Studies on the Asiatic Charophyta III.*

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今堀宏三：東亞輪藻類小記 III

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§ Two species of *Nitella* which produce an accessory fertile branch at the first furcation of branchlet.

So far as the investigation made by the author is concerned, *Nitella microcarpa* from Surinam and *N. flagellifera* from Saharanpur only have these proliferous character, i.e. the production of fertile branches at the furcations of branchlets. Recently, he has collected two kinds of plants with outstanding character and discovered that one of them is *N. flagellifera* which has been the endemic to India and the other is a new species which he calls *Nitella Tuyamae*.

Nitella flagellifera Groves & Allen in Journ. Bot., 65, 1927, p. 337; G. O. Allen in Journ. Ind. Bot. Soc. 7, 1928, p. 59, pl. 4; Zaneveld in Blumea 4, 1940, p. 81.

Plants monoecious, green to dark green, 20~30 cm high. Stem moderately stout, 300~500 μ in diameter; internodes in the lower parts 2~3-times and in the upper parts as long as the branchlets. Fertile and sterile branchlets similar, 3-times furcate; dactyls uniformly bicellular, elongated. Occasionally an accessory fertile branch which furcate 2~3-times, produced at the first furcation of branchlets. ♀ and ♂ gametangia produced together at the second and third furcations, not at the first. Antheridia terminal, 230~250 μ in diameter. Oogonia solitary, 500~600 μ long by 400 μ broad, with 9 spiral convolutions. Oospores brown to dark brown, 300~330 μ long, 250~300 μ broad with 6 ridges; membrane reticulate.

Nom. Jap.: Chinpin-hurasumo.

Hab.: in ponds, pH. 6.8.

Loc.: in Honshu—Prov. Noto; Tokuda, Nanao City, Sept. 10, 1948, K. I. No. 1013—Prov. Ettyu; Hukumitsu-cho, Tonami-gun, Aug. 8, 1948, K. I. No. 611—Prov. Yamashiro; Kyoto, Aug. 20, 1948, K. I. No. 611—Prov. Yamashiro; Kyoto, Aug. 20, 1948, leg. K. Kubota, K. I. No. 601.

Distr.: Asia (India—Gangetic Plain), new to Japan.

It is the most remarkable characteristic of *Nitella flagellifera* that it has accessory branches which are very small and produced at the first furcation. These accessory branches are found in only a few species, viz. *Nitella microcarpa* and *N.*

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Tuyamae. But the present species differs from these by the elongated and bicellular dactyls, rather large oogonia and oospores, and reticulate oospore-membrane.

Since Dr. G. O. Allen first described this species in India, no one has been able to collect the plant of this species. It is very interesting that such uncommon and rare specimens were detected in several ponds in the far distant district, 37°N, Japan.

Fig. 3. Accessory branches. (1 & 2, *Nitella flagellifera* Gr. et All. 3 & 4, *Nitella Tuyamae* Imah.)

1. Fertile branchlet, with an accessory branch at the primary furcation, $\times 3$.
2. Accessory branch, enlarged, $\times 15$.
3. Accessory branch, produced at the base of a whorl of branchlets, $\times 30$.
4. Accessory branch produced at the first furcation of a branchlet, $\times 30$.

Nitella Tuyamae Imahori sp. nov.

Planta monoecia, 10~20 cm alta, claro-viridis, diaphana. Caulis tenuis, 260~300 μ crassus; internodia quam ramuli 1~3-plo longiora. Verticilli fertiles et steriles similes, 3~4 tim furcati; radii primarii fere dimidium longitudinis totius ramulorum attingentes, 120~140 μ crassus; radii secundarii 6~7; radii tertii 4~5; radii quaternii 2~3, quorum 1 saepe iterum in radiis 2~4-quintis furcati; dactyli 2~4, semper 2-cellulati, cellula ultima 40~80 μ longa et basi 16~22 μ lata. Verticilli

superioribus et ad nodum primum frequenter ramulos accessores et fertiles portantes; ramuli accessori parva, ad basi verticillorum 7~8 aggregata, ad nodum primum solitari; radii primarii $1/3 \sim 1/4$ totius longitudinis ramulis; radii secundarii 3~4; radii terti 2~3; dactyli 2-cellulati.

