

Flora Desmidiarum Japonicarum III

Auctore

Minoru HIRANO

Sect. *Cyclidium* TURNER emend. HIRANO

Cosmarium sect. *Circulares* CEDERGREN in Ark. Bot. 25A: 4, 49, 1933 (pro parte) — sect. *Labidophorae* CEDERGREN in l. c. 25A: 4, 49, 1933 (pro parte) — subgen. *Cyclidium* TURNER in K. Sv. Vet. Akad. Handl. 25, 73, 1893.

Cellulae circulares vel ellipticae, generalis profunde constrictae, sinu generalis angusto-lineari; semicellulae semicirculares, subsemicirculares, semiellipticae vel subovales.

- 1a. Semicellulae semicirculares vel subsemicirculares, circiter tam longae quam latae vel leviter longiores quam latiores.
 - 2a. Cellulae cum marginibus lateralibus integris.
 - 3a. Semicellulae cum denticulis submammillatis vel obtusis ad angulos basales ordinatae.
 - 4a. Cellulae leviter latiores quam longiores..... *C. obsoletum*
 - 5a. Cellulae parvae, 34–46 μ in longitudinem..... *f. typica*
 - 5b. Cellulae magnae, 57–64 μ in longitudinem..... var. *sitvense*
 - 4b. Cellulae leviter longiores quam latiores..... *C. maximum*
 - 5a. Cellulae 140–145 μ in longitudinem..... *f. typica*
 - 5b. Cellulae 60–110 μ in longitudinem..... var. *minor*
 - 3b. Semicellulae cum angulis basalibus oblique truncatis ordinatae.. *C. auriculatum*
 - 3c. Semicellulae cum angulis basalibus rotundis ordinatae.
 - 4a. Cellulae magnae, 33–110 μ in longitudinem.
 - 5a. Cellulae cum chromatophoris parietalibus ordinatae..... *C. Ralfsii* var. *montanum*
 - 5b. Cellulae cum chromatophoris axialibus.
 - 6a. Cellulae circiter tam longae quam latae vel leviter latiores quam longiores.
 - 7a. Apice leviter recto, cellulae transversaliter ellipticae..... *C. dorsitruncatum*
 - 7b. Apice convexo, cellulae circulares.
 - 8a. Cellulae in vertice visae rhomboido-ellipticae; membrana cum crassitudine mediana..... *C. Lundellii* var. *circulare*
 - 8b. Cellulae in vertice visae angusto-ellipticae; membrana sine crassitudine mediana..... *C. circulare*
 - 9a. Cellulae parvae, 33–35 μ in longitudinem..... *f. minor*
 - 9b. Cellulae magnae, 54–75 μ in longitudinem..... *f. typica*
 - 6b. Cellulae leviter longiores quam latiores..... *C. pachydermum*

- 7a. Margine laterali inferiori convexo.
- 8a. Membrana incrassata..... f. typica
- 8b. Membrana tenue var. aethiopicum
- 7b. Margine laterali inferiori recto et parallelo..... var. heptagonum
- 4b. Cellulae parvae, $20\text{-}30\mu$ in longitudinem.
- 5a. Isthmo elongato; cellulae cum scrobiculis medianis ordinatae.. *C. ocellatum*
- 5b. Isthmo non elongato; cellulae sine scrobiculis medianis.
- 6a. Semicellulae semicirculares, sinu angusto-lineari, cum inflatione
 mediana..... *C. tithophorum* var. minor
- 6b. Semicellulae depresso-semicirculares, sinu acute aperto, cum papilla
 prominente ordinato..... *C. tithophorum* var. depressum
- 4c. Cellulae minutae, 10μ in longitudinem..... *C. pseudocellatum*
- 3d. Cellulae cum angulis basalibus oblique versis deorsum productis ordinatae.
- 4a. Cellulae hexagono-circulares, in vertice visae polis attenuatis et leviter
 productis; pyrenoidibus singulis in unaquaque semicellula
 *C. taxichondriforme*
- 4b. Cellulae circulares, in vertice visae polis rotundis non productis;
 pyrenoidibus duobus in unaquaque semicellula..... *C. taxichondrum*
- 5a. Cellulae cum granulis in serie apicali ordinatae..... var. decachondrum
- 5b. Cellulae sine granulis.
- 6a. Cellulae 42μ in longitudinem..... var. nudum
- 6b. Cellulae 80μ in longitudinem..... var. magnum
- 2b. Margine laterali undulato..... *C. undulatum*
- 3a. Semicellulae quadrato-semicirculares, undulis $10\text{-}12$; cellulae $54\text{-}64 \times 39\text{-}52\mu$
 f. typica
- 3b. Semicellulae elliptico-semicirculares.
- 4a. Cellulae cum undulis $9\text{-}10$; cellulae modicae, $34 \times 28\mu$ f. minor
- 4b. Cellulae cum undulis 8; cellulae parvae, $17\text{-}30\mu$ in longitudinem.
- 5a. Cellulae $28\text{-}30 \times 23\mu$ var. crenulatum
- 5b. Cellulae $17 \times 13\mu$ var. crenulatum f. Kriegeri
- 4c. Semicellulae subsemicirculares, undulis $12\text{-}14$, cellulae $21\text{-}28 \times 18\text{-}21\mu$
 var. minutum
- 2c. Margine laterali crenulato..... *C. obtusatum*
- 1b. Semicellulae semiellipticae, circiter $1\frac{1}{2}\text{-}2$ plus longiores quam latiores.
- 2a. Margine laterali integro.
- 3a. Cellulae magnae, $145\text{-}160\mu$ in longitudinem.
- 4a. Cellulae in latere visae ellipticae; isthmo angusto..... *C. maculatum*
- 4b. Cellulae in latere visae obovato-ellipticae; isthmo lato..... *C. javanicum*
- 3b. Cellulae modicae, $50\text{-}110\mu$ in longitudinem.
- 4a. Cellulae in vertice visae ellipticae; membrana sine crassitudine mediana.
- 5a. Cellulae in latere visae ovato-lanceolatae..... *C. pandriforme*
- 5b. Cellulae in latere visae truncato-ovatae; chromatophoris parietalibus
 *C. cucumis*
- 5c. Cellulae in latere visae late ellipticae; chromatophoris axialibus
 *C. subcucumis*
- 6a. Cellulae circiter 1.5 plus longiores quam latiores..... f. typica
- 6b. Cellulae duplo longiores quam latiores..... var. elongatum
- 4b. Cellulae in vertice visae rhomboido-ellipticae; membrana cum
 crassitudine mediana.

- 5a. Semicellulae semiellipticae.....*C. Lundellii* var. *ellipticum*
- 5b. Semicellulae leviter truncato-pyramidatae.....*C. Lundellii* var. *corruptum*
- 3c. Cellulae parvae, 36-40 μ , in longitudinem.....*C. microsphinctum*
- 2b. Margine laterali crenulato.
- 3a. Cellulae 1 $\frac{1}{2}$ -1.5 plus longiores quam latiores, crenis circa 10-14 in unaquaque semicellula; in latere visae oblongae.....*C. petsamoense*
- 4a. Cellulae cum undulis circa 10, apicibus retusis.....*f. typica*
- 4b. Cellulae cum undulis circa 14, apicibus biundulatis*f. simplicius*
- 3b. Cellulae 1 $\frac{3}{4}$ plus longiores quam latiores, crenis numerosis circa 16-18 in unaquaque semicellula; in latere visae ovatae ...*C. speciosum* var. *simplex*

Cosmarium obsoletum (HANTZSCH) REINSCH in NORDSTEDT Lund Univ. Årsskr. 16, 7, 1880; ROY & BISSET Journ. Bot. 24, 195, 1886; WEST Monogr. Brit. Desm. 2, 133, 1905; FUJISAWA Journ. Jap. Bot. 10, 443, 1934; HIRANO Act. Phytotax. Geobot. 11, 95, 1943.

