *Nebela americana* and *Quadrula symmetrica*, are found there presenting the same modification; this variation must be of rare occurrence as Leidy records only a single test of this kind, and I am not aware of any other record: the association of so many in one limited habitat suggests that this form may be induced sporadically by certain local conditions.

Light is thrown on the question of the origin of the plates with which the *Nebelæ* construct their tests by the occurrence at Good Ground of the tests of *N. equicalceus* and *N. collaris* containing, and sometimes largely composed of, the scales of *Euglypha denticulata* var. *minor*, including even spines with the basal scales still attached; at Lakehurst, on the other hand, are found *N. scutellata* and forms of *N. vitrea* with tests composed of quadrangular or angular plates which can hardly have had a foreign origin.

NEBELA AMERICANA, Taránek.

Sitzber. böhm. Ges. Wiss. 1881; Abh. böhm. Ges. Wiss. xi. (1882), pl. 3. figs. 15, 16.

N. collaris pars, Leidy, pl. 23. fig. 7 (30).

N. americana, Cash & Hopk., pl. 31. figs. 15–18 (10); Penard, p. 363, figs. 4–6 (36).

The identification of this species presents certain difficulties. As first described by Taránek it is glabrous, not compressed, and intermediate in outline between *N. barbata*, Leidy, pl. 24. figs. 14–17, and figs. 18 & 19 (*N. tubulata*, Brown). The only *Nebela*, with which I am acquainted, answering to this description is *N. longicollis*, Pen., which is rare. A much more common species having a compressed test, wedge-shaped in broad view, has been generally accepted as the one which Taránek had under observation. To exchange the names now would only cause confusion and

serve no good purpose. I have, therefore, here recorded as *N. americana* a species answering to the following description: "Test wedge-shaped in broad view, rounded at the apex in narrow view, with a thickness equal to about two-thirds of the breadth and 120–175 μ in length," as illustrated by Cash & Hopkinson, pl. 31 (10).

Length 120–168 μ ; breadth 60–90 μ ; aperture 20–23 μ ; thickness 40–50 μ .

Distribution. Absecom (*Leidy*) and Lakehurst, N.J.; Good Ground, Long Island.

Var. *FALCATA*, var. nov.

Many of the curved tests found in Penney's Pond, L.I., agree in size and structure with normal individuals of this species found there, but the specific characters are so modified that general characteristics must be relied on for their identification, and it is possible that the largest of these forms may be derived from *N. tubulosa*.

Length 130–170 μ .

N. ANSATA, *Leidy*.

Leidy, pl. 25. figs. 1–8 (30).

At Lakehurst not uncommon in submerged sphagnum.

Length 217–242 μ ; breadth, of body 94–110 μ , over horns 130–160 μ ; aperture 40–45 μ by 27–31 μ ; thickness 60–70 μ .

N. BARBATA, *Leidy*.

Leidy, pl. 24. figs. 14–17 (30).

This species is distinguished from all other species of *Nebela* by the fine cilia scattered over the surface of the test; they are of uniform diameter, terminating in truncate ends, 10–18 μ in length, less than 0.5 μ in diameter. They are unaffected by cold sulphuric acid and become invisible in oil of cloves and in Canada balsam.

Length 112–126 μ ; breadth 40–50 μ ; aperture 12–17 μ ; thickness 35–40 μ . At Good Ground one individual measured only, length 80 μ , breadth 35 μ , aperture 12 μ .

Distribution. Lakehurst; Absecom (*Leidy*), N.J.; Good Ground, Long Island; British Isles (3, 10, 45); Sierra Leone (coll. by Major Wailes).

N. CAUDATA, *Leidy*.

Leidy, pl. 26. figs. 21–24 (30).

Found in sphagnum on the borders of Trout Pond, Good Ground; it is rare and the proportion of living individuals observed was small; some have been kept alive in sphagnum during the winter, but up till the time of writing they have refused to become active.

Length 80–84 μ ; breadth 60–68 μ ; aperture 20 μ . Spines 4 or 3 in number and 16–20 μ in length.

Nucleus about 12 μ in diameter with a large nucleole.

Distribution. Long Island, N.Y.; Absecon, N.J. (*Leidy*); Nantucket Isl., Mass. (18); Ohio (28); British Columbia (39); Scotland (*Murray*); Ile Macquarie (39); New Zealand (39); Australia (39); Gough Isl. (*Penard*).

NEBELA CARINATA (*Archer*), *Leidy*.

Leidy, pl. 24, figs. 1–5, 9, 10.

Often numerous in submerged sphagnum.

Length 200–260 μ ; breadth 135–160 μ ; aperture 30–40 μ ; thickness 63–73 μ .

N. COLLARIS (*Ehrenb.*), *Leidy*.

Leidy, pl. 22, figs. 1–10, 13–15, 17–20 (30).

Not abundant; length 100–130 μ .

Var. RETORTA, *Leidy*. (Pl. 12, figs. 6 & 7.)

Leidy, pp. 151, 289, fig. p. 151 (30).

Tests answering to *Leidy*'s description and drawing are not uncommon in Penney's Pond, Good Ground, the only locality in which I found them. They are not merely curved tests but are modified to such an extent as to veil the specific characteristics. The curvature takes place in the plane of the greatest width and is generally greater than in *Leidy*'s drawing (p. 151); in narrow view there is no curvature and the tests are compressed. The aperture, which is not notched, loses its smooth outline and is bordered by circular or oval plates.

Accompanying the *Nebela* was a similar form which could without hesitation be referred to *Quadrula symmetrica*, the typical form of which is numerous there. Two species of *Nebela* seem to be thus modified, viz. *N. collaris* and *N. americana*, and the latter in its typical form is much the more numerous. The occurrence together, in fair numbers and in a single limited habitat, of these special forms seems to indicate that local conditions have a controlling influence in their formation and that they are not autonomous species but sporadic varieties locally induced.

Length 130–170 μ ; breadth 52–97 μ ; aperture 26–39 μ . *Leidy* observed a single individual only, length 144 μ .

N. CRATERA, sp. nov. (Pl. 12, figs. 8 & 9.)

Test of moderate size, not compressed, pyriform, neck small and parallel; aperture bordered by a prominent collar semicircular in section. Plasma and pseudopodia normal.

Length 120–135 μ ; diameter 74–80 μ ; neck about 30 μ diameter and 30–35 μ in length. Aperture 25–35 μ in diameter; collar 30–40 μ in diameter.

Habitat. Submerged sphagnum.

Distribution. New Jersey.

This species belongs to the group of which *N. tenella* and *N. griseola* are the other members, but it exceeds them in size and is of quite distinctive shape. The test is formed of angular plates mixed with a few circular plates and diatoms; it is of a dark colour, more or less opaque, and is very fragile. It is circular in transverse section.

N. DENTISTOMA, Penard.

Leidy, pl. 24. fig. 12 (30).

Typical individuals of this species occur only sparingly, and varied in length from 90 μ to 110 μ , with a breadth equal to $\frac{2}{3}$ – $\frac{3}{4}$ of the length. No circular or *N. flabellulum*-shaped tests were observed.

Var. *LACUSTRIS*, var. nov. (Pl. 12. fig. 10.)

? *N. collaris* pars, Leidy, pl. 24. fig. 11 (30).

Test large, pyriform, compressed, formed of angular siliceous plates and grains of various sizes; with a small neck and aperture broadly oval.

Length 120–206 μ ; breadth 100–143 μ ; aperture 25–45 μ ; thickness 64–90 μ .

Distribution. Lakehurst, N.J.; Augusta, Ga.

This variety exceeds in size every other of the numerous forms of this species and appears to be a link with the large *N. vitrea*, Pen. sp. ver.; its size also distinguishes it from *N. scotica*, Brown (3. l. 78–82 μ).

The test illustrated by Leidy, pl. 24. fig. 11, taking as correct the given magnification ($\times 250$), measures 208 μ in length and 152 μ in breadth, which nearly agrees with the Lakehurst specimens: the given measurement of another, viz. length 100 μ , breadth 68 μ , is very like *N. scotica*, Brown, but the thickness given, 20 μ , seems improbable.

N. EQUICALCEUS, Leidy (31, 1874).

N. hippocrepis, Leidy (30), pl. 24. fig. 13; pl. 25. figs. 9–14.

This is a scarce species; it is found in Penney's Pond, Good Ground. Leidy illustrates two forms: one (pl. 25. figs. 9–14) provided with a solid carina extending around the fundus, the other (pl. 24. fig. 13) without this carina; only the latter of these two forms was seen. The development of the internal processes varied somewhat.