♀ et ♂ gametangia ad nodos secundarii et tertii ramulorum ordinariarum, et ad omnibus nodos ramulorum accessoriarum, plerumque solitaria. Antheridia $200 \sim 220 \mu$ diametro, brevistipitata. Oogonia $500 \sim 530 \mu$ longa et $300 \sim 330 \mu$ lata, cellulis spiralibus 8; coronula parva, 15μ alta et basi 50μ lata. Oospora brunnea, $280 \sim 300 \mu$ longa et $250 \sim 280 \mu$ lata; striis alatis 7; membrana dense granulata.

Nom. Jap.: Tuyama-hurasumo.

Hab.: in ponds, pH 8.0, growing with *Nitella Saitoiana*.

Loc.: in Honshu—Prov. Inaba; Hase, Yamato-mura, Aug. 23, 1951, K. I. No. 838.

Distr.: endemic to Japan.

The most remarkable characteristic of this species is the accessory branchlets, which are produced not only at the base of whorls but also at the first furcations of the branchlets, and by this characteristic the present species is easily distinguishable from the all other resembling species which belong to the section "*Heteroclemae*". The new name is chosen to express the author's thanks to Dr. T. Tuyama, who gave me kind advice and criticism.

§ On the species "*Nitella laxa* T. F. Allen".

Dr. T. F. Allen established *Nitella laxa* as an independent species. He distinguished *N. laxa* from *N. flexilis* only by the larger habit and grumous membrane of oospores of the former. But the decoration of oospore membrane shows no difference between these plants, because, though those membrane of *Nitella flexilis* seem quite smooth, the outer opaque layer conceals the inner grumous layer. Consequently, there is no doubt that *N. laxa* must be identified with *N. flexilis* var. *longifolia*.

Nitella flexilis Agardh, in Syst. Alg. 1824, p. 124; Imahori in Sci. Rep. Kanaz. Univ. 1, 1951, p. 210.

var. *longifolia* Braun apud Migula in Rabenhorst. Krypt. Fl. Deutschl. ed. 2, Characeen, 1897, p. 137; ibid., in Hedwigia 70, 1930, p. 211; Wood in Farlowia 3, 1948, p. 349.

Syn. *Nitella laxa* Allen in Bull. Torrey Bot. Club, 23, 1896, p. 533 (fide Imahori); Makino in Journ. Jap. Bot. 6, 1929, pp. 373, 379, 380.

Plants 30~40 cm high, very flexible and translucent, bright green. Stem stouter than typical form, ca. $500 \sim 800 \mu$ in diameter: internodes as long as to $2/3$ the length of branchlets. Fertile and sterile branchlets similar, 6~8 in a whorl, once divided. Dactyls 1~3, $1/3 \sim 1/4$ the length of the primary rays, at the apex abruptly pointed.

Antheridia and oogonia produced together. Antheridia $400 \sim 500 \mu$ in diameter. Oogonia solitary or geminate, $700 \sim 800 \mu$ long, $580 \sim 620 \mu$ wide with 8~9 spiral convolutions. Oospore dark brown to black, $450 \sim 600 \mu$ long, $400 \sim 500 \mu$ wide with 6

prominent ridges; membrane quite similar to that of typical form.

Nom. Jap.: Oh-hurasumo.

Hab.: in ponds and swamps, pH 6.5~7.1, occasionally growing with *Nitella furcata*.

Loc.: in Hokkaido—Prov. Kushiro; Hamanaka-mura, Sept. 29, 1951, K.I. Nos. 989 990.

in Honshu—Prov. Rikuzen; Takadate-mura, Natori-gun, Nov. 10, 1950, K. I. No. 783—Prov. Kaga; Kasadani-mura, Kahoku-gun, Oct. 12, 1947, K. I. No. 530 — Prov. Inaba; Hase, Yamato-mura. Aug. 23, 1951, K. I. No. 936—Prov. Yamashiro; Yakushiji pond, Kyoto (by Allen 1896)—Prov. Bizen; Gokan (by Migula, 1930).

in Kyushu—Prov. Bungo; Marunuma, Imazu, Shimoge-gun, Aug. 14, 1951, K. I. No. 848.

Distr.: Asia, Europe, North America.

The variety of this plant is distinguished from the typical form by the elongated branchlets, larger, stouter habit and its bright greenish color. The plant generally grows so abundantly as to give a bushy appearance in the fields.

§ A new species "*Nitella Allenii*".

Since Dr. T. F. Allen had described a plant as "*Nitella subglomerata* var. *japonica*", no one has been able to recollect or redescribed this plant, the author was lucky enough to detect and study this alga, and detected that the plant must be an independent species.

Nitella Allenii Imahori, sp. nov.

Syn. *Nitella subglomerata* A. Braun var. *japonica* Allen in Bull. Torrey Bot. Club, 22, 1895, p. 69; Makino in Journ. Jap. Bot. 6, 1929, p. 373. Jap.

Planta monoecia, 15~25 cm alta, zonatim incrustata, obscuriviridis. Caulis flexilis, 0.4~0.5 mm diametro; internodia et ramuli vulgo aequilonga. Verticilli fertiles quam steriles paulum breviores, plus minus congesti. Verticillorum ramuli steriles 6~8, 1.5~2 cm longi, duplicato furcati; radii primarii 3/5 totius longitudinis ramulorum; radii secundarii 4~5; radii tertiarii 2~3. Verticillorum ramuli fertiles 6, gymnocephali, duplicato furcati; radii primarii 1/2 totius longitudinis ramulorum; radii secundarii 3~4; radii tertiarii 2~3. Dactyli ramulorum sterilium eis fertilium similes, semper unicellulati, acuminati.

♀ et ♂ gametangia ad nodos omnes. Antheridia terminalia, ca. 200 μ diametro. Oogonia plerumque aggregata, parva, constanter 260~270 μ longa, 210~220 μ lata, cellulis spiralibus 7, apices versus elongatis; coronula delapsa, 35 μ alta, ad basin 40 μ lata. Oospora subglobosa, atro-brunnea, 200~220 μ longa, 180~200 μ lata; striis 5, multo alatis; membrana anguloso-reticulata.

Nom. Jap.: Allen-hurasumo.

Hab.: in ponds, pH 7.2.

Loc.: in Honshu—Mikawa; Seishin pond (by Allen, 1895)—Prov. Kii; Kasuga-jinja, Ikeda-mura, June 8, 1943, K. I. Nos. 553, 554 (Type specimen No. 553).

Distr.: endemic to Japan.

This plant resembles *Nitella acuminata* var. *subglomerata* in its appearance, but there are too many and significant differences between them to be identified as the same species. The present species has branchlets which regularly twice furcate, and oospores which are very small, with strongly reticulate decoration on their membranes.

It is a very remarkable characteristic of this plant that the dactyls are uniformly 1-celled in spite of twice-furcation of their branchlets. The flanged ridges of oospores are also found in those of *Nitella acuminata* var. *subglomerata*, though those ridges of the present species are less in number. The plant which the author collected, shows well marked annular incrustations of calcium carbonate.

§ New locality of *Nitella confervacea*.

Nitella confervacea is distributed widely in Europe and some other continents,

Fig. 4. *Nitella Allenii* Imahori

1. Plant, $\times \frac{1}{2}$
2. Young fertile branchlet with antheridia and unripe oogonia, $\times 19$.
3. Matured fertile branchlet with ripe oogonia, $\times 19$.
4. Coronula, $\times 300$
5. A part of a dactyl, $\times 19$.
6. Oospore with flanged ridges, $\times 75$.
7. Reticulate oospore-membrane, $\times 300$.

but it is a very unusual plant, as is pointed out by Dr. J. Groves. The author could collect a specimen of the present species which was growing in a pond in Kyushu.

Nitella confervacea A. Braun, Consp. Syst. Charac. Europ., 1867, p. 2; Braun & Nordstedt in Abh. Koen. Akad. Wiss. Berlin, 1882, pp. 12, 64; Migula, Die Characeen, 1890, p. 182; Wood in Bot. Rev. 18, 1952, p. 332.

Syn. *Nitella Nordstedtiana* H. & J. Groves in Journ. Bot. 28, 1890, p. 67; Wood in Farlowia 3, 1948, p. 380.

Chara batrachosperma Thuiller, accord. to Reichenbach, Iconograph. Bot. 8, 1830, p. 794.

Nitella batrachosperma (Reichenbach) A. Braun, Neue Denkschr. Schweiz. Gesell. Naturw. 10 (3), 1847, p. 10; Braun & Nordstedt in Abh. Koen. Wiss. Berlin, 1882, pp. 12, 66; Migula, Die Charac., 1890, p. 184; J. Groves & Bullock-Webster, Brit. Charoph., 1, 1920, p. 124; J. Groves in Journ. Linn. Soc. Bot., 46, 1924, pp. 367; G. O. Allen in Journ. Bombay Nat. Hist. Soc. 30, 1925, p. 597; *ibid.*, in Journ. Ind. Bot. Soc., 7, 1928, p. 58; Pal in Journ. Linn. Soc., Bot., 49, 1932, pp. 64, 71; Zaneveld in Blumea 4, 1940, p. 80; Daily in Butler Univ. Bot. Stud. 6, 1944, p. 154; Olsen in D. Kgl. Dansk. Vidensk. Selskab, Biol. Skrifter. 3, 1944, p. 40.

Plants monoecious, graceful, slender and small, up to 5 cm high. Internodes 2~3 times the length of branchlets. Sterile and fertile branchlets similar, 6~8 in a whorl, 2~3-times furcate; primary rays half to one third the length of the entire branchlets; secondary rays 4~6, shorter than each of the other ray; tertiary rays 3~5, of which 1~2 furcate once more. Dactyls 2~5, elongated, uniformly 2-celled. ♀ and ♂ gametangia produced at the first and second furcations, solitary or conjunct, occasionally covered with thick mucus crowd. Antheridia 180~220 μ in diameter. Oogonia solitary, 380~430 μ long (incl. coronula) by 300~330 μ wide, showing 9~10 spiral convolutions; coronula rather small, 30~35 μ high and 40~45 μ wide. Oospore yellowish to dark brown, 270~300 μ long, 250~270 μ wide, with 7~8 prominent ridges; membrane first finely granulate, and later tending to become definitely reticulate.

Nom. Jap.: Ko-hurasumo.

Hab.: in ponds, pH 7.4, occasionally growing with *Chara Braunii*, *C. Bentharii* and rarely with *Chara corallina*.

Loc.: in Kyushu—Prov. Chikuzen; Kasuga-mura, Tsukushi-gun, Aug. 20, 1951, K. I. No. 978.

Distr.: Asia (India, Burma), Europe, North America and Australia, new to Japan.

The very slender and small habit, remote nodes of branchlets and elongated dactyls give this species a very distinct appearance, and it can never be mistaken for any of the other Japanese Nitellae, with the exception of *Nitella gracillima*. But this species differs from the *N. gracillima* by the fertile primary furcations of branchlets, larger o spores and finely granulate membranes of oospores. The ridges of oospore are more flanged than those of the English specimen, but as prominent as those of German specimen, which were described and figured by Dr. W. Migula (1897, p 187).