Cellulae mediocres, transverse ellipticae, leviter latiores quam longiores, profunde constrictae, sinu angusto linearis in vertice subampliato et exterius aperto; semicellulae semiellipticae vel depresso-semicirculares, angulis basalibus submamillosi et leviter incrassatis; a latere visae depresso-globosae; a vertice visae ellipticae, polis leviter obtuse conicis; membrana scrobiculata et dense punctata inter scrobiculos. Long. 39-50 μ , Lat. 47.6-53 μ , Lat. isth. 21-25 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro: Toyokoro in Tokachi; Nikurunuma, Koetoi-konuma, Shimoyûbetsu in Kitami; Horomui, Nakano near Sapporo, Minenobu in Ishikari; Yûfutsu, Tôasa-numa, Numanohata, Tomakomai, Benten-numa in Iburi: Shizukari in Oshima. **Hondo**: Nagatai, Kurobonuma, Bora-numa in Mutsu: Koke-numa, Kotomo-numa, Moritake-ôtsutsumi, Hirumo-numa, Kariwano in Ugo: Hakuryu-ko, Hijiori-naga-numa, Ôishita, Chûkawa-ike in Uzen; Hizume in Rikuchû; Kesho-numa, Izu-numa in Rikuzen; Ojiroi, Nanko, Umaushi-numa in Iwaki; Akai, Nogiwano-kwannon-numa, Kôriyama in Iwashiro; Ômine-numa, Oze in Kôzuke; Kôridonono-ike in Echigo; Daimon-pass, Inago of Kitamaki-mura, Ôhanami-ike, Ashinota-ike, Lake Nakatsuna, Kizaki in Shinano; Mt. Hichimenzan in Kai; Takashihara, Kotsutsumi-nishi-ike, Suhara-ike in Mikawa; Biwa-ike in Owari; Tamaru, Jôdo-ike in Ise; Nukigawa, Matsubara-naiko, Fuse-ike, Shinohara-ike, Mt. Hira in Oomi; Mizoroga-ike, Takaraga-ike, Shakuhachi-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamada in Tosa; Yamauchi-mura in Sanuki. **Kiushiu**: Imuta-ike, Kagami-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi; Miyazaki, Koshiki-ike, Byakushi-ike of Kirishima in Hiuga. (Pl. XXI, f. 4)

Distr. Japan, Manchuria, China, Malay, Thailand, India, Ceylon, Egypt, Europe, N. America, Brazil, Australia, E. Africa.

var. **sitvense** GUTW. in WEST Monogr. Brit. Desm. 2, 134, 1905; BERNARD Dep. agr. Indes. Néerl. 102, 1908; KRIEGER Arch. Hydrobiol. suppl. 11, 181, 1932; HIRANO Act. Phytotax. Geobot. 11, 96, 1943.

Cellulae maiores. Long. 62-77 μ , Lat. 69-78 μ , Lat. isth. 39-42 μ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Yûfutsu, Tôasa-numa in Iburi; Horomui, Nakano near Sapporo in Ishikari. **Hondo**: Kurobo-numa in Mutsu: Hirumo-numa, Megata, Moritake-ôtsutsumi in Ugo; Hakuryu-ko, Chûkawa-ike, Ôishita in Uzen; Izu-numa in Rikuzen; Kashima-cho in Iwaki; Ozegahara in Kôzuke; Inago of Kitamaki-mura, Ôhanami-ike in Shinano; Tanuki-numa in Suruga; Takashihara, Kotsutsumi-nishi-ike in Mikawa; Jôdo-ike in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizorôga-ike, Takaraga-ike, Sawano-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi. (Pl. XXI, f. 5)

Distr. Japan, Burma, Malay, S. W. China, Java, Sumatra.

Cosmarium obsoletum is said to be abundant in tropical and subtropical countries and the var. *sitvense* is found in tropical Asia. In Japan the typical species are widely distributed in the marshes or moor-bogs and more common than the var. *sitvense* in distribution area. The var. *sitvense* is larger in size than the dimension given by W. & G. S. WEST in his monograph III. and sparsely distributed up in Hokkaido.

Cosmarium maximum (BÖRG.) WEST in BORGE Ark. Bot. 15, 35, 1918.

Cellulae magnae, paene circulares, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae semicirculares, angulis basalibus bene rotundis granulis acutis vel papillis oblique deorsum directis instructis; a latere et vertice visae ellipticae; membrana punctata. Long. 92 μ , Lat. 84 μ , Lat. isth. 36.4 μ .

Hab. **Hondo**: Ariga-ike in Yamashiro (New to Asia) (Pl. XXII, f. 4)

Distr. Brazil.

var. **minor** W. & G. S. WEST in Journ. Bot. 35, 114, 1897.

A typo differt dimensionibus minoribus. Long. 64.5 μ , Lat. 56 μ , Lat. isth. 28 μ .

Hab. **Hondo**: Kesho-numa in Rikuzen; Junsai-tsutsumi of Ôishita in Uzen; Nanko in Iwaki; Ômine-numa in Kôzuke; Tanuki-numa in Suruga. (New to Asia) (Pl. XXII, f. 5)

Distr. Africa.

Cosmarium auriculatum REINSCH in Contrib. Alg. Fung. 83, 1875; FUJISAWA Journ. Jap. Bot. 10, 443, 1934.

Cellulae mediocres, late ellipticae, leviter longiores quam latae, profunde constrictae, sinu aperto acutangulo ad verticem leviter dilatato; semicellulae subsemicirculares, angulis basalibus truncatis vel subtruncatis cum granulis tribus, sed interdum uno vel duobus vel nullis, apicibus levissime rectis; a latere visae ellipticae; a vertice visae rhomboido-ellipticae, polis subacutis; membrana scrobiculata. Long. 56μ , Lat. 47.6μ , Lat. isth. 28μ .

Hab. **Hondo**: Ina in Shinano. (FUJISAWA) **Shikoku**: Yamada in Tosa. (Pl. XVII, f. 12-14)

Distr. Japan, France.

Cosmarium Ralfsii BRÉB. var. **montanum** RACIB. in WEST Monogr. Brit. Desm. 2, 142, 1905; DICK Mitt. Pfalz Ver. Nat. Pollichia 3, 132, 1930; CEDERGREN Ark. Bot. 25A, 49, 1933; TAYLOR Pap. Mich. Acad. Sci. 19, 264, 1934; WHELDEN Nat. Mus. Canad. Bull. 97, 88, 1947.

Semicellulae cum sinu aperto, angulis basalibus minus rotundis leviter productis. Long. 64.5μ , Lat. 60μ , Lat. isth. 30μ .

Hab. **Hondo**: Ô-numa in Mikawa. (New to Asia) (Pl. XXI, f. 3)

Distr. Europe, Arctic Canada.

Cosmarium Ralfsii var. *montanum* from Ô-numa, Mikawa province does not exactly coincide with the WEST's description. His figure shows the punctate cell wall while in our form the cell wall is scrobiculated and punctated, punctations are densely disposed between the scrobiculations and also the size of cells is much smaller than the WEST's dimension, but our form coincides with the small form of GEORGEVITCH's dimension that is length 63μ , breadth 54μ , isthmus 24μ .

Cosmarium dorsitruncatum (NORDST.) WEST in G. WEST Journ. Linn. Soc. Bot. 39, 59, 1909; KRIEGER Arch. Hydrobiol. suppl. 11, 176, 1932.—*Cosmarium scenedesmus* DELP. var. *dorsitruncatum* NORDST. in K. Sv. Vet. Akad. Handl. 22, 59, 1888; WEST Journ. Bot. 35, 116, 1897; TAYLOR Pap. Mich. Acad. Sci. 19, 265, 1934.

Cellulae mediocres, circiter $1\frac{1}{4}$ latiores quam longiores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae depresso-truncato-subpyramidatae vel subellipticae, angulis basalibus rotundis, apicibus aliquantum truncatis; a latere visae circulares; a vertice visae oblongo-rhomboides; membrana minute punctata. Long. $29.4-35\mu$, Lat. $39-47.6\mu$, Lat. isth. $11-14\mu$.

Hab. **Hokkaido**: Shizukari in Oshima. **Hondo**: Koke-numa, Hirumo-numa in Ugo; Akai in Iwashiro; Ishigaki-ike in Ise; Fuse-ike in Oomi. (New to Japan) (Pl. XIX, f. 3, Pl. XXI, f. 8)

Distr. Java, Australia, Africa, New Foundland.

Cosmarium dorsitruncatum of our country does not always exactly

coincide with the tropical form. The cell outline is elliptic and the apex of semicell is not truncate but convex and sometimes scarcely flattened while in tropical form from Africa and Sunda Islands is truncate therefore cell outline is almost hexagonal. This species is allied to the *Cosmarium obsoletum*, but is distinguished from it by the more depressed semicell and lackness of the mamillate thickening of the basal angle.

Cosmarium circulare REINSCH in WEST Monogr. Brit. Desm. 2, 136, 1905; MIGULA Krypt. Fl. 2, 421, 1907; SMITH Wisc. Bull. 57, 29, 1924; PRESCOTT Univ. Iowa Stud. 13, 119, 1931.

Cellulae modicae vel submagnae, leviter latiores quam longiores, late ellipticae, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae depresso-semicirculares vel semiellipticae cum angulis basalibus rotundis; a vertice visae angusto-ellipticae; membrana punctata. Long. 51-75 μ , Lat. 48-73 μ , Lat. isth. 20-34 μ .

Hab. **Hokkaido**: Tomakomai in Iburi; Ko-numa in Oshima. **Hondo**: Izu-numa in Rikuzen; Goda-numa in Shimofusa; Sanpôji-ike in Musashi; Lake Nakatsuna in Shinano; Lake Biwa in Oomi. **Shikoku**: Yamada in Tosa. (Pl. XIX, f. 1).

Distr. Japan, Manchuria, India, Ceylon, Europe, N. America, Brazil, E. Africa.

forma **minor** W. & G. S. WEST in Monogr. Brit. Desm. 2, 137, 1905.

A typo differt dimensionibus minoribus. Long. 40.6 μ , Lat. 47.6 μ , Lat. isth. 16.8 μ .

Hab. **Hokkaido**: Yasuushi in Teshio. **Hondo**: Goda-numa in Shimofusa; Ô-numa in Mikawa. (New to Asia) (Pl. XIX, f. 2)

Distr. British Isles, Poland.

Cosmarium pachydermum LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 39, 1871; ROY & BISSET Journ. Bot. 24, 196, 1886; WEST Monogr. Brit. Desm. 2, 139, 1905; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 55, 9, 1924, HOMFFELD Pflanzenf. 12, 48, 1929; INSAM & KRIEGER Hedw. 76, 104, 1937.

Cellulae magnae, late ellipticae, circiter 1½ longiores quam latae, profunde constrictae, sinu angusto-lineari in vertice subampliato et exterius aperto; semicellulae late semiellipticae, angulis basalibus et apicalibus late rotundis; a latere visae subcirculares; a vertice visae ellipticae; membrana crassa et dense punctata. Long. 84-106 μ , Lat. 70-78 μ , Lat. isth. 25-34 μ .

Hab. **Hokkaido**: Chôboshi-numa, Okineppe in Nemuro; Akan-junsai-numa, Tokotan, Kiritappu in Kushiro; Toyokoro in Tokachi; Shimoyûbetsu in Kitami; Minenobu, Horomui, Nakano near Sapporo in Ishikari; Tomakomai, Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda,

Kurobo-numa, Kyutai in Mutsu; Naga-numa of Hachimantai in Rikuchū; Hakuryu-ko in Uzen; Umaushi-numa, Nanko, Kashima-cho in Iwaki; Akai, Nogiwano-kwannon-ike, Kōriyama in Iwashiro; Oze in Kōzuke; Kōridono-ike in Echigo; Ashinota-ike, Ôhanami-ike, Oyamada-ike, Nenbutsu-ike of Togakushi, Kamikōchi, Happō-ridge, Daimon-pass in Shinano; Ishigaki-ike in Ise; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Bōgatsuru of Mt. Kujū in Bungo; Hirabaru of Yabakei in Bunzen; Nakahama of Lake Ikeda in Satsuma. (Pl. XXII, f. 1)

Distr. Japan, Manchuria, Siberia, China, Sumatra, Java, Europe, N. & S. America, Australia, New Zealand, Azores, Patagonia.

var. **aethiopicum** W. & G. S. WEST in Monogr. Brit. Desm. 2, 140, 1905; STRÖM Vidensk. Skrift. 1. math.-nat. kl. 4, 30, 1921; FUJISAWA Journ. Jap. Bot. 10, 443, 1934; OKADA in Asahina's Inkwa. 163, 1940; TAFT Ohio Journ. Sci. 45, 198, 1945.

Semicellulae aliquantum semicirculares, membrana tenuior. Long. 64-98 μ , Lat. 56-78 μ , Lat. isth. 28-34 μ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Kyutai in Mutsu; Izunuma in Rikuzen; Nogiwano-kwannon-ike in Iwashiro; Gono-ike in Hitachi; Onjaga-ike in Kamifusa; Higusa-numa in Shimofusa; Ina (FUJISAWA), Inago of Kitamaki-mura in Shinano; Matsubara-naiko in Oomi. **Shikoku**: Dôgo, Shiramizu-pass in Iyo. **Kiushiu**: Kagami-ike, Nakahara-ike of Fukiagenohama in Satsuma. (Pl. XXII, f. 2)

Distr. Japan, Manchuria, China, Europe, W. Africa.

var. **heptagonum** GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. 47, 45, 1920; FUJISAWA Journ. Jap. Bot. 10, 443, 1934.

Semicellulae 5-angulares, marginibus lateralibus inferioribus subparallelis et leviter convexis, marginibus superioribus convexis et convergentibus, angulis superioribus obtusis; membrana sparse punctata, inter punctulos minute et dense scrobiculata. Long. 100-102 μ , Lat. 47-48 μ , Lat. isth. 16-17 μ .

Hab. **Hokkaido**: Shiraoi-poroto-numa in Iburi. **Hondo**: Lake Haruna in Kōzuke; Senjōgahara in Shimotsuke; Ina (FUJISAWA) in Shinano. (Pl. XXII, f. 3)

Distr. Japan, Finland.

Cosmarium ocellatum EICHL. & GUTW. in WEST Monogr. Brit. Desm. 2, 144, 1905; HOMFELD Pflanzenf. 12, 47, 1929; HIRANO Act. Phytotax. Geobot. 12, 96, 1943.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu linearis aperto; semicellulae subsemicirculares, angulis basalibus rotundis, apicibus late rotundis; a latere visae subcirculares; a vertice visae ellipticae, lateribus cum ocella magna in medio utrobique; membrana glabra vel fine punctata, cum ocella magna distincta in medio semicellularum. Long. 20-

28μ , Lat. $20\text{--}25\mu$, Lat. isth. $4.8\text{--}5.6\mu$.

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro in Tokachi; Horomui, Minenobu in Ishikari; Yûfutsu, Tomakomai in Iburi; Shizukari, Junsai-akanuma in Oshima. **Hondo**: Nagatai, Kotsutsumi in Mutsu; Moritake-ôtsutsumi in Ugo; Chûkawa-ike, Ôishita, Hakuryu-ko in Uzen; Kesho-numa, Izu-numa, Naga-numa in Rikuzen; Akaiyachi in Iwashiro; Umaushi-numa in Iwaki; Oze-numa in Kôzuke; Happô-ridge, Inago of Kitamaki-mura in Shinano; Suhara-ike, Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike, Jôdo-ike in Ise; Nukigawa, Shinohara-ike in Oomi; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamada in Tosa. **Kiushiu**: Ahira in Ôsumi; Miyazaki in Hiuga. (Pl. XVIII, f. 11)

Distr. Japan, Europe.

Cosmarium tithophorum NORDST. var. **minor** RACIB. in Pamietn. Wydz. Akad. Um. Krakow 17, 11, 1889. (reprint)

Cellulae minores, circulares, sinu angusto-lineari; semicellulae semicirculares; in vertice visae rhombido-ellipticae, polis rotundis; membrana subtiliter punctata. Long. 22.4μ , Lat. 18.2μ , Lat. isth. 6μ .

Hab. **Hondo**: Ariga-ike in Yamashiro. (New to Asia) (Pl. XIX, f. 23)
Distr. Europe.

var. **depressum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 164, 1902.

Semicellulae parvior quam in forma typica et plus depressae. Long. 19.6μ , Lat. 19.6μ , Lat. isth. 5.6μ .

Hab. **Hokkaido**: Tomakomai in Iburi. (New to Japan) (Pl. XIX f. 22)
Distr. Ceylon.

Cosmarium pseudocellatum HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, 19, 67, 1948.

Cellulae minutae, subcirculares, circiter tam longae quam latae, profunde constrictae, sinu aperto lineari, extremo rotundato, isthmo leviter elongato; semicellulae subsemicirculares vel transverse semiellipticae, angulis basalibus rotundatis; a latere visae circulares; membrana glabra. Long. 9.5μ , Lat. 9.6μ , Lat. isth. 1.7μ .

Hab. **Hondo**: Ko-ike in Yamashiro (Pl. XIX, f. 8)
Distr. Japan.

Cosmarium taxichondriforme EICHL. & GUTW. in WEST Monogr. Brit. Desm. 2, 136, 1905; DICK Bot. Arch. 3, 221, 1923; SKUJA Act. Horti. Bot. Univ. Latv. 3, 174, 1928; HOMFELD Pflanzenf. 12, 58, 1929.

Cellulae submediocres, paene circulares, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari in apice leviter dilatato; semicellulae semicirculares, angulis basalibus leviter productis et incrassatis oblique exterius directis; a latere visae subcirculares; a vertice visae ellipticae, polis productis; membrana fine punctata. Long. 47-52 μ , Lat. 43-47 μ , Lat. isth. 12-13 μ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise; Shinohara-ike in Oomi. (New to Asia) (Pl. XVIII, f. 17, Pl. XXII, f. 7)
Distr. Europe.

Cosmarium taxichondrum LUND. **decachondrum** (ROY & BISSET) RACIB.
in Pam. Wydz. Math.-Przyr. Akad. Um. 17, 16, 1889.—*Cosmarium decachondrum* ROY & RISSET
in Journ. Bot. 24, 196, 1886.

Cellulae modicae, circiter tam longae quam latae, paene circulares, profunde constrictae, sinu aperto acutangulo; semicellulae semicirculari-undulatae, angulis basalibus acute rotundis, leviter deorsum directe productis, marginibus lateralibus leviter undulatis, (undulis 4-5), apicibus leviter convexo-undulatis, intra apicem cum serie horizontali granulorum 4 (in mediana parte duplo mojore); a vertice visae elliptico-rhomboides, lateribus cum granulis tribus parvis in medio utrobique et granulis duobus prominentibus intra marginem, polis acute rotundis cum duobus apiculis ornatis, membrana fine punctata. Long. 28-32 μ , Lat. 29-31 μ , Lat. isth. 5.6-8.4 μ .

Hab. **Hondo**: Benze-numa in Mutsu; Nishi-numa, Moritake-ôtsutsumi, Ogata in Ugo; Hizume in Rikuchû; Izu-numa in Rikuzen; Kanori-ike in Shinano; Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Miyazaki in Hiuga. (Pl. XVIII, f. 14)

Distr. Japan, Manchuria.

var. **nudum** TURNER in K. Sv. Vet. Akad. Handl. 25, 60, 1893.

Membrana glabra sine granulis. Long. 31-42 μ , Lat. 31-42 μ , Lat. isth. 8.5-14 μ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Nanko in Iwaki. (New to Japan) (Pl. XVIII, f. 15, 16)

Distr. India, Ceylon, Canada.

var. **magnum** HIRANO in Act. Phytotax. Geobot. 14, 71, 1951.

Cellulae magnae, duplo maiores quam in forma typica, paene circulares, apice non recto, angulis basalibus incrassatis et mamillato-productis; membrana scrobiculata sine granulis. Long. 78-84 μ , Lat. 78-80 μ , Lat. isth. 39-44 μ .

Hab. **Hondo**: Ojiroi, Kashima-cho in Iwaki; Kanashôzu in Ise. (Pl. XXI, f. 6)

Distr. Japan.

Cosmarium undulatum CORDA in WEST Monogr. Brit. Desm. 2, 148, 1905.

Cellulae raro parvae, hexagono-ellipticae, circiter $1\frac{1}{3}$ duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae truncato-subpyramidatae vel angulari-subtrapeziformes, partibus latissimis semicellularum supra basim, marginibus lateralibus convexis convergentibus, 5-undulatis cum angulis apicalibus et basalibus, undulis basalibus leviter maioribus, apicibus truncatis, 4-undulatis cum angulis apicalibus; a latere visae subcirculares vel ovatae; a vertice visae ellipticae; membrana punctata. Long. 39μ , Lat. 30μ , Lat. isth. 9.8μ .

Hab. **Shikoku**: Yodo in Iyo. (New to Japan) (Pl. XIX, f. 12)

Distr. China, Afghanistan, Abyssinia, whole Europe, Spitzbergen, Greenland, U. S. A., New Zealand.

forma minor W. & G. S. WEST in Monogr. Brit. Desm. 2, 149, 1905.

Forma minor, sed leviter latior. Long. $34\text{--}38\mu$, Lat. $26\text{--}36\mu$, Lat. isth. $8.5\text{--}14\mu$.

Hab. **Hondo**: Komozuchi in Mutsu; Izu-numa in Rikuzen; Kamaga-ike near Otari in Shinano; Rokujizo, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Dôgo in Iyo. (New to Asia) (Pl. XIX, f. 16)

Distr. British Isles, Galicia.

var. crenulatum (NÄG.) WITTR. in WEST Monogr. Brit. Desm. 2, 150, 1905; HIRANO Bot. Mag. 66, 205, 1953.

Cellulae minores quam in forma typica, undulis marginibus circ. 10 cum angulis basalibus, apicibus retusis sed ceteris paene rectis. Long. $16\text{--}20\mu$, Lat. $13\text{--}15\mu$, Lat. isth. $4\text{--}5.6\mu$.

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Yûfutsu, Tomakomai in Iburi; Minenobu in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Naga-numa, Kesho-numa in Rikuzen; Ôishita, Chûkawa-ike in Uzen; Kôriyama in Iwashiro; Lake Jiuemon-ike in Kôzuke; Gono-ike in Hitachi; Matsunoyama-ôike in Echigo; Kanori-ike, Kamikôchi, Happô-ridge, Daizahôshi-ike in Shinano; Biwa-ike in Owari; Kotsutsumi-nishi-ike, Ô-numa in Mikawa; Jôdo-ike in Ise; Nukigawa in Oomi. **Kiushiu**: Nakahara-ike in Satsuma; Miyazaki in Hiuga. (Pl. XIX, f. 14, 15)

Distr. Japan, India, Europe, Spitzbergen, Brazil.

Our form of *Cosmarium undulatum* var. *crenulatum* is fairly smaller

than the European form and this small form is already recorded by DICK from Germany (Bot. Arch. 3, 1923) and by FRITSCH & STEPHENS from Africa.

forma Kriegeri HIRANO forma nov.

Cosmarium undulatum CORDA var. *crenulatum* (NÄG.) WITTR. **forma KRIEGER** in Arch. Hydrobiol. suppl. 11, 190, 1932.

Cellulae minores, undulatis marginibus cum angulis basalibus circ. 10, apicibus retusis sed ceteris non retusis paene rectis. Long. 17 μ , Lat. 13 μ , Lat. isth. 4.3 μ .

Hab. **Hokkaido**: Moseushi, Barato in Ishikari. **Hondo**: Nagatai in Mutsu ; Oze-numa in Kōzuke ; Mohara in Kamifusa ; Gōno-ike in Hitachi ; Matsubara-naiko, Fuse-ike in Oomi ; Ariga-ike, Shakuhachi-ike in Yamashiro ; Ikejiri-ike in Tanba. (Pl. XX, f. 15)

Distr. Sumatra.

I have often met with a small form of var. *crenulatum* and its marginal nature is quite similar to the European description but its size is about half of it.

var. minutum WITTR. in SKVORTZOW Phillip. Journ. Sci. 49, 150, 1932; TAYLOR Pap. Mich. Acad. Sci. 19, 271, 1934; HIRANO Journ. Jap. Bot. 20, 49, 1944.

Cellulae minores, circiter 1.5 duplo longiores quam latiores, undulatis marginibus non distinctis. Long. 17-25 μ , Lat. 12-22 μ , Lat. isth. 5-14 μ .

Hab. **Hondo**: Izu-numa in Rikuzen; Mizoroga-ike in Yamashiro. **Shikoku**: Dōgo, Yodo-mura in Iyo. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XIX, f. 13)

Distr. Manchuria, Korea, Germany, N. America.

Cosmarium obtusatum SCHMIDLE in WEST Monogr. Brit. Desm. 3, 7, 1908; ALIORGE Rev. Alg. 1, 466, 1924; DICK Krypt. Forsch. 1, 449, 1926; FUJISAWA Journ. Jap. Bot. 10, 443, 1934; INSAM & KRIEGER Hedw. 76, 103, 1937; YONEDA Act. Phytotax. Geobot. 11, 205, 1937; HIRANO Act. Phytotax. Geobot. 12, 96, 1943.

Cellulae modicae, circiter 1 $\frac{1}{2}$ longiores quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato ; semicellulae semicirculares vel truncato-pyramidatae, angulis basalibus rotundis, marginibus lateralibus undulatis, undulis lateralibus circ. 8 utrobique, undulis similibus in seriebus radiantibus 1-2 intra marginem, apicibus truncato-rotundis vel leviter convexis ; a latere visae late ellipticae ; a vertice visae oblongo-ellipticae, polis undulatis, undulis in seriebus parallelibus 4-5 ; membrana punctata vel reducto-granulata, granulis in punctulis quaternis compositis. Long. 48-56 μ , Lat. 39-48 μ , Lat. isth. 14-17 μ .

Hab. **Hokkaido**: Okineppe, Chōbushi-numa, Onne-numa in Nemuro ; Kiritappu, Tokotan, Tōro in Kushiro ; Toyokoro in Tokachi ; Wakkanai,

Koetoi-konuma, Sarufutsu, Kutcharo-konuma, Notoro-konuma in Kitami ; Moseushi, Horomui, Nakano near Sapporo, Minenobu in Ishikari ; Tôasana-numa, Yûfutsu, Numanohata, Shiraoi-poroto-numa in Iburi ; Shizukari in Oshima. **Hondo** : Nagatai, Bora-numa in Mutsu ; Futatsuyagata, Aka-numa in Ugo ; Kirifushi-numa, Izu-numa, Kesho-numa, Naga-numa in Rikuzen ; Chûkawa-ike in Uzen ; Ojiroi in Iwaki ; Hôzawa-ike, Ôuchi-numa in Iwashiro ; Oze-numa in Kôzuke ; Senjôgahara in Shimotsuke ; Goda-numa, Higusa-numa in Shimofusa ; Onjaga-ike in Kamifusa : Gôno-ike, Kitaura in Hitachi ; Kagami-ike of Matsunoyama in Echigo ; Tashihara-ike in Etchû ; Kama-ike of Otari, Togakushi-nenbutsu-ike, Kanori-ike, Kamikôchi, Lake Nakatsuna in Shinano ; Tanuki-numa in Suruga ; Biwa-ike in Owari ; Takashihara in Mikawa ; Tamaru in Ise ; Matsubara-naiko, Nukigawa in Oomi ; Ariga-ike, Mizoroga-ike in Yamashiro ; Ikejiri-ike in Tanba. **Shikoku** : Yamauchi-mura in Sanuki ; Yamada in Tosa ; Dôgo, Yodo-mura, Shiramizu-pass in Iyo. **Kiushiu** : Bôgatsuru of Mt. Kujû in Bungo ; Nakahama of Lake Ikeda in Satsuma ; Miyazaki in Hiuga ; Ahira, Kurino in Ôsumi. (Pl. XIX, f. 5, 11)

Distr. Japan, Manchuria, Siberia, China, Europe, N. America, Africa.

Cosmarium maculatum TURNER in K. Sv. Vet. Akad. Handl. 25, 49, 1893 ; SKUJA Symb. Sinica 1, 90, 1937 ; HIRANO Journ. Jap. Bot. 20, 37, 1944.

Cellulae magnae, circiter duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato ; semicellulae semiellipticae vel ovatae, angulis basalibus bene rotundis, apicibus angustis leviter convexis ; a latere visae ovatae ; membrana distincte punctata. Long. 138-168 μ , Lat. 73-90 μ , Lat. isth. 39-45 μ .

Hab. **Hokkaido** : Shizukari in Oshima. **Hondo** : Kashima-cho in Iwaki ; Kôridonono-ike in Echigo ; Ishigaki-ike, Jôdo-ike in Ise ; Mizoroga-ike in Yamashiro. **Kiushiu** : Hirabaru of Yabakei in Bunzen ; Kagami-ike, Nakahama of Lake Ikeda in Satsuma ; Ahira in Ôsumi (Pl. XXI, f. 1)

Distr. Japan, India, Ceylon, S. China.

Cosmarium javanicum NORDST. in LUND Univ. Årsskr. 16, 7, 1880 — *Pleurotaeniopsis subturgida* (TURN.) SCHMIDLE forma *minor* SCHMIDLE in Bernard Dep. agr. Indes Néerl. 83, 1908.

Cellulae magnae, oblongo-ellipticae, circiter 1½ longiores quam latae, modice constrictae, sinu angusto-lineari in capite subampliato ; semicellulae subsemiellipticae, angulis basalibus rectangulari et bene rotundis, marginibus lateralibus convexis convergentibus, apicibus angustis rectis vel leviter convexis, angulis apicalibus late rotundis ; a latere visae ovato-ellipticae ; membrana punctata. Long. 112-118 μ , Lat. 59-65 μ , Lat. isth. 43-48 μ .

Hab. **Hondo**: Matsubara-naiko in Oomi; Mizoroga-ike in Yamashiro.
(New to Japan) (Pl. XXI, f. 2)

Distr. Java.

Cosmarium pandriforme TURNER in K. Sv. Vet. Akad. Handl. 25, 49, 1893;
HIRANO Journ. Jap. Bot. 20, 47, 1944.

Cellulae modicae, circiter 1.5 longiores quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae semiellipticae, angulis basalibus rotundis, apicibus angustis leviter convexis vel bene rotundis; a latere visae ovatae; membrana punctata. Long. 98-102 μ , Lat. 56-62 μ , Lat. isth. 20-25 μ .

Hab. **Hondo**: Ojiroi in Iwaki; Kanashôzu in Ise; Fuse-ike in Oomi.
Kiushiu: Hirabaru of Yabakei in Bunzen. (Pl. XXI, f. 7)

Distr. Japan, India.

Cosmarium cucumis (CORDA) RALFS in Brit. Desm. 93, 1848; WEST Monogr. Brit. Desm. 2, 152, 1905; INSAM & KRIEGER Hedw. 76, 99, 1937.

Cellulae magnae, circiter 1½ longiores quam latae, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae late truncato-ovatae, angulis apicalibus bene rotundis, apicibus rectis vel leviter convexis; membrana subtiliter punctata; a vertice visae late ellipticae. Long. 112 μ , Lat. 67 μ , Lat. isth. 25 μ .

Hab. **Hondo**: Takaraga-ike in Yamashiro. (New to Japan) (Pl. XXI, f. 6)
Distr. China, Siberia, Burma, Europe, Nova Zembla, Spitzbergen, Iceland, Greenland, N. America, Brazil, Patagonia.

Cosmarium subcicumis SCHMIDLE in WEST Monogr. Brit. Desm. 2, 155, 1905; HOMFELD Pflanzenf. 12, 56, 1929; FUJISAWA Journ. Jap. Bot. 10, 445, 1934; TAYLOR Pap. Mich. Acad. Sci. 19, 267, 1934; TAFT Ohio Journ. Sci. 45, 199, 1945.

Cellulae mediocres, ellipticae, circiter 1.5 duplo longiores quam latores, profunde constrictae, sinu angusto-lineari in capite dilatato; semicellulae semiellipticae, angulis basalibus rotundis, apicibus late rotundis; a latere visae ellipticae; a vertice visae ellipticae; membrana subtiliter punctata. Long. 49-61 μ , Lat. 28-39 μ , Lat. isth. 17-20 μ .

Hab. **Hokkaido**: Okineppe in Nemuro; Akan-junsai-numa, Kiritappu in Kushiro; Kucharo-ponto in Kitami; Shizukari, Junsai-numa in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Hachimantai, Mt. Iwate in Rikuchû; Koke-numa, Hoso-numa, Mt. Komagatake, Moritake-ôtsutsumi, Megata, Karaso-numa, Mt. Kanpu in Ugo; Hakuryu-ko, Kaibai-ike, Hijiori-naga-numa in Uzen; Kesho-numa in Rikuzen; Akai, Ôuchi-numa, Mt. Bandai, Mt. Azuma in Iwashiro; Kanazuka-mura, Kôridonono-ike, Kurosawano-ike in

Echigo; Oze, Mt. Akagi in Kôzuke; Senjôgahara in Shimotsuke; Onjaga-ike in Kamifusa; Kitaura in Hitachi; Gakinotanbo, Mt. Tateyama, Kurobejii-daira in Etchû; Kazafuki-koshiki-ike, Kamikôchi, Togakushi-nenbutsu-ike, Shigakôgen, Ashinota-ike, Lake Kizaki, Mt. Sanpôgamine Mt. Kirigamine (FUJISAWA) in Shinano; Takashihara, Kotsutsumi-nishi-ike in Mikawa; Matsubara-naiko, Mt. Hira in Oomi; Mizoroga-ike in Yamashiro. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Hirabaru of Yabakei in Bunzen; Bôgatsuru of Mt. Kujû in Bungo; Koshiki-ike, Ôhatayama of Kirishima in Hiuga. (Pl. XVIII, f. 13, Pl. XIX, f. 28)

Distr. Japan, Europe, Greenland, N. America, E. Africa.

var. **elongatum** HIRANO in Act. Phytotax. Geobot. **14**, 36, 1959.

Semicellulae elongato-semiellipticae, apice angustiore quam forma typica, isthmo latiore. Long. 64.4μ , Lat. 30.8μ , Lat. isth. 22.4μ .

Hab. **Hondo**: Hirumo-numa in Ugo. (Pl. XVIII, f. 12)

Distr. Japan.

Cosmarium Lundellii DELP. var. **circulare** (REINSCH) KRIEGER. in Arch. Hydrobiol. suppl. **11**, 178, 1932.

Cellulae raro parvae, nonnihil circulares vel late ellipticae; semicellulae semicirculares, apicibus plus latis et nonnihil rectis. Long. $53\text{--}73\mu$, Lat. $48\text{--}56\mu$, Lat. isth. $17\text{--}25\mu$.

Hab. **Hokkaido**: Tôro in Kushiro; Nakano near Sapporo in Ishikari; **Hondo**: Kurobo-numa, Kyutai in Mutsu; Moritake-ôtsutsumi, Ogata, Hirumo-numa, Nishi-numa in Ugo; Hizume in Rikuchû; Chûkawa-ike, Ôishitano-junsaisutsumi in Uzen; Kôriyama, Hôzawano-ike, Kagami-ishi-mura in Iwashiro; Kanori-ike in Shinano; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike, Ô-numa in Mikawa; Fuse-ike, Matsubara-naiko in Oomi. **Shikoku**: Matsuyama in Iyo; Yamauchi-mura in Sanuki; Sumiyoshi-ike of Misato-mura in Tosa. (New to Japan) (Pl. XXII, f. 10.)

Distr. Java.

var. **ellipticum** WEST in Monogr. Brit. Desm. **2**, 138, 1905; KRIEGER Arch. Hydrobiol. suppl. **11**, 178, 1932; OKADA in ASAHIWA's Inkwa. 165, 1939; TAFT Ohio Journ. Sci. **45**, 196, 1945.

Cellulae minores, circiter $1\frac{1}{8}$ longiores quam latiores. Long. $50\text{--}73\mu$, Lat. $42\text{--}56\mu$, Lat. isth. $14\text{--}25\mu$.

Hab. **Hokkaido**: Toyokoro in Tokachi; Notoro-ponto in Kitami; Horomui in Ishikari; Tomakomai, Yûfutsu in Iburi; Shizukari, Junsai-numa in Oshima. **Hondo**: Nagatai in Mutsu; Hachimantai in Rikuchû; Megata, Hirumo-numa,

Kariwano in Ugo, Hijiori-naga-numa, Hakuryu-ko in Uzen; Kirifushi-numa in Rikuzen; Nogiwano-kwannon-numa, Akaiyachi, Ôuchi-numa in Iwashiro; Umaushi-numa in Iwaki; Gôno-ike in Hitachi; Kôridonono-ike in Echigo; Tashihara-ike in Etchû, Inago of Kitamaki-mura, Daimon-pass, Lakes Nakatsuna and Kizaki in Shinano; Biwa-ike in Owari; Tamaru in Ise; Nukigawa, Fuse-ike in Oomi; Mizoroga-ike, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Kagami-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi. (Pl. XXII, f. 8)

Distr. Japan, Manchuria, Formosa, Europe, Canada.

var. corruptum (TURN.) W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 162, 1902; Monogr. Brit. Desm. 2, 139, 1905; DICK Bot. Arch. 3, 219, 1923; SKVORTZOW Phillip. Journ. Sci. 49, 152, 1932.—*Cosmarium corruptum* TURNER in K. Sv. Vet. Akad. Handl. 25, 51, 1893; OKADA Bot. Mag. 50, 314, 1936.

Semicellulae subsemicirculari-triangulares, apicibus leviter rectis; membrana scrobiculata, sed leviter maiores ad marginem. Long. 42–53 μ , Lat. 42–45 μ , Lat. isth. 11–18 μ .

Hab. **Hokkaido**: Shiraoi-poroto-numa, Tomakomai in Iburi. **Hondo**: Ô-numa in Uzen; Izu-numa in Rikuzen; Matsubara-naiko in Oomi (Pl. XXII, f. 9)

Distr. Japan, India, Ceylon, Europe, U. S. A.

Cosmarium microsphinctum NORDST. in Ofvers. K. Vet. Akad. Förh. 33, 1876; WEST Monogr. Brit. Desm. 2, 156, 1905; SKUJA Act. Horti. Bot. Univ. Latv. 4, 60, 1929; KRIEGER Hedw. 77, 62, 1937; Ber. Dtsch. Bot. Ges. 56, 62, 1938.

Cellulae parvae, circiter 1½ longiores quam latae, modice constrictae, sinu angusto-lineari ad apicem leviter dilatato; semicellulae semiellipticae vel semielliptico-pyramidatae, angulis basalibus rectangulari-rotundis, apicibus rotundis et aliquantum leviter rectis; a latere visae ovatae; a vertice visae rhomboido-ellipticae; membrana subtiliter punctata. Long. 41–42 μ , Lat. 27–28 μ , Lat. isth. 15–17 μ .

Hab. **Hondo**: Mt. Kanpû in Ugo; Mt. Akagi in Kôzuke. (New to Japan) (Pl. XVII, f. 11, Pl. XIX, f. 4)

Distr. Asia minor, Europe, Greenland, Spitzbergen, Nova Zembla, Franz Joseph Land, N. America.

Cosmarium petsamoense CEDERCREUTZ in Mem. Soc. Faun. Flor. Fenn. 7, 244, 1932; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS. II : 3, 419, 1936.

Cellulae parvae, 1.5 duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo dilatato; semicellulae semiellipticae, apice leviter retuso sed aliquando biundulato, marginibus lateralibus circa 7 undulatis utrobique, undulis lateralibus superioribus majoribus quam undulis inferiori-

bus; membrana glabra; a latere visae elliptico-oblongae. Long. 30-31 μ , Lat. 18.2 μ , Lat. isth. 8.4 μ .

Hab. **Hondo**: Ôniu in Shinano. (New to Japan) (Pl. XIX, f. 29)

Distr. E. Siberia, Finland.

forma **simplicius** KOSSINSKAJA in Act. Inst. Bot. Acad. Sci. URSS. II, 3: 419, 1936.

Var. marginibus lateralibus minus undulationibus quam in forma typica, 4-5 lateralibus omnibus undulatis generaliter (cum angulis basalibus et apicalibus). Long. 35 μ , Lat. 25.8 μ , Lat. isth. 9.8 μ .

Hab. **Hondo**: Ôniu-ike on Mt. Norikura in Shinano. (New to Japan) (Pl. XIX, f. 17)

Distr. Siberia.

Cosmarium speciosum LUND. var. **simplex** NORDST. in GRÖNBLAD Mem. Soc. Faun. Flor. Fenn. 10, 269, 1934.

Membrana glabra sine seriebus crenatis vel granulis. Long. 45 μ , Lat. 26.6 μ , Lat. isth. 14 μ .

Hab. **Kiushiu**: Aso-kôga-muta in Higo. (New to Japan) (Pl. XIX, f. 6)

Distr. S. China, Europe, Spitzbergen, Canada.

Sect. **Pyramidatae** CEDERGREN emend. HIRANO

Cosmarium sect. *Pyramidatae* CEDERGREN in Ark. Bot. 25A: 4, 46, 1933 (pro parte) ——
sect. *Tetragoni* CEDERGREN in I. c. 25A: 4, 52, 1933.

Cellulae hexagonales, profunde constrictae; semicellulae pyramidatae, trapeziformes vel subtriangulares.

- 1a. Margine integro, non undulato vel crenulato.
- 2a. Margine laterali retuso rare recto.
 - 3a. Apice retuso vel rare recto.
 - 4a. Cellulae in vertice visae sine tumore mediano..... **C. urceum**
 - 4b. Cellulae in vertice visae cum tumore mediano..... **C. Pokornyanum**
 - 3b. Apice truncato et recto, levissime convexo.
 - 4a. Cellulae sine granulis ad sinum utrobique.
 - 5a. Angulis basalibus rotundis.
 - 6a. Cellulae minutae, 10-13 μ in longitudinem; semicellulae in latere visae circulares..... **C. succisum**
 - 7a. Membrana rufa-fuscescens..... f. **typica**
 - 7b. Membrana incolora..... var. **hyalinum**
 - 6b. Cellulae parvae, 22-23 μ in longitudinem; semicellulae in latere visae obovatae..... **C. incertum**

- 6c. Cellulae modicae, 40-65 μ in longitudinem; semicellulae in latere visae ovatae vel circulares.
- 7a. Cellulae sine scrobiculis..... **C. Hammeri**
 8a. Cellulae sine inflatione mediana, 40-50 μ in longitudinem.... **f. typica**
 8b. Cellulae cum inflatione mediana.
 9a. Cellulae parvae, 24-35 μ in longitudinem..... var. **protuberans**
 9b. Cellulae magnae, 54-65 μ in longitudinem..... var. **homalodermum**
- 7b. Cellulae cum scrobiculis medianis..... **C. Nymannianum**
- 5b. Angulis basalibus rectangularibus.
- 6a. Semicellulae subquadrato-pyramidatae, circiter tam longae quam latae..... **C. quadratum**
- 6b. Semicellulae pyramidatae, circiter 1.5 plus longiores quam latiores..... **C. granatum**
 7a. Margine laterali recto..... **f. typica**
 7b. Margine laterali sinuato..... var. **subgranatum**
- 6c. Semicellulae 3-lobatae, 1.5 plus longiores quam latiores.. **C. trilobatum**
 7a. Apice recto vel paulo convexo..... **f. typica**
 7b. Apice retuso, marginibus lateralibus inferioribus divergentibus ..var. **Printzii**
- 4b. Cellulae cum granulis ad sinum utrobique, angulis basalibus subacutis .. **C. tetrachondrum**
- 2b. Margine laterali convexo.
- 3a. Cellulae parvae, 15-50 μ in longitudinem.
- 4a. Cellulae cum pyrenoidibus duobus in unaquaque semicellula .. **C. galeritum** var. **minus**
- 4b. Cellulae cum pyrenoidibus singulis in unaquaque semicellula.
- 5a. Cellulae circiter 1-1 $\frac{1}{2}$ plus longiores quam latiores; semicellulae generaliter trapeziformes, in latere visae circulares.
- 6a. Membrana cum serie verticali crispata, in vertice visa rhomboida .. **C. crispatum**
- 6b. Membrana glabra vel punctata, in vertice visa elliptica .. **C. subtumidum**
- 7a. Cellulae cum apice lato.
- 8a. Cellulae 30-40 μ in longitudinem..... **f. typica**
 8b. Cellulae 12-15 μ in longitudinem..... **f. minor**
- 7b. Cellulae cum apice rotundo..... var. **rotundum**
- 7c. Cellulae cum apice angusto et recto..... var. **Klebsii**
- 5b. Cellulae circiter 1.5 plus longiores quam latiores; semicellulae rotundo-pyramidatae.
- 6a. Cellulae in latere visae circulares; semicellulae sine ocella .. **C. nitidulum** var. **pseudorectangulare**
- 6b. Cellulae in latere visae ellipticae; semicellulae cum ocella mediana .. **C. variolatum** var. **foraminum**
- 5c. Cellulae circiter 1 $\frac{1}{2}$ plus longiores quam latiores; semicellulae pyramidatae, in latere visae ellipticae .. **C. pseudopyramidatum** var. **stenonotum** f. **minor**
- 3b. Cellulae magnae, 50-100 μ in longitudinem.
- 4a. Cellulae cum pyrenoidibus singulis in unaquaque semicellula.
- 5a. Margine laterali convexo..... **C. pseudopyramidatum**

- 5b. Margine laterali retuso..... var. *carniolicum*
- 4b. Cellulae cum pyrenoidibus duobus in unaquaque semicellula.
 - 5a. Cellulae 1 $\frac{1}{2}$ plus longiores quam latores, apice lato, angulis basalibus rectangularibus..... *C. pseudonitidulum* var. *validum*
 - 5b. Cellulae 1.5 plus longiores quam latores, apice angusto, angulis basalibus rotundis..... *C. pyramidatum*
- 1b. Margine undulato vel crenulato.
 - 2a. Apice recto vel retuso, non undulato vel crenulato.
 - 3a. Cellulae parvae, 20-25 μ in longitudinem..... *C. lapponicum*
 - 4a. Membrana glabra vel punctata, marginibus undulatis..... var. *undulatum*
 - 4b. Membrana granulata, marginibus undulatis..... var. *granulatum*
 - 3b. Cellulae modicae, 25-50 μ in longitudinem.
 - 4a. Cellulae leviter longiores quam latores.
 - 5a. Margine laterali 3-undulato; semicellulae in latere visae ellipticae
 - *C. venustum*
 - 6a. Cellulae 33-42 μ in longitudinem..... f. *typica*
 - 6b. Cellulae 20-25 μ in longitudinem..... f. *minor*
 - 5b. Semicellulae in latere visae circulares, marginibus lateralibus 3-5 undulatis..... *C. garrolense*
 - 5c. Semicellulae in latere visae circulares, marginibus lateralibus 6-7 undulatis..... *C. sublatere-undatum*
 - 4b. Cellulae 1 $\frac{1}{2}$ -1.5 plus longiores quam latores.
 - 5a. Margine laterali circiter 7-undulato.... *C. nitidulum* var. *subundulatum*
 - 5b. Margine laterali 4-undulato..... *C. venustum* var. *brevius*
 - 3c. Cellulae magnae, 80-100 μ in longitudinem, marginibus lateralibus circiter 11-12 undulatis..... *C. cymatopleurum* var. *Tyrolicum*
 - 2b. Apice undulato vel crenulato.
 - 3a. Margine laterali convexo.
 - 4a. Cellulae tam longae quam latae; semicellulae in latere visae circulares.
 - 5a. Margine laterali 4-crenato, membrana glabra..... *C. raeticum*
 - 5b. Margine laterali 3-crenato, membrana cum serie curva scrobicularum
 - *C. fuseense*
 - 4b. Cellulae 1 $\frac{1}{2}$ plus longiores quam latores, marginibus lateralibus 3-crenatis.
 - 5a. Cellulae in latere visae ellipticae; apice convexo..... *C. suborthogonum*
 - 5b. Cellulae in latere visae quadratae; apice truncato
 - *C. crenatum* var. *bicrenatum*
 - 4c. Cellulae 1.5 plus longiores quam latores; semicellulae in latere visae ovatae, marginibus lateralibus circiter 6 crenatis
 - *C. notabile* forma *arcticum*
 - 3b. Margine laterali retuso in parte superiori; marginibus inaequaliter 4-undulatis..... *C. humile* var. *striatum*

Cosmarium urceum W. & G. S. WEST in Journ. Linn. Soc. Bot. 33, 164, 1897;
HIRANO Act. Phytotax. Geobot. 12, 161, 1943.

Cellulae parvae, circiter duplo longiores quam latores vel leviter breviores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semi-

cellulae elongato-subtruncato-pyramidatae, marginibus lateralibus retusis, angulis basalibus bene rectangulari-rotundis, apicibus truncatis leviter retusis in medio cum angulis apicalibus rotundis; a latere visae oblongae; a vertice visae oblongo-ellipticae; membrana subtiliter punctata. Long. 28-36.4 μ , Lat. 16.8-33.6 μ , Lat. isth. 5-6 μ .

Hab. **Hondo**: Ozegahara in Kôzuke; Mt. Hira in Oomi; Ishigaki-ike in Ise. (Pl. XXII, f. 30, 36)

Distr. Japan, Malay.

Cosmarium urceum of our country is somewhat capitated at the apical part of semicell and otherwise is quite similar to the WEST's original description.

Cosmarium Pokornyanum (GRUN.) W. & G. S. WEST in SKUDA Act. Horti Bot. Univ. Latv. 3, 165, 1928; TAYLOR Pap. Mich. Acad. Sci. 19, 260, 1934; OKADA Bot. Mag. 50, 257, 1936; KOSSINSKAJA Act. Inst. Bot. Acad. URSS, Pl. Crypt. 3, 420, 1936; KRIEGER Ber. Dtsch. Bot. Ges. 56, 62, 1938; HIRANO Journ. Jap. Bot. 20, 48, 1944; TAFT Ohio Journ. Sci. 45, 198, 1945.

Cellulae parvae, circiter 1.5 longiores quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae paullo trilobo-sub-pyramidatae, marginibus lateralibus inferioribus paene parallelis vel leviter divergentibus cum angulis basalibus rectangularibus, marginibus lateralibus superioribus retuso-convergentibus, apicibus rectis et retusis in medio, angulis apicalibus rectangulari-rotundis; a latere visae ovatae cum apicibus truncatis; a vertice visae rhomboido-ellipticae; membrana glabra. Long. 21-24 μ , Lat. 12-14 μ , Lat. isth. 4-4.6 μ .

Hab. **Hokkaido**: Tôro-ko in Kushiro; Ko-numa in Oshima. **Hondo**: Benze-numa, Bora-numa in Mutsu; Moritake-ôtsutsumi, Nishi-numa, Megata, Hirumo-numa, Kariwano in Ugo; Hakuryu-ko in Uzen; Hizume in Rikuchû; Akai-yachi in Iwashiro; western foot of Mt. Yatsugatake (OKADA) in Shinano; Ishigaki-ike, Jôdo-ike in Ise. **Kiushiu**: Yabakei in Bunzen; Ahirain Ôsumi; Imuta-ike in Satsuma. (Pl. XXIV, f. 25)

Distr. Japan, Manchuria, Europe, Spitzbergen, Greenland, N. America.

Cosmarium succisum WEST in Journ. Linn. Soc. Bot. 29, 146, 1892; Monogr. Brit. Desm. 2, 179, 1905.

Cellulae minutae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari; semicellulae subtrapeziformes, angulis lateralibus rotundis, marginibus lateralibus inferioribus leviter convexis, apicibus truncatis rectis cum angulis apicalibus obtusis; a latere visae circulares; a vertice visae ellipticae; membrana glabra. Long. 8.4-13 μ , Lat. 7-12 μ , Lat. isth. 2.8-4.3 μ .

Hab. **Hokkaido** : Onne-numa in Nemuro ; Nikuru-numa in Kitami ; Horomui in Ishikari ; Shizukari in Oshima. **Hondo** : Kurobô-numa in Mutsu ; Aka-numa, Moritake-ôtsutsumi, Megata in Ugo ; Chûkawa-ike, Ôishita, Kaibai-ike in Uzen ; Kirifushi-numa in Rikuzen ; Kagamiishi-mura, Kôriyama in Iwashiro ; Umaushi-numa in Iwaki ; Gôno-ike in Hitachi ; Ôhanami-ike in Shinano ; Takashihara in Mikawa ; Jôdo-ike in Ise ; Fuse-ike, Shinohara-ike in Oomi ; Mