

# SOME NEW MYXOPHYCEAE FROM SZECHWAN PROVINCE, CHINA

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During a ten-year period (1937-1946) of collecting algae in the mountainous Szechwan Province of China, the writer secured several new species of *Myxophyceae*. Six of these were collected from Mt. Omei in August, 1942, and have already been described (Chu, 1944). Additional collections from different localities in the province have brought to light other apparently undescribed *Myxophyceae*. In this paper one genus, five species and two varieties are considered as new to science; two species have been placed in a genus other than the one in which they were originally described. They all belong to the phylum *Myxophyta*, class *Myxophyceae*, order *Chroococcales*; the first six described in the paper are in the family *Chroococcaceae* and the remaining three in the *Entophysalidaceae*.

## 1. *Chroococcus limneticus* Lemm. var. *multicellularis* Chu var. nov.

Figures 5, 6

Cellulae sphaericae ad semisphaericae, 4-128 vel plures in communi involucreo gelatinoso, spherico, pyramidalis quadratove; vagina lata, non lamellata, 4-8-16 cellulae plerumque confertae et in latiore vagina gelatinosa, globosa, cineracea subpurpureave inclusae; 8-16 coloniae vicissim in matris vagina gelatinosa inclusae; cellulae 5-9 $\mu$  diam., intus pallide aut nitide caeruleo-virides, homogeneae.

Cells spherical to semispherical, 4-128 or more in a common spherical, pyramidal or quadrate gelatinous envelope; sheath wide, not lamellated, 4-8-16 cells generally lying close together and enclosed in a wider ball-shaped pale-gray or pale-purple gelatinous sheath; 8-16 colonies in turn enclosed in the mother gelatinous envelope; cells 5-9 $\mu$  in diameter; cell contents pale to bright green, homogeneous.

The chief distinctive characteristics of this variety are: (1) the special colonial sheath of each small group of cells in the mother colony is more or less distinct and (2) numerous small colonies are enclosed in the original sheath.

This alga was found in a stony pool at the bank of a rapid stream, Helungkiang, in Omei-Shan, Szechwan. The plant was attached to leaves and stems of hydrophytic macrophytes. Collection date: Aug. 28, 1941.

## 2. *Gloeothece fusco-lutea* Naeg. var. *unilamellaris* Chu var. nov.

Figure 4

Cellulae vagina primaria unilamellari tectae, vagina secundaria typicae plantae (*G. fusco-lutea*) carente; cellulae cylindricae, plus minusve oliveformes, extrematibus subrotundatis, 4.0-6.5 x 5.2-7.2 $\mu$  sine vagina, 4.6-6.8 x 7.2-8.0 $\mu$  cum vagina, intus pallide caeruleo-virides.

Cells covered by a single-layered primary sheath, no secondary sheath as in the species proper; cells cylindrical, more or less olive-shaped with slightly rounded ends, 4.0-6.5 x 5.2-7.2 $\mu$  without sheath, 4.6-6.8 x 7.2-8.0 $\mu$  with sheath; cell contents pale blue-green.

This variety differs from the type species in two ways: (1) rounded ends and wider dimensions of cells and (2) one-layered sheath. Collected on wet stones submerged in a rapid stream on Mt. Kingfu, Szechwan, Aug. 24, 1944.

## 3. *Aphanothece lemnae* Chu sp. nov.

Figure 7

Planta endophytica in spatiis intercellularibus *Lemnae* sp. (*L. trisulca*?); massa plantae spherica ovatave, involucreo gelatinoso lato, incolorato, 68-80 $\mu$  (interdum usque ad 160 $\mu$ ) diam. inclusa; cellulae oblongae cylindricave, extrematibus rotundatis, plerumque binae vel quaternae (aut interdum singulae), ab aliis intra vaginam coloniae aliquantum remotae; cellulae 3.2-4.4

x 4.2–6.8 $\mu$ ; vagina singula omnino confluens, raro apparens; cellulae intus homogeneae, pallide caeruleo-virides.

Plants endophytic in intercellular spaces of species of *Lemna* (*L. trisulca*?); plant mass spherical or ovoid, enclosed in a wide colorless, gelatinous envelope, 68–80 $\mu$  (occasionally up to 160 $\mu$ ) in diameter; cells oblong or cylindrical with rounded ends, generally in groups of two or four (or sometimes solitary), separated a considerable distance from other groups of cells inside the colonial sheath; cells 3.2–4.4 x 4.2–6.8 $\mu$ ; individual sheath completely confluent or very occasionally present; cell contents homogeneous, pale blue-green.

This species differs from *A. nidulans* Richt. v. *endophytica* W. & G. S. West by its larger size and the ordinary two- or four-celled groups separated from other groups at considerable distances. It also differs from *Gloeocapsa magma* (Breb.) Kuetz. in its endophytic habit, its colorless sheath, the small size of its cells and the complete confluence of its individual sheaths. Collected in an artificial pond in Chengtu, in early August of 1940.

#### *Asterocapsa* Chu gen. nov.

Massa plantae grumosa, gelatinosa, olivaceo-viridis, flava ad lutean aut pallide caerulea; cellulae sphaericae oblongave, 2–4–8–16 vel plures in involucro crasso, vaginato, lamellato aut non lamellato, non confluentem; inclusae vaginae coloniae crassissima, rigida, lamellas confluentes in involucri margine habens, incolorata aut flava aut punicea, plerumque adulta fuscenscens; superficies vaginae cellularum singularum atque involucri coloniae projectionibus verruciformibus, brevis longisve, minutis crassisve, perfusa; cellulae intus homogeneae aut minute granulatae (pseudovacuae?), olivaceo-virides, nitide caeruleo-virides aut fusco-virides, in 2–3 plana divisae.

Multiplicatio per divisionem vegetativam aut per fragmentationem coloniae, necnon per aplanosporas facta.

Plant mass grumose, gelatinous, olive-green, yellow to golden brown or light blue; cells spherical or oblong, 2–4–8–16 or more cells enclosed in the thick-sheathed envelope, lamellated or not, not confluent; colonial sheath very thick, stiff, with confluent lamellae at the margin of the envelope; sheath colorless, yellow or pink, becoming mostly yellowish brown with age; surface of sheath of both individual cells and the colonial envelope covered by short or long, minute or stout wart-like projections; cell contents homogeneous, or finely granulated (pseudovacuaes?), olive-green, bright blue-green or brownish green; cell division in two or three planes. Multiplication by vegetative division or fragmentation of the colony; aplanospores present.

Members of this genus differ from the related genus *Gloeocapsa* chiefly by the wart-like projections on both individual cell-sheath and colonial envelope, by the spherical shape of the mature colonies and by the non-confluent lamellae of the individual cells. Three species of this new genus have been found in the mountainous regions of Szechwan. The type species is designated as *Asterocapsa gloeotheciformis* Chu.

#### KEY TO THE SPECIES

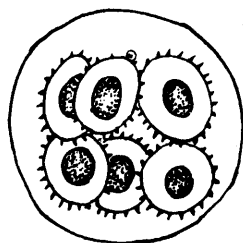
- |   |                            |
|---|----------------------------|
| 1. Cells oblong.....                                    | <i>A. gloeotheciformis</i> |
| 1. Cells spherical.....                                 | 2                          |
| 2. Cells 2.5–3.6 $\mu$ in diameter, without sheath..... | <i>A. hyalina</i>          |
| 2. Cells 10–13 $\mu$ in diameter, without sheath.....   | <i>A. trochiscioides</i>   |

#### 4. *Asterocapsa gloeotheciformis* Chu sp. nov.

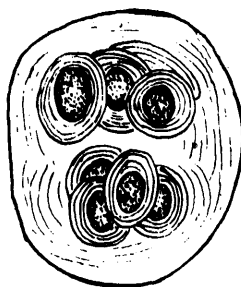
Figures 8, 9

Massa, plantae grumosa, crustacea, gelatinosa, olivaceo-virides; cellulae binae, quaternae vel octonae in vagina lata, incolorata puniceave, lamellata inclusae; coloniae paucae aut multae vicissim matris involucri gelatinoso, pallide subflavo, spherico oblongove, marginaliter confluentem tectae; cellulae oblongae, aut per compressionem mutam angulatae; projectiones verruciformes in vaginae superficie breves, basibus latioribus, numerosae, per omnem superficiem involucri fere perfusae; cellulae 7–9 x 12–16 $\mu$ ; coloniae 70–250 $\mu$  diam.; cellulae intus homogeneae aut minute granulatae (pseudovacuae?), caeruleo-virides.

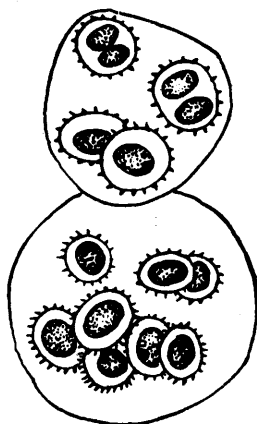
Plant mass grumose, crustaceous, gelatinous, olive-green; cells 2–4–8 in groups enclosed in a wide colorless or pinkish lamellated sheath; few to many small colonies in turn covered by a very wide, pale yellowish gelatinous envelope, spherical or oblong, or angled under mutual compression;



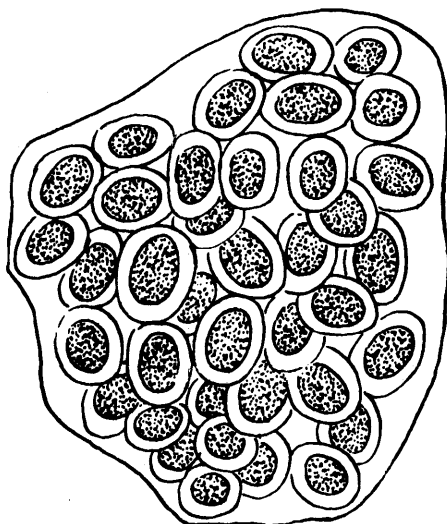
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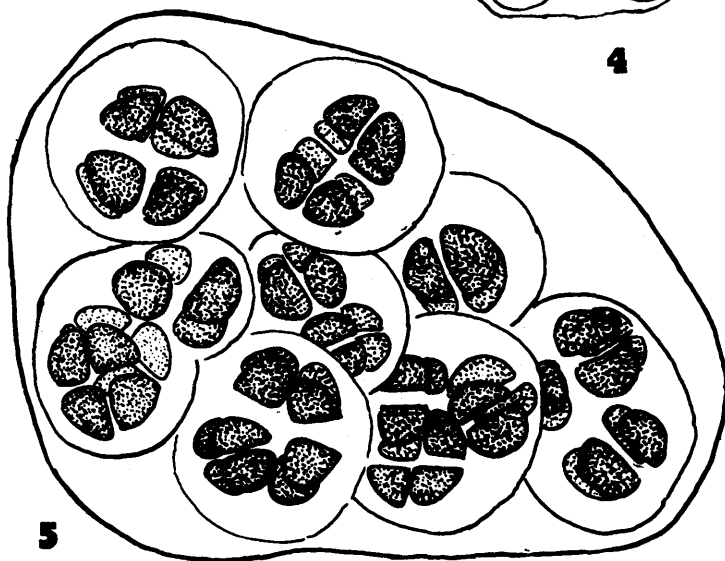
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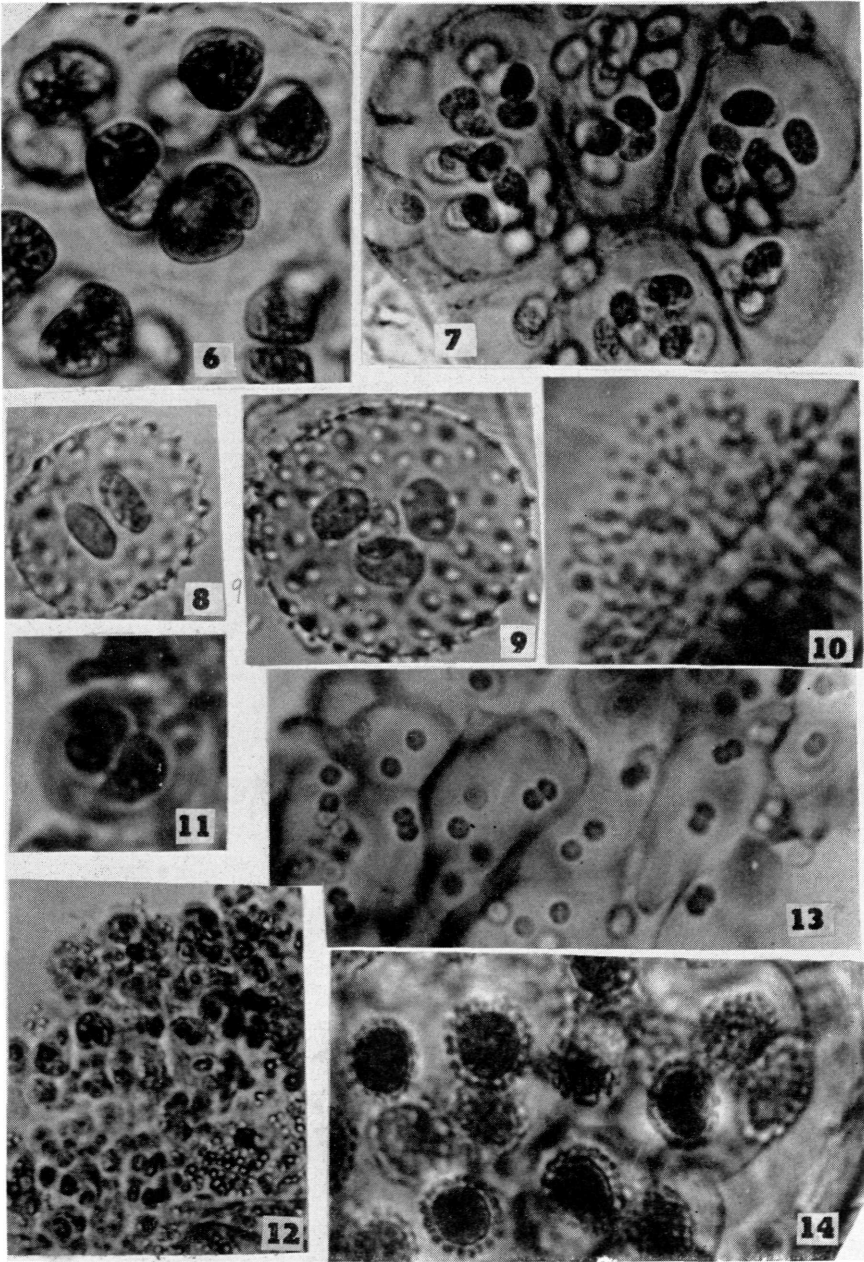
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4



5



EXPLANATION OF FIGURES IN PLATES I AND II

- 1-3. *Asterocapsa hyalina* (Chu) Chu comb. nov.
4. *Gloeothece fusco-lutea* Naegeli var. *unilamellaris* Chu var. nov.
- 5, 6. *Chroococcus limneticus* Lemmermann var. *multicellularis* Chu var. nov.
7. *Aphanothece lemnae* Chu sp. nov. Colony inside host tissue in intercellular spaces.
- 8, 9. *Asterocapsa gloeotheceformis* Chu sp. nov. (8) two-celled colony, (9) surface view of four-celled colony showing wart-like projections.
10. *Chlorogloea sinensis* Chu sp. nov. A cluster of the thallus.
- 11, 12. *Cyanostylon sinensis* Chu sp. nov. (11) cells with stalks, (12) habit sketch.
13. *Entophysalis robusta* Chu sp. nov. Part of colony showing arrangement of branches.
14. *Asterocapsa trochiscioides* (Jao) Chu comb. nov. Small part of a large colony.

wart-like projections on the surface of the sheath soft, short, with widened bases, numerous, and nearly covering the whole surface of the envelope; cells 7-9 x 12-16 $\mu$ ; colonies 70-250 $\mu$  in diameter; cell contents homogeneous or finely granulated (pseudovacuoles?), blue-green.

This alga was found on wet surfaces of caves and rocks and cliffs under dripping water at an altitude between 2000 and 3500 meters in Mt. Omei and Mt. Kingfu.

5. *Asterocapsa hyalina* (Chu) Chu comb. nov.

Figures 1, 2, 3

*Anacystis hyalina* Chu. Sinensia 15: 153-158. 1944.

This alga was collected from wet rocks, cliffs, under dripping waters of old caves and falls, at altitudes of 1000-2500 meters in mountainous regions of the Province. It is generally mixed with other Chroococaceae and with species of *Nostoc*, *Scytonema*, *Stigonema* and others. It is smaller than either of the other two species of the genus.

6. *Asterocapsa trochiscioides* (Jao) Chu comb. nov.

Figure 14

*Anacystis trochiscioides* Jao. Sinensia 15: 1-32. 1944.

This species grows on wet rocks of caves, and rocks and cliffs under dripping water at altitudes of 1000-3000 meters in the mountainous southwestern and southeastern parts of Szechwan. It is very wide-spread, distributed from Kwangsi Province northward through Kweichow to Szechwan and perhaps also westward to Yunnan Province.

It is felt that the last two species have characteristics that associate them with the newly described genus *Asterocapsa*. They are therefore removed from their doubtful assignment to the genus *Anacystis*.

7. *Cyanostylon sinensis* Chu sp. nov.

Figures 11, 12

Massa plantae crustacea, grumosa, mollis, caeruleo-viridis; cellulae sphaericae, hemisphaericae, oblongae aut ellipsoideae, in cacuminibus cauliculorum gelatinosorum, brevium, crassorum, incoloratorum sitae, 2.5-6.8 $\mu$  diam., singulae binaeve, aut (forsan modo post divisionem?) ternae vel quaternae; vagina incolorata aut aliquantulum cinerea, perspicue aut inperspicue lamellata; lamellae firmae, vix aut haud confluentes, 2-3 strata circum omnem cellulam formantes; cum duae, tres vel quattuor cellulae cacumini uni adsunt, in vagina communi, unum vel duo strata habente, includuntur; cauliculus cylindricus, pyriformis aut irregularis, lamellas inperspicuas.

Plant mass crustaceous, grumose, soft, blue-green; cells spherical, hemispherical, oblong, ellipsoid, situated at the tips of short, stout, colorless gelatinous stalks, 2.5-6.8 $\mu$  in diameter; unicellular or in groups of two, three or four, the latter two cases perhaps just after division; sheath colorless or slightly pale green, distinctly or indistinctly lamellated; lamellae firm, non-confluent, or somewhat confluent forming two to three layers around each cell; if two, three or four cells are present on the same tip, they are enclosed by a common one or two-layered sheath; stalk cylindrical, pyriform or irregular, with indistinct lamellae; cell contents homogeneous or granulated, brownish olive-green or bright blue-green.

This species grows on wet rocks under dripping water and on rocks submerged in artificial ponds in Omei-shan at an altitude of about 1200 meters. Collected in August, 1941.

8. *Entophysalis robusta* Chu sp. nov.

Figure 13

Massa plantae grumosa, crustacea, rubro-brunnea aut purpureo-brunnea; usque ad 250-400 $\mu$  diam.; cellulae sphaericae, plerumque binae vel quaternae, interdum singulae; vagina crassa, rubro-purpurea aut rubra, non lamellata; pseudofilamenta brevia crassaque; cellulae 3.5-4.5 $\mu$  diam., sine vagina, intus homogeneae aut tenuiter granulatae, maxime caeruleo-virides; vagina coloratae 6.8-8.0 $\mu$  diam.

Plant mass grumose, crustaceous, reddish brown to purplish brown, up to 250-400  $\mu$  in diameter; cells spherical, generally two or four cells in a group, sometimes unicellular; sheath thick, reddish purple or red, non-lamellated; pseudofilaments short, stout, with cells 3.5-4.5 $\mu$  in

diameter, without sheath; cell contents homogeneous or finely granulated, deep blue-green; colonial sheath 6.8–8.0 $\mu$  in thickness.

This alga was found on wet rocks mixed with *Gloeocapsa*, *Chroococcus*, *Schizothrix* and other blue-green algae at the entrances to deep caves, Kingfu-shan, Nanzechwan, in August, 1946.

#### 9. *Chlorogloea sinensis* Chu sp. nov.

Figure 10

Massa plantae epiphytica, gelatinosa, hemispherica aut lamelliformis, usque ad 25–40 x 50–80 (–100) $\mu$ ; coloniae vagina gelatinosa, delicatula, dissolvente tectae; vagina cellulae deest; cellulae a basali parte thalli radiatim ordinatae, ordinibus parte in superiore interdum dichotome ramosis; cellulae sphaericae, oblongae aut ellipsoideae, 1.2–2.2 $\mu$  diam., intus olivaceo-virides aut pallide caeruleo-virides, homogeneae.

Plant mass epiphytic, gelatinous, hemispherical or plate-like, up to 25–40 x 50–80 (–100) $\mu$ ; colonies covered by a delicate, dissolving gelatinous sheath; individual sheath wanting; cells arranged radially from the basal part of the thallus, sometimes dichotomously branched at the upper part; cells spherical, oblong or ellipsoid, 1.2–2.2 $\mu$  in diameter; cell contents olive-green, pale blue-green, homogeneous.

This new member of the entophysalidacean blue-green algae somewhat resembles *C. tuberculosa* (Hansg.) Wille. The new species differs, however, in the size of the plant mass, in having distinctly dichotomous branches (especially at the tip), and in its freshwater habitat. It was found growing epiphytically on *Chantransia*, mixed with *Dermocarpa*, *Chamaesiphon* and diatoms; the host plant was attached to rocks of an artificial dam—"Flower Stream"—in South-Hot-Spring Park, Chungking, in December, 1944.

The writer wishes to express his gratitude to Dr. Hannah Croasdale for her kindness in supplying the Latin translations of the diagnoses.

#### LITERATURE CITED

- Chu, H. J. 1944. Some new Myxophyceae from Omei, Western Szechwan. *Sinensia*, 15: 153–158.
- Jao, C. C. 1944. New Myxophyceae from Kwangsi. *Sinensia*, 15: 1–32.
- Geitler, L. 1927. Neue Blaualgen aus Lunz. *Arch. Protistenk.*, 60: 440–448.
- Geitler, L. 1932. Cyanophyceae in Rabenhorst's *Kryptogamenfl.* 14: 1–312. Leipzig.