Dimensions. Length 203–235 μ ; breadth 126–142 μ ; aperture 38–45 μ ; thickness 72–80 μ . Length of horns when well developed 35–60 μ .

The test is composed of plates of various shapes and sizes ; sometimes they are large, circular and imbricated, or they may be small and separated from each other. Some were found with tests largely composed of the scales of *Euglypha crenulata* var. *minor*, which were quite perfect and easily recognisable, as they differ slightly in shape from the scales of *E. crenulata*, a species not recorded from Good Ground (*vide* Pl. 12. fig. 38).

NEBELA GRACILIS, Penard (37, 1910).

N. collaris pars, Leidy, pl. 23. figs. 4-6 (30).

N. galeata pars, Penard, p. 351, figs. 4, 5 (36).

Described only recently by Penard, this species is not uncommon at Lakehurst and Good Ground. Leidy represents it very faithfully in figs. 4 and 5 (length 110 μ), but in the end view fig. 6 the sides appear to have been crushed. usually they are flattened but not concave. At Lakehurst it is found in a very handsome form up to 130 μ in length ; at Good Ground it is of normal size, 97-110 μ in length.

Dimensions. Length 97-130 μ ; breadth 42-65 μ ; aperture 14-23 μ ; thickness 25-40 μ .

Habitat. Submerged sphagnum.

Distribution. Absecom (*Leidy*) and Lakehurst, N.J. ; Penney's Pond, Good Ground, L.I. ; Switzerland (*Penard*).

N. GRISEOLA, Penard (39).

Clare Island Survey, figs. 25 a-g (45).

This species, recently described by Penard from Australia and from Ireland, is found at Lakehurst in association with the two other species of *Nebela* possessing beaded apertures, *N. tenella*, Pen., and *N. cratera*, sp. nov. ; usually larger than the former. at Lakehurst they are of nearly equal size, but can be distinguished from one another by the greater compression of the test of *N. tenella*.

Length 80-85 μ ; breadth 53-60 μ ; aperture 16-18 μ in diameter ; thickness 43-50 μ .

Distribution. Lakehurst, N.J. ; Australia (39) ; Ireland (45).

N. LONGICOLLIS, Penard (34).

This species is distinguished from *N. americana* by the slight compression of the test and the elongated neck. It is much smaller than *N. tubulosa* and of slighter proportions.

Length 133-140 μ ; breadth 45-52 μ ; aperture 20 μ ; thickness 40-48 μ .

Distribution. Colorado (35) ; New Jersey ; Switzerland (36) ; Australia, New Zealand (39).

At Lakehurst it is rare ; it has a resemblance to *N. barbata*, Leidy, but is glabrous, more robust, and has a shorter neck.

N. MARGINATA, Penard (36).*N. carinata* pars, Leidy, pl. 24. figs. 6-8 (30).

Not common, only a few individuals being found in sphagnum at Lakehurst. Length 150 μ ; breadth 115 μ ; aperture 40 μ .

N. MINOR, Penard (36).*N. collaris* pars, Leidy, pl. 22. figs. 11, 12, 16 (30).

Found in New Jersey sphagnum. Length 80-90 μ .

N. MILITARIS, Penard (34).*Hyalosphenia tinctoria* pars, Leidy, pl. 20. fig. 18 (30).

Generally distributed but not abundant. Length 65-80 μ .

N. PARVULA, Cash (10).

Found in dry sphagnum and moss. Length 74-84 μ .

N. TENELLA, Penard, 1893 (36).

This species is found in sphagnum and occurred numerously in a sample from New Jersey; the size was above normal and approached that of *N. griseola*, a species from which its greater compression serves to distinguish it.

Length 68-84 μ ; breadth 45-60 μ ; aperture 13-17 μ ; thickness 30-39 μ ; collar 20-28 μ in diameter.

N. SCUTELLATA, sp. nov. (Pl. 12. figs. 11 & 12.)*Quadrula symmetrica* pars, Leidy, pl. 24. fig. 25 (30).

Test moderately large, hyaline, pyriform, compressed; composed of small siliceous, rectangular plates arranged in irregular rows, while smaller rectangular plates may be superimposed at the junctions of the larger plates; margin of aperture often irregular; plasma and pseudopodia normal; nucleus small with several nucleoles.

Length 120-135 μ ; breadth 74-90 μ ; aperture 24-30 μ ; thickness nearly two-thirds of the breadth.

Habitat. Sphagnum and wet mosses.

Distribution. New Jersey; the Seychelles.

The test of this species resembles, in its possession of small superimposed plates, a form of *N. vitrea* which is found at Lakehurst and shown on Pl. 12. figs. 15-17; it also bears a great resemblance in structure to *N. tropica*, Pl. 12. figs. 13 & 14.

In the Seychelles (fig. 43) it is found without the small covering-plates, but having an admixture, usually 5 to 10 per cent., of circular discs in the composition of the tests.

It differs from *Quadrula symmetrica* both in shape and structure of the test.

Leidy's illustration is of an individual, length 140 μ , breadth 100 μ , aperture 30 μ .

NEBELA TINCTA (*Leidy*), *Aver.*

Hyalosphenia tincta, Leidy.

Nebela bursella, Taránek.

Nebela bohémica, Taránek.

Plentiful in all gatherings of sphagnum, but scarce in mosses. The limits of this species, both as regards size and form, are difficult to define. On the one hand it approaches *N. collaris*, and on the other *N. flabellulum*.

N. TROPICA, sp. nov. (Pl. 12. figs. 13 & 14.)

Test of medium size, hyaline, pyriform, compressed; composed of rectangular siliceous plates; aperture dilated in broad view, with a shallow notch in narrow view.

Length 74-93 μ ; breadth 45-60 μ ; aperture 20-30 μ ; thickness 30-35 μ .

Habitat. Moss.

Distribution. Borneo; Seychelles (fig. 44).

The arrangement of the plates forming the test is generally more regular near the fundus, where they are arranged diagonally, than near the aperture. In the outline of the test there is a close resemblance to *N. militaris*, but the structure and general appearance are very similar to those of *N. scutellata*, a species to which it is undoubtedly closely allied. For comparison with *Quadrula symmetrica*, figures of the latter are given on Pl. 12. figs. 18, 19, 45. The moss in which this species was first found was collected at Sarawak, Borneo, by J. Brook.

N. TUBULATA, *Brown* (3).

Leidy, pl. 24. fig. 18 (30).

This is not uncommon in sphagnum; the form with a torulose neck is also frequent (45).

Length 56-78 μ ; breadth 28-48 μ ; aperture 10-15 μ ; length of neck 18-32 μ .

Leidy's fig. 18 measures 80 μ in length, but fig. 19 of a similar test scales 250 μ at the stated magnification of $\times 100$; this is probably a mistake for $\times 350$, at which the test would measure 71 μ in length.

N. TUBULOSA, Penard.

Not abundant; at Good Ground the large proportion of quadrangular plates often present in the tests was a noticeable feature.

Length 174–196 μ ; breadth 74–93 μ ; aperture 30–35 μ .

At Lakehurst an abnormally large individual occurred, length 300 μ , breadth 150 μ , aperture 40 μ , the test principally composed of imbricated discs 6–12 μ in diameter; it may have been a case of plastogomy or double encystment.

N. VITRÆA, Penard. (Pl. 12. figs. 15–17.)

Two individuals of large size similar to those, until now, known only from the deep Swiss Lakes, were found at Lakehurst; length 258 μ and 187 μ , breadth 135 μ and 130 μ , apertures 45 μ and 40 μ ; they had tests composed of square and angular plates, with apertures bordered by 8 or 9 large grains.

The form usually found at Lakehurst is smaller, often with a curiously constructed test (figs. 15–17), in which circular plates predominate mixed with some angular or irregularly shaped plates, the interstices between them being re-enforced by small covering-plates somewhat similar to those figured by Penard (36. p. 272, fig. 4), and analogous to the ones found on the test of *N. scutellata*.

Length 115–155 μ ; breadth 70–100 μ ; aperture 23–31 μ .

The small sphagnum-inhabiting variety of normal type and about 100 μ in length, as illustrated by Cash & Hopkinson (10), is not common in the localities under investigation. As has been pointed out by Penard (45. p. 51 note), this form is intermediate in character between *N. vitrea*, sp. ver., and *N. dentistoma*, but further investigation and comparison of specimens from various localities are necessary in order to determine the limits of the various forms; they can be grouped, however, in a series of types which may be differentiated as *N. vitrea*, sp. ver., var. *minor* and var. *sphagni*; all of which occur in association at Lakehurst.

Genus QUADRULA, *F. E. Schulze.*QUADRULA SYMMETRICA (*Wallich*), *F. E. Sch. (Pl. 12. figs. 18 & 19.)*

Leidy, pl. 24. figs. 20–24 and p. 144 (30).

This species is certainly very distinct from *Q. irregularis* (*vide* Penard, 39), and approaches the genus *Nebela* very closely, a relationship which is accentuated by a comparison with such species as *N. tropica* and *N. scutellata*.

Length 68–120 μ ; breadth 45–74 μ ; aperture 20–30 μ .

Distribution. Colorado (35); Massachusetts (17); New Hampshire (19); New Jersey! (30); New York! (20); Pennsylvania (30); British Columbia (39); Alaska.

Var. IRREGULARIS, *Penard*. (Pl. 12. fig. 20.)

Less common than type and below the normal size.

Length 140 μ or under.

Var. CURVATA, var. nov. (Pl. 12. fig. 21.)

Test as in the type, but curved as in *Cyphoderia*; aperture polygonal, formed by 6-7 plates.

Length 80-100 μ ; breadth 33-45 μ ; aperture 11-16 μ ; thickness 25-28 μ .

Distribution. Penney's Pond, Good Ground.

Several living, but no active individuals were seen; the amount of curvature of the test is subject to variation.

[Cockerell (12, 1911) records this genus as *Quadrulella*, the name *Quadrula* being preoccupied in another Philum.]

Genus HELEOPERA, *Leidy*.

HELEOPERA NODOSA, sp. nov. (Pl. 12. figs. 22-24.)

Heleopera petricola pars, *Leidy*, pl. 26. figs. 12, 15, 20.

Test large, elongate, slightly compressed, the ratio of the transverse axes being about 3:4; apex acute, terminated by a nodular mass of large quartz-grains; aperture bordered by slightly recurved lips; plasma and pseudopodia normal.

Length 152-213 μ ; breadth 80-94 μ ; thickness 60-75 μ ; aperture 45-60 μ in width.

Habitat. Submerged sphagnum.

Distribution. Lakehurst, New Jersey.

Leidy (fig. 12) illustrates an individual of this species broader in proportion to its length than any of those found at Lakehurst. *H. nodosa* is distinguished from *H. petricola* by its greater size, its elongate form, the acute apex bearing a nodular mass of sand-grains, and its less compression; it bears no resemblance to any other species of *Heleopera*. At Lakehurst, N.J., it is not uncommon.

H. SPHAGNI (*Leidy*), *Hopk.* (10).

Diffugia (*Nebela*) *sphagni*, *Leidy* (1874) (31).

Heleopera picta, *Leidy* (1879) (30), pl. 26. figs. 1-11,

This species is very numerous in the Lakehurst sphagnum. Dimensions:—Length 116–155 μ ; breadth 90–125 μ ; thickness about half the breadth.

Var. *LÆVIS*, var. nov.

Dimensions. Length 63–95 μ ; breadth 46–70 μ .

Habitat. Submerged sphagnum.

Distribution. Lakehurst, N.J.

This variety is distinguished from the type only by its small size, from *H. sordida* by its smooth test destitute of adherent particles. At Lakehurst it occurs plentifully in company with *H. sphagni*. Leidy does not give any illustration of this small variety.

H. PETRICOLA, *Leidy*.

Leidy, pl. 26. figs. 13, 14, 16–19 (30).

Abundant in sphagnum of a light brown colour; in lakes and ponds frequently colourless. Length 70–114 μ .

Var. *MAJOR*, *Cash* (10).

The larger individuals agree with Cash's description of this variety. Length 120–135 μ .

Var. *AMETHYSTEA*, *Penard*.

Not common, of normal size and colour.

H. ROSEA, *Penard*.

Not frequent except at Good Ground; the broader test and yellow lips as well as the rose colour differentiate it from the last species.

H. SORDIDA, *Penard* (37, 1910).

Not uncommon at Lakehurst and of normal size. Length 62–68 μ .

Genus *AWERINZEWIA*, *Schouteden*.

AWERINZEWIA CYCLOSTOMA (*Penard*), *Schout.*

This species is rare; in appearance it resembles *Heleopera petricola* var. *amethyستا*, but it is larger and has opaque white plates or grains incorporated with its violet-coloured test; the aperture, which is small and oval, is bordered by an internal thickening of the test. Length about 150 μ .

Distribution. Switzerland (36); Ireland (45); Ontario (39); Seychelles,

Genus EUGLYPHA, *Dujardin*.

The study of the American species of this genus has resulted in the addition of one new species and five new varieties, and a revision of the table of species published in the Clare Island Survey (45) is rendered necessary*.

DIVISION I. *Spines when present always modified scales. Transverse section circular (except E. bryophila) and aperture circular.*

		Length.
1. <i>E. aspera</i> , <i>Pen.</i>	Scutiform scales; rough test.	150-170 μ
2. <i>E. crenulata</i> , <i>sp. nov.</i>	Denticulated scutiform scales; spines.	115-140 μ
<i>Var. minor</i> , <i>var. nov.</i>	Do. do. ; glabrous or spined.	80-110 μ
3. <i>E. scutigera</i> , <i>Pen.</i>	Scutiform scales; glabrous.	77- 88 μ
4. <i>E. armata</i> , <i>Wailes</i>	Oval scales; spines around apex.	55-100 μ
5. <i>E. alveolata</i> , <i>Duj.</i>	Circular or oval scales; glabrous.	45-100 μ
<i>Var. minor</i> , <i>Taránek</i>	Do. do.	30- 45 μ
<i>Var. cirrata</i> , <i>var. nov.</i>	Short spines at apex.	65- 75 μ
6. <i>E. mucronata</i> , <i>Leidy</i>	Single or double spine at apex.	108-140 μ
7. <i>E. cristata</i> , <i>Leidy</i>	Spines in tuft at apex.	33- 71 μ
<i>Var. major</i> , <i>Wailes</i>	Glabrous.	60- 90 μ
<i>Var. acicularis</i> , <i>var. nov.</i>	Single or double spine at apex.	84- 94 μ
8. <i>E. brachiata</i> , <i>Leidy</i>	Lateral spines near aperture.	93-128 μ
<i>Var. librata</i> , <i>var. nov.</i>	Oar-shaped arms near middle of test.	100-104 μ
9. <i>E. bryophila</i> , <i>Brown</i>	Tuft of spines at apex; test slightly compressed.	35- 52 μ

DIVISION II. *Spines, when present, always articulated.*

Section A. *Test compressed, aperture circular.*

10. <i>E. filifera</i> , <i>Penard</i>	Long spines in single or double rows.	55- 93 μ
<i>Var. spinosa</i> , <i>var. nov.</i>	Spines scattered over test.	60- 90 μ
11. <i>E. strigosa</i> (<i>Ehrenb.</i>) <i>Leidy</i> , <i>f. glabra</i> & <i>heterospina</i> .	Thickened aperture-scales. Spines.	45-100 μ
<i>Var. muscorum</i> , <i>Wailes</i>	Test wider than type; scales smaller.	50- 80 μ
12. <i>E. rotunda</i> , <i>Wailes</i>	Thin aperture-scales; glabrous.	22- 52 μ

Section B. *Test compressed, aperture oval.*

13. <i>E. lævis</i> , <i>Perty</i>	Undenticulate aperture-scales; glabrous. (May have subcircular section and aperture.)	22- 55 μ
14. <i>E. ciliata</i> , <i>Ehrenb. spec.</i> , <i>f. glabra</i> & <i>heterospina</i> .	Thin denticulated aperture-scales; spines.	40- 90 μ
15. <i>E. compressa</i> , <i>Carter</i> , <i>f. glabra</i> .	Lenticular section; spines.	70-132 μ

* Instances are rare in which the identity of individuals of this genus is doubtful, provided the tests are in good condition and the specific characters can be clearly observed; tests slightly crushed (accidentally) are to be guarded against. Active individuals are the best for study, but in some species it may be necessary to isolate and treat them with sulphuric acid, first cold and dilute to dissolve the plasma, and then with concentrated acid and boiled to dryness to disintegrate the test into its elements.

EUGLYPHA ALVEOLATA, Duj.

Leidy, pl. 35. fig. 14 (30).

Under this name Leidy includes a whole group of species, and subsequent American workers have followed his classification and have generally failed to specify which of the various forms illustrated by Leidy they have found. In gatherings from over 40 counties in the British Isles no spined form of *E. alveolata* was seen by me, but in the United States a form occurs which is undoubtedly *E. alveolata*, and is furnished with one or two short scale-spines at or near the apex; the presence of these scale-spines shows that this species is a member of the group of *Euglyphæ* belonging to Division I. in the table, and is quite distinct from species that bear articulated spines. It may also be pointed out that it is only among the species belonging to Division I. that two rows of denticulated aperture-scales are present. The following is the description of *E. alveolata* :—

Test of medium size, elongate oviform; not compressed, glabrous. Body-scales circular to broadly oval. Aperture circular, bordered, generally, by two rows of finely denticulated scales, 8–12 in each row. Nucleus 10–15 μ diam., with a single nucleole. Pseudopodia few, long, and radiating.

Dimensions. Length 45–100 μ ; breadth about half the length; aperture 0.4 to 0.5 of the breadth.

Var. MINOR, *Tarínék* *.

Similar to the type but smaller. Length 30–45 μ .

The body-scales are oval; it is much less common than the type.

Var. CIRRATA, var. nov. (Pl. 12. figs. 25–27.)

E. alveolata pars, Leidy, pl. 35. figs. 5, 9 (30).

Test as in the type, but the fundus furnished with one or two short scale-spines; aperture usually bordered by two rows of denticulated scales. Nucleus and pseudopodia normal.

Length 60–75 μ ; diameter 0.46–0.5 length; aperture 13–14 μ ; spines 10–17 μ in length.

Distribution. Split Rock Lake, N.J.; Pennsylvania (*Leidy*).

In the United States the breadth of this variety, and also of the type, is generally less than half the length of the test, whereas in Europe it is generally more than equal to half the length. Two pairs of this variety were seen in conjunction, and in both cases the individuals of each pair were similar.

* Sitzungsab. böhm. Ges. der Wiss. 1881, p. 233 (1882).

EUGLYPHA BRACHIATA, *Leidy* (31). (Pl. 12. figs. 28 & 30.)

Leidy, pl. 37. figs. 5, 6, 8-10 (30).

This species has from two to six tapering spines arising from scales in one or more of the first three rows of scales adjoining the aperture: rarely, a second series is also present (*vide Leidy*, pl. 37. fig. 6); the distance between their origin and the aperture usually varies from 10-20 μ ; the spines are from 50-65 μ long and 2 μ in diameter at the base, tapering to a point. Those found by Penard at Vancouver (39) had the spines modified into flat ribbon-like appendages (fig. 30 *b*), and one found at Lakehurst also had the spines flattened to 3 μ wide and 1 μ thick with thickened extremities (figs. 30 *c*, *c'*).

Dimensions. Length 87-123 μ ; diameter 28-39 μ ; aperture 19-13 μ .

Habitat. Submerged sphagnum.

Distribution. New Jersey! (*Leidy*): Roan Mountains, Va. (*Leidy*, 30); Wales and Ireland (*G. S. West*, *J. Linn. Soc.*, Zool. xxviii. p. 328, 1901); British Columbia (*Penard*, 39).

Var. LIBRATA, var. nov. (Pl. 12. figs. 29 & 30 *a*.)

E. brachiata pars, *Leidy*, pl. 37. fig. 7 (30).

Test as in the type, but furnished with two to four lateral appendages arising from near the centre of the sides, their free ends widened into oar-like blades. Nucleus and pseudopodia normal.

Length 100-104 μ ; diameter 32-35 μ ; aperture 13 μ ; arms 35-38 μ long, 1 μ diameter, widening to 2.5 μ at the extremities.

Habitat. Submerged sphagnum.

Distribution. New Jersey! (*Leidy*): Roan Mountains, Va. (*Leidy*)?

Much less common than *E. brachiata*, of which at least twenty were seen for each one of var. *librata*; also less variable in size and number of arms, which generally consist of two only.

E. CRISTATA, *Leidy* (31).

Leidy, pl. 37. figs. 1-4 (30).

This species, found in moss and in lakes and ponds, varies between the following dimensions:—Length 34-70 μ ; breadth 12-24 μ ; aperture 5-9 μ . With an average size of:—Length 40-50 μ ; breadth 14-17 μ . Only one or two individuals above or below these limits were found; the tuft of spines at the apex is sometimes absent.

Var. MAJOR, *Wailes* (45). (Pl. 12. fig. 31.)

The test of this variety is generally larger than the type, less contracted towards the aperture, and usually devoid of spines. The plasma and pseudopodia are normal. Length 60-90 μ ; diameter 20-30 μ ; aperture 10-14 μ .

Distribution. Lakehurst, N.J. ; Long Island, N.Y. ; Scotland (Orkney Islands) (46) ; Ireland (Mayo) (45).

Those found at Lakehurst measured from 70–90 μ in length and are broader than the British variety ; those found at Good Ground, Long Island, were 60–70 μ in length and smaller than the British.

Var. ACICULARIS, var. nov.* (Pl. 12. figs. 32 & 33.)

Test larger than in the type, the fundus rather more acute and furnished with either one or two erect spines, which may be flexuous ; the spines when solitary often coinciding with the longitudinal axis of the test ; plasma and pseudopodia normal.

Length 84–94 μ ; diameter 23–24 μ ; aperture 12–14 μ ; spines 23–42 μ in length.

Habitat. Submerged sphagnum.

Distribution. Clare Island, Mayo ; Inishbofin, Galway ; Ireland (45) *.

The spines of *E. mucronata*, Leidy, originate in scales at the extreme apex of the test, which is prolonged into a sharp cone, whilst in the variety under consideration the scales furnishing the spines are below the apical scales and the flexure necessary in order to bring a spine coincident with the axis of the test is a little distance above its base.

EUGLYPHA CRENULATA, sp. nov. (Pl. 12. figs. 34–37.)

E. alveolata pars, Leidy, pl. 35. figs. 2, 3, 4, 15–18 (30).

Test large, not compressed, either elongate-oviform or with sides tapering from the hemispherical fundus in nearly straight lines to the aperture. Fundus furnished with 2–6 stout scale-spines arising at nearly equal distances from the apex. Aperture circular and bordered by two rows of finely denticulated scales, 12–14 in each row. The body-scales scutiform, with crenulated lower margins. Nucleus large, placed posteriorly ; pseudopodia normal.

Length 115–140 μ ; diameter 67–77 μ . Aperture 25–30 μ . Length of spines 20–50 μ . Body-scales 10–12 μ long. Nucleus about 35 μ in diameter.

Habitat. Submerged sphagnum, lakes, ponds, &c.

Distribution. New Jersey! (*Leidy*) ; New York State, Long Island ; Pennsylvania (*Leidy*).

Distinguishing features. Is distinguished from *E. scutigera* and *E. armata* by its crenulated scutiform body-scales and its greater size ; from *E. aspera* by its smooth test and usually smaller size.

Remarks. This species appears to be represented by Leidy, pl. 35. figs. 2, 3, 6, 15–18, but the lower margins of the scales are not shown even in fig. 18 ; the form represented by his fig. 3 is perhaps the most common, at any rate in

* The Roy. Irish Acad. Report No. 65 of the Clare Island Survey was in the press when this variety was found and its description could not be included in that paper (*op. cit.* pp. 40 and 62, notes).

some localities. These tests, when empty, are characterised by the peculiar optical effect of the small circles formed by the imbrication of the scales at their upper and lower edges; in living individuals the outlines of the scales are obscured from view by the plasma.

The form of the spines is subject to the same variation as in *E. armata*: they may be either (a) short and truncate, (b) short and pointed, (c) long and straight, or (d) long and flexuous; they are sometimes incurved. Tests destitute of spines are occasionally found.

Leidy, pl. 35. fig. 2, shows an individual $160\ \mu$ in length (none were seen by me over $140\ \mu$), but it may represent a double-sized encystment test.

Var. MINOR, var. nov. (Pl. 12. fig. 38.)

Test similar to type, but smaller and usually destitute of spines.

Length $80\text{--}110\ \mu$; breadth $45\text{--}64\ \mu$; aperture $16\text{--}20\ \mu$.

Habitat. Lakes and ponds.

Distribution. Split Rock Lake, N.J., and Long Island, N.Y.

Is usually glabrous, but when provided with spines only distinguished from *E. armata* by the shape of the body-scales.

The body-scales are somewhat different in shape from those of the type; they are shown in fig. 38. When incorporated in the tests of *Nebela collaris* and *N. equicalceus* they are displayed with perfect distinctness, and can be observed even better than when artificially isolated. These scales are generally $11\text{--}12\ \mu$ in length, but the width varies according to the position they occupy on the test, those centrally placed being the widest.

EUGLYPHA FILIFERA, Pen. (34).

E. ciliata pars, Leidy, pl. 36. figs. 7, 11-14; pl. 37. fig. 28.

The test of this species as found in Europe is oviform in shape, and the spines are distributed at regular intervals in a single row; the compression of the test is slight, the ratio of the transverse axes not exceeding 4:5. In the United States the following forms are found:—

- (a) Test similar to European type (Leidy, pl. 36. fig. 7).
- (b) The spines are duplicated and arranged in a double row or rarely irregularly (Leidy, pl. 36. figs. 11-13).
- (c) The test is constricted near the aperture and is more compressed, the ratio of the transverse axes being 2:3 (Leidy, pl. 36. fig. 14).
- (d) The test is of typical form but sparsely covered with scattered spines—
var. *spinosa*, var. nov.

The forms (a) and (b) occur at Lakehurst and at Good Ground, L.I. Dimensions: Length $73\text{--}93\ \mu$; breadth $30\text{--}42\ \mu$; aperture $10\text{--}15\ \mu$. Transverse section from subcircular to a ratio of axes of 4:5. Spines $20\text{--}30\ \mu$ long.

Form (c) is found at Good Ground, L.I. Dimensions: Length 48–58 μ ; breadth 24–29 μ ; aperture 7–10 μ ; thickness two-thirds of the breadth. Spines 18–26 μ long, arranged in a single row.

Var. SPINOSA, var. nov. (Pl. 12. fig. 39.)

? *E. ciliata* var. *strigosa* pars, Leidy, pl. 35. fig. 19 (30).

Test like type, but furnished with spines sparsely scattered over the surface of the test. Plasma and pseudopodia normal.

Length 60–90 μ ; breadth 26–40 μ ; aperture 10–15 μ ; thickness 0.8 to 0.9 μ . Spines 10–30 μ in length. Scales about 9.5 μ by 4.5 μ . Nucleus 12–14 μ in diameter.

Habitat. Submerged sphagnum.

Distribution. New Jersey; Alabama (*Leidy*).

Like the type, this variety is distinguished from *E. alveolata* and all other species included in Div. I. of the Table of *Euglypha* by having articulated spines; the slight compression of the test distinguishes it from other spine-bearing species included in Div. II.

E. MUCRONATA, *Leidy* (31, 1878).

Leidy, pl. 37. figs. 11–14 (30).

The individuals of this species recorded from Lakehurst (about half a dozen) agreed with Leidy's descriptions and illustrations; none were observed in a state of activity. The following additional details may be added to Leidy's account of this species:—The aperture-scales are bluntly rounded, each having three crenulations in relief, which form low rounded projections beyond the edge; the body-scales are oval, about 13 μ by 10 μ , becoming narrower towards the extremities of the test; the spines are continuations of the terminal scale or scales, which are fitted together with great exactness; just within the apex there may be a chitinous diaphragm; the spines are flattened, measuring 2 μ by 1.25 μ near the base, 12–23 μ in length.

Length 100–130 μ (*Leidy*, 108–140 μ); diameter 37–43 μ (*Leidy*, 32–44 μ); aperture 15–20 μ ; spines 12–23 μ (*Leidy*, 20–44 μ).

Distribution. New Jersey! (*Leidy*); Cape Horn (*Certes*).

E. STRIGOSA (*Ehrenb.*), *Leidy*.

E. ciliata var. *strigosa* pars, *Leidy*, pl. 35. fig. 20 (30).

In all the localities, as in Britain, this is the most numerous species; it did not exceed in size those found in Europe, namely 45–100 μ in length. Owing to Leidy as a rule showing only one view of the tests which he illustrates, fig. 20 is the only one of this species about which there is no reasonable doubt. The characteristic features are a compressed test with a circular aperture, generally bordered by thickened aperture-scales.

Var. MUSCORUM, *Wailes* (45).

E. ciliata pars, Leidy, pl. 36. fig. 18 (30).

This variety, recently described, is generally found in moss or dry sphagnum. It may be spined, as shown by Leidy, pl. 36. fig. 18, or may be glabrous; the width is greater in proportion to the length than in the type, and it is more compressed, but the aperture retains its circular shape; the body-scales are smaller.

Distribution. United States, Panama, Peru, Europe.

Genus PLACOCYSTA, *Leidy*.

PLACOCYSTA SPINOSA (*Carter*), *Leidy*.

Leidy, pl. 38. figs. 1-16 (30).

Often numerous in sphagnum from New Jersey. Length 115-163 μ ; breadth 80-120 μ ; aperture 50-80 μ ; spines 20-35 μ in length, varying from linear to lanceolate in form.

Var. SETIGERA, var. nov. (Pl. 12. fig. 40.)

Test slightly smaller than the type, but otherwise similar; furnished with numerous long acicular spines scattered near the edges and arising at the imbrications of the scales. Plasma and pseudopodia normal.

Length 125-135 μ ; breadth 75-85 μ ; aperture 55-65 μ ; spines 25-45 μ in length.

Habitat. Sphagnum.

The disposition of the spines varies: they may be confined to the borders of the test, or be spread over its surface until only the central portions are glabrous; none were found having the whole of the test covered with spines as in *P. jurassica*. Although larger than the smallest individuals of *P. spinosa*, the average size was decidedly less than that of the type.

Genus ASSULINA, *Ehrenberg*.

ASSULINA SEMINULUM, *Leidy*.

Leidy, pl. 37. figs. 18-25 (30).

Not plentiful. Length 80-85 μ .

A. MUSCORUM, *Greeff*.

A. minor, Penard (36).

A. seminulum pars, Leidy, pl. 37. figs. 15-17, 26 (30).

Numerous and generally distributed. Length 40-50 μ .

Leidy includes this species with the former, but the difference in size is usually sufficient to distinguish them.

Genus CYPHODERIA, *Schlumberger*.CYPHODERIA AMPULLA (*Ehrenb.*), *Schlumb.**C. margaritacea*, Schlumb.

Leidy, pl. 34, figs. 1-16 (30).

Small and rather scarce, found only in the lakes and larger ponds; it is found in the New York City water-supply.

Length 95-110 μ . Leidy gives the length as 110-200 μ ; in the British Isles the limits are 61-190 μ (45).

Distribution. North America. British Columbia (39), Colorado (35), Florida (30), Iowa (21), New Jersey (30), Michigan (41), New York (20), Nova Scotia (30), Pennsylvania (30), Rhode Island (30), Wyoming (30).

C. TROCHUS var. *AMPHORALIS*, *Wailes* (45).

Of similar form to the preceding, but the test is composed of imbricated plates instead of non-imbricated discs. Found in the same localities as the preceding; also in Long Island.

Length 110-120 μ . Limits in Britain, 87-153 μ (45).

A description and classification of this genus will be found in the Proc. Royal Irish Academy, 1911 (45), from which it will be seen that, in the absence of definite information as to the structure of the test (*i. e.* whether imbricated or not), drawings of individuals cannot be identified.

In the absence of this information some of Leidy's illustrations may represent *C. trochus* or one of its varieties; but taking for granted that all the tests are of the type shown in pl. 34, fig. 16 (30)—that is, are composed of round discs with a superficial hexagonal appearance—then figs. 5-8 represent *C. ampulla* var. *papillata*, Wailes (45), a variety which has been found in the Western States by Edmondson (private letter).

C. ampulla var. *major*, Pen., is also probably represented among Leidy's illustrations, but cannot be identified without details of the structure of the test (45).

Genus CAMPASCUS, *Leidy*.CAMPASCUS MINUTUS, *Penard*.

Occurs in the New York water-supply drawn from the Croton Lake Reservoir, which is situated about 30 miles north of the city.

This species has not been recorded previously from America. Length 64 μ ; diameter 30 μ ; aperture 10 μ .

Distribution. Switzerland (*Penard*); Loch Ness (*Penard*) and Hebrides, Scotland.

Genus TRINEMA, *Dujardin*.TRINEMA COMPLANATUM, *Pen.*

T. enchelys pars, Leidy, pl. 39. figs. 41, 47, 48, 61, 62, 63, 67, 68 (30).

Not uncommon, but generally of small size. Length 25–55 μ .

T. ENCHELYS, *Leidy*.

Leidy, pl. 39, pars (30).

Not numerous, and in some localities rare. Usually 40–70 μ in length, but a few individuals exceeded 100 μ (up to 105 μ). On pl. 39 Leidy depicts three species of *Trinema* and *Corythion dubium*, q. v.

T. LINEARE, *Penard*.

T. enchelys pars, Leidy, pl. 39. figs. 38, 43, 55–59, 65 (30).

Generally numerous. Length 20–32 μ .

Genus CORYTHION, *Taránek*.CORYTHION DUBIUM, *Taránek*.

T. enchelys pars, Leidy, pl. 39. figs. 12, 13 (30).

Generally distributed, but not very numerous.

Genus SPHENODERIA, *Schlumb.*SPHENODERIA DENTATA, *Penard*.

S. lenta pars, Leidy, pl. 34. fig. 40 (30).

Numerous and above the average size. Length 50–60 μ ; diameter 25–30 μ .

S. LENTA, *Schlumb.*

Leidy, pl. 34. figs. 25–39, 41 (30).

Generally distributed, and in some localities numerous. Length 29–64 μ ; breadth 17–50 μ ; aperture 7–24 μ .

S. MACROLEPIS, *Leidy* (30).

Rare, but widely distributed in sphagnum.

Length 30–32 μ .

Distribution. Malaga (*Leidy*); Lakehurst, N.J.; Long Island, N.Y.; British Isles (3) (45).

S. fissirostris, Pen., was not found and has not yet been recorded from America. Two of Leidy's illustrations (30. pl. 34. figs. 37, 38) may refer to this species, but seem rather to represent abnormal forms of *S. lenta*.

Genus AMPHITREMA, *Archer*.

Three species belonging to this genus are recorded from Lakehurst, N.J. None are numerous and all are of medium size. They have not been recorded previously from America.

AMPHITREMA FLAVUM (*Archer*), *Penard*.

Ditrema flavum, *Archer*.

Length 50–77 μ ; breadth 37–42 μ ; thickness 15–20 μ .

A. STENOSTOMA, *Nüsslin*.

Length 80 μ ; breadth 60 μ ; thickness 35 μ .

A. WRIGHTIANUM, *Archer*.

Length 50–63 μ ; breadth 30–56 μ ; thickness 15–30 μ .

HELIOZOA.

The four species recorded are not uncommon and are generally distributed.

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SUPPLEMENTAL NOTES ON FRESHWATER RHIZOPODA
FROM THE SEYCHELLES.

IN January 1912 I received from Sergt. Godley, Overseer of Crown Lands, a gathering of moss and some sediment from a pool, collected in Mahé at the beginning of December 1911. Mahé is of granite formation, and contains few pools or lakes in which aquatic vegetation flourishes. The following list consists principally of moss-inhabiting species; considering the restricted habitat the list is a fairly long one. Forty species and three varieties are here recorded, of which two varieties are now described for the first time, namely :—

Nebela gracilis var. *stomata*.

Nebela lageniformis var. *minor*.

Two recently described species, *Nebela scutellata* and *N. tropica*, occur fairly numerous, and, curiously, in both species circular discs are mingled with the square plates which usually form the sole constituents of the tests. The presence of these discs confirms the propriety of placing these two species among the *Nebelæ*.

Few of the species occurred numerous, and most of the individuals were below the average size.

Class SARCODINA.

Sub-Class RHIZOPODA.

Order AMŒBINA.

Family LOBOSA.

Genus AMŒBA.

AMŒBA VERRUCOSA, *Ehrenberg*.

Syn. *A. terricola*, Greeff.

Owing to the exceptional powers of this species in resisting desiccation it was possible to identify one or two individuals.

Order CONCHULINA.

Family ARCELLIDA.

Genus ARCELLA.

ARCELLA ARENARIA, *Greeff*.

Rare. Diameter 80–90 μ .

Genus AWERINZEWIA.

AWERINZEWIA CYCLOSTOMA (*Penard*), *Schouteden*.Syn. *Heleopera cyclostoma*, *Penard*.

Not common. It is very similar in size and appearance to *Heleopera petricola* var. *amethystea*, *Pen.*, but the aperture, instead of being linear and wide, is small and oval, and is surrounded by a more or less thickened internal border, the thickening taking place gradually on the inside of the test.

The test is noticeable for the opaque whitish plates scattered on a bright amethystine groundwork. The usual size is about $150\ \mu$ in length; those found here were rather small, measuring about $130\ \mu$ in length.

Genus CENTROPYXIS.

CENTROPYXIS ACCULEATA, *Stein*.

Of this usually numerous species only one individual was observed.

C. ARCELLOIDES, *Penard*.

Several seen, about $70\ \mu$ in diameter.

C. LÆVIGATA, *Penard*.

Not common. Diameter $80\text{--}120\ \mu$.

Genus DIFFLUGIA.

DIFFLUGIA ARCULA, *Leidy*.

Syn. *Trigonopyxis arcula* (*Leidy*), *Penard*, *q. v.*

D. CONSTRICTA, *Leidy*.

Numerous. Length $50\text{--}90\ \mu$.

D. OBLONGA, *Ehrenb.*

Syn. *D. pyriformis*, *Perty*.

Rare. Length $80\text{--}100\ \mu$.

D. PRISTIS, *Penard*.

Rare. Length $65\ \mu$.

Genus HELEOPERA.

HELEOPERA SORDIDA, *Penard*. (*Rev. Suisse Zool.* 1910.)

Below the average size, often with but few adherent particles on the crown of the test. Length $45\text{--}55\ \mu$.

HELEOPERA SYLVATICA, *Penard*.

Rare. Length $70\ \mu$.

Genus HYALOSPHENIA.

HYALOSPHENIA ELEGANS, *Leidy*.

Several seen. Length $80\text{--}85\ \mu$.

H. SUBFLAVA, *Cash*.

Many were abnormally short and broad. Length $45\text{--}65\ \mu$; breadth $30\text{--}45\ \mu$.

Genus LESQUERUSIA.

LESQUERUSIA MODESTA, *Rhumbler*.

This is a pond form. Several seen, all about $80\ \mu$ in length; $62\ \mu$ in breadth; aperture $21\ \mu$ in diameter.

Genus NEBELA.

NEBELA COLLARIS, *Leidy*.

Not common and below the usual size. Length $95\text{--}110\ \mu$.

N. GRACILIS, *Penard*. (Rev. Suisse Zool. 1910.)

Var. STOMATA, var. nov. (Pl. 12. figs. 41 & 42.)

This variety differs from the type in the possession of two evaginated pores, one on either side of the neck. Similar protuberances occur on other *Nebelæ*, i. e. *N. tuberosa* and *N. americana*. Individuals also occur here of a more slender form than shown in figs. 41 & 42, with a long, slender neck; they are below the average size, measuring about $90\ \mu$ in length.

Length $90\text{--}130\ \mu$; breadth about half the length or less; thickness two-thirds of the breadth; aperture oval, about $20\ \mu$ by $13\ \mu$, slightly notched in narrow view.

Distribution. Peru (l. $107\text{--}130\ \mu$); Long Island, U.S.A. (l. $100\text{--}116\ \mu$).

N. LAGENIFORMIS, *Penard*.

Rare but quite typical. Length $120\text{--}130\ \mu$.

Var. MINOR, var. nov.

A small form, which differs from the type in size only, is not uncommon; the individuals observed varied from $85\text{--}100\ \mu$ in length.

This variety is widely distributed, and is referred to in the report on the Rhizopoda of Clare Island *.

The torulose neck and usually larger size distinguish it from *N. tubulata*, Brown.

Length 77–100 μ .

Distribution. England *; Ireland *; Peru; Australia (*Penard*) †; Colorado, U.S.A.

NEBELA MILITARIS, *Penard*.

Not uncommon. Length 68–80 μ .

N. SCUTELLATA, *Wailes*. (Pl. 12. fig. 43.)

This species, first described in the present Journal, occurs here numerous but of rather small size: the tests, as also those of *N. tropica*, are remarkable for the presence of small circular discs, which are mingled with the rectangular plates, usually the sole constituents of the test; the discs vary in number from none to sixty or more in a single test, few tests having less than a dozen of them; the square plates measured from 6–7 μ in width; occasionally a few diatom frustules are also present. Several living individuals were seen, but none were active; the plasma was of the normal type and crowded with food-particles; the nucleus is small, about 7 μ in diameter, and contains several ill-defined nucleoles. No tests were found in which small covering-plates are present, such as occur in the United States.

Length 105–120 μ ; one abnormal individual measured, length 174 μ ; breadth 120 μ ; aperture 35 μ .

Distribution. United States.

N. TINCTA (*Leidy*), *Awerinzew*.

Rare. Length 100 μ .

N. TROPICA, *Wailes*. (*Vide* p. 140.) (Pl. 12. fig. 44.)

Not uncommon: as in the case of *N. scutella* the tests were remarkable for having numerous circular discs mingled with the quadrangular scales; in other respects they were quite typical. It is worthy of note that these two recently described species, which in other localities are characterised by the rectangular scales which form the tests, should in this locality occur in association, and both have circular discs mingled with the square scales.

Length 70–75 μ .

Distribution. Borneo; Peru.

* Wailes & Penard in Proc. Roy. Irish Acad. vol. xxxi. (1911). Clare Island Survey, pt. 65, pp. 48, 50, pl. 5. fig. 28 a, b (1911).

† Brit. Antarctic Exped., Biol. vol. i. pt. 6 (1911).

NEBELA TUBULATA, *Brown*. (Journ. Linn. Soc., Zool. xxxii. (1911), p. 79.)
Several were seen. Length about 60 μ .

N. TUBULOSA, *Penard*.

Not uncommon. Length 175 μ .

Genus PHRYGANELLA.

PHRYGANELLA HEMISPHERICA, *Penard*.

Numerous, but no living individuals were observed. Diameter 30–60 μ .

Genus PLAGIOPYXIS.

PLAGIOPYXIS LABIATA, *Penard*. (Brit. Antarctic Exped., Biol. vol. i. pt. 6 (1911).)

Several were seen. Certain forms of *Diffugia constricta* approach this species very closely in the form of the test; a study of active individuals is desirable for ascertaining the exact relationships of this species. Diameter 55–80 μ .

Genus QUADRULA.

QUADRULA SYMMETRICA, *F. E. Schulze*. (Pl. 12. fig. 45.)

All the observed tests were of an elongated type; the larger scales varied from 8–10 μ in breadth. Length 84–90 μ .

Genus TRIGONOPYXIS.

TRIGONOPYXIS ARCULA (*Leidy*), *Penard*.

Syn. *Diffugia arcula*, Leidy, Rhiz. North Amer. 1879.

Trigonopyxis arcula, Penard, Revue Suisse Zool. 1912.

Occurs numerously. This Rhizopod, which occupied an anomalous position among the *Diffugiae*, has been placed by Penard in a new genus. Diameter 80–135 μ ; aperture regularly trilobed.

Family EUGLYPHINA.

Genus ASSULINA.

ASSULINA MUSCORUM, *Greeff*.

Numerous. Length 40–45 μ .

Genus EUGLYPHA.

EUGLYPHA ALVEOLATA, *Dujardin*.

Rare. Length about 60 μ .

EUGLYPHA CILIATA, *Ehrenberg*.
Not rare. Length 60–70 μ .

E. COMPRESSA, *Carter*.
A few seen. Length about 70 μ .

E. CRISTATA, *Leidy*.
Not uncommon. Length 40–65 μ .

E. FILIFERA, *Penard*.
Rare. Length 65 μ .

E. LÆVIS, *Perty*.
Not uncommon. Length 22–40 μ .

E. ROTUNDA, *Wailes*. (Proc. Roy. Irish Acad. vol. xxxi. pt. 75 (1911).)
Only one seen ; length 55 μ .

E. STRIGOSA, *Leidy*.
Common. Length 60–70 μ .

Var. MUSCORUM, *Wailes*.
Of average size : length 70 μ ; breadth 50 μ ; aperture 22 μ .

Genus SPHENODERIA.

SPHENODERIA DENTATA, *Penard*.
Not common. Length 48–50 μ .

Genus TRINEMA.

TRINEMA COMPLANATUM, *Penard*.
Not common. Length about 40 μ .

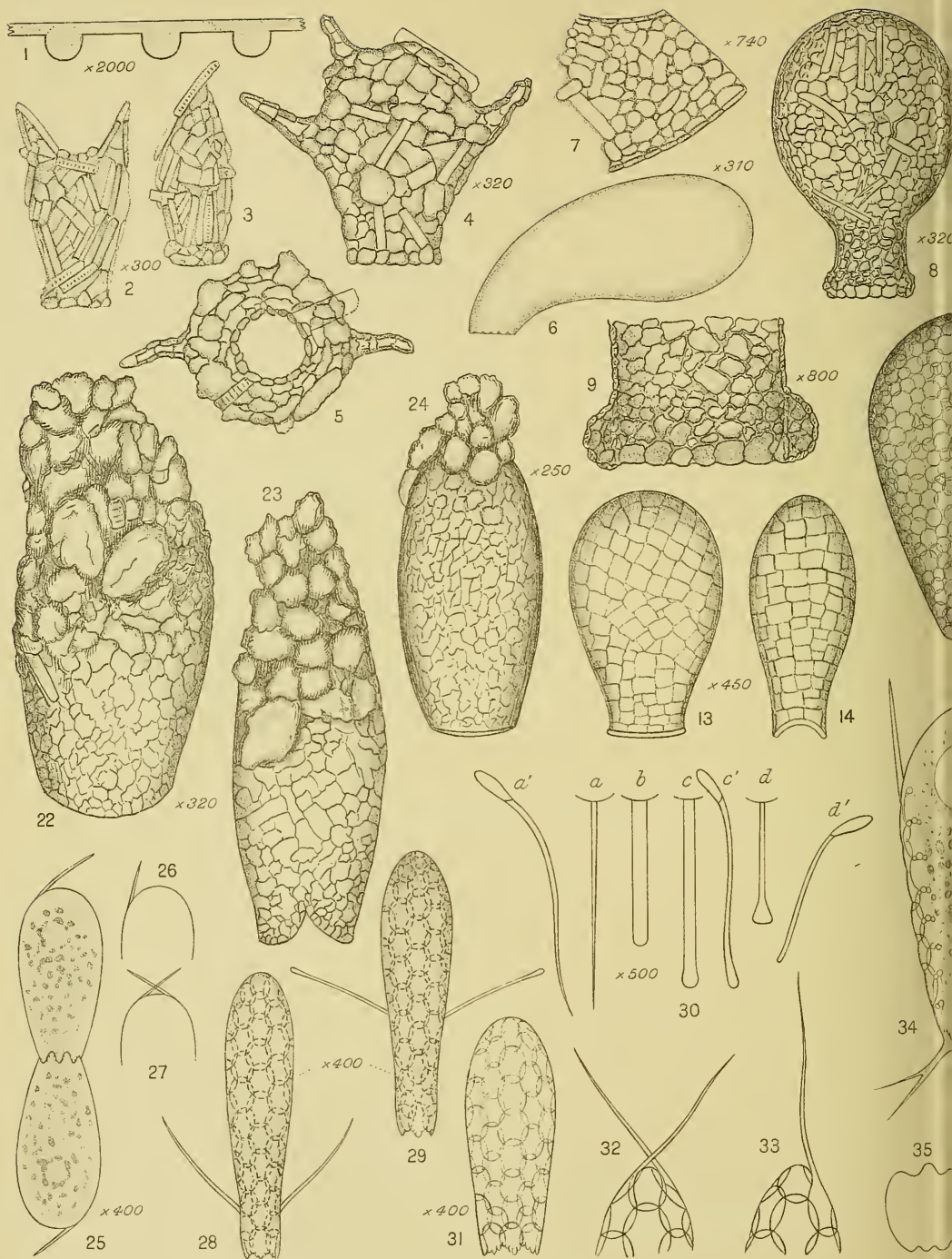
T. ENCHELYS, *Leidy*.
Rare. Length 35–70 μ .

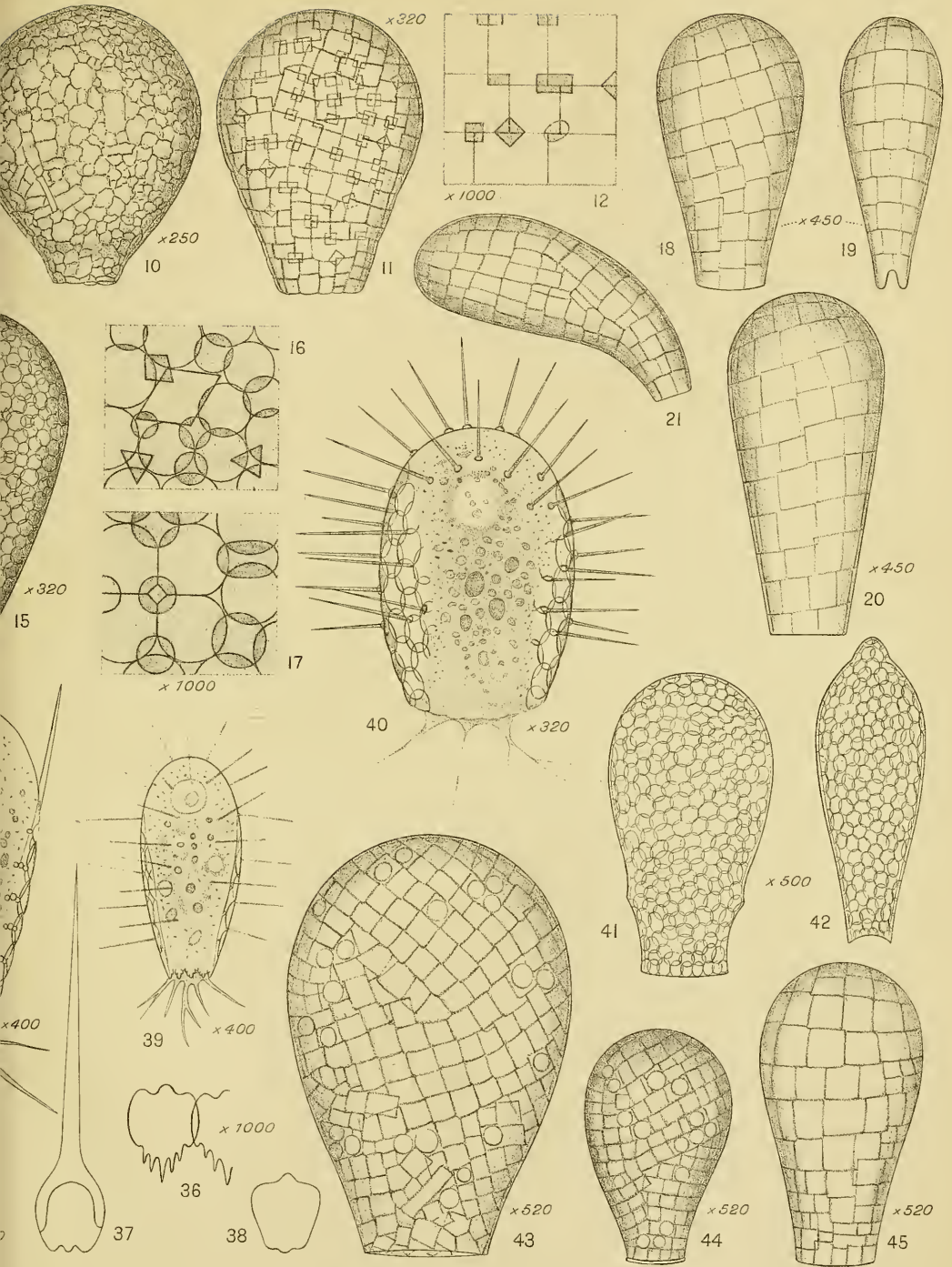
T. LINEARE, *Penard*.

Numerous but usually small : length 18–23 μ . A few abnormal individuals were observed, possessing long and narrow tests with large apertures : length 35–45 μ ; breadth 12–14 μ ; aperture 6–7 μ .

EXPLANATION OF PLATE 12.

- Fig. 1. *ARCELLA ARTOCREA*, Leidy. Section of a test through the pores around the aperture, showing nodules projecting internally; $\times 2000$. Lakehurst.
- 2, 3. *DIFFLUGIA BACILLIARUM* var. *ELEGANS* (Pen.), Cash; $\times 300$. 2, Broad, and 3, narrow, side views of test. Lakehurst.
- 4, 5. *DIFFLUGIA LEIDYI*, sp. nov.; $\times 320$. 4, Side view; 5, oral view. Lakehurst.
- 6, 7. *NEBELA COLLARIS* var. *RETORTA*, Leidy. 6, Test, $\times 310$; 7, aperture, $\times 740$. Penney's Pond, Good Ground, Long Island.
- 8, 9. *NEBELA CRATERA*, sp. nov. 8, Test, $\times 300$; 9, aperture, $\times 800$. Lakehurst.
10. *NEBELA DENTISTOMA* var. *LACUSTRIS*, var. nov.; $\times 250$. Lakehurst.
- 11, 12. *NEBELA SCUTELLATA*, sp. nov. 11, Broad view of test, $\times 320$; 12, portion of test, $\times 1000$. Lakehurst.
- 13, 14. *NEBELA TROPICA*, sp. nov.; $\times 450$. 13, Broad, 14, narrow, side views of test. Borneo.
- 15-17. *NEBELA VITRÆA*, Penard. 15, Broad side view of test, $\times 320$; 16, 17, portions of test, $\times 1000$. Lakehurst.
- 18, 19. *QUADRULA SYMMETRICA* (Wallich), F. E. Schulze; $\times 450$. 18, Broad, 19, narrow, side views of test. New Jersey.
20. Do. do. var. *IRREGULARIS*, Pen.; $\times 450$. Good Ground, Long Island.
21. Do. do. var. *CURVATA*, var. nov.; $\times 450$. Penney's Pond, Good Ground, Long Island.
- 22, 23. *HELEOPERA NODOSA*, sp. nov.; $\times 320$. 22, Broad, and 23, narrow, side views. Lakehurst.
24. Do. do. $\times 250$. Broad side view of test. Lakehurst.
- 25-27. *EUGLYPHA ALVEOLATA* var. *CIBRATA*, var. nov. 25, Two individuals in conjunction; 26, 27, apices, showing varieties of spines, $\times 400$. Split Rock Lake, New Jersey.
28. *EUGLYPHA BRACHIATA*, Leidy; $\times 400$. Lakehurst.
29. Do. do. var. *LIBRATA*, var. nov.; $\times 400$. Lakehurst.
30. Do. do. *a, a'*. Spine as seen from side and end views of a test; *b*. End view of a spine from Vancouver, British Columbia (after Penard, 39); *c, c'*. Intermediate form of spine.
- Do. do. var. *LIBRATA*. *d, d'*. Two views of a spine. Lakehurst. All $\times 500$.
31. *EUGLYPHA CRISTATA* var. *MAJOR*, Wailes; $\times 400$. Lakehurst.
- 32, 33. Do. do. var. *ACICULARIS*, var. nov. Apices and varieties of spines; $\times 700$. Inishbofin, Ireland.
- 34-37. *EUGLYPHA CRENULATA*, sp. nov. 34, Active individual, $\times 400$; 35, body-scale; 36, aperture-scale; 37, spine-scale. 000. Augusta, Georgia.
38. Do. do. var. *MINOR*, var. nov. Body-scale; $\times 1000$.
39. *EUGLYPHA FILIFERA* var. *SPINOSA*, var. nov.; $\times 320$. Broad view of active individual. Lakehurst.
40. *PLACOCYSTA SPINOSA* var. *SETIGERA*, var. nov.; $\times 320$.
- 41, 42. *NEBELA GRACILIS* var. *STOMATA*, var. nov. 41, Broad, and 42, narrow, views of test. Seychelles.
43. *NEBELA SCUTELLATA*, sp. nov.; $\times 520$. Seychelles.
44. *NEBELA TROPICA*, sp. nov.; $\times 520$. Seychelles.
45. *QUADRULA SYMMETRICA* (Wallich), F. E. Schulze; $\times 520$. Seychelles.





West, Newman lith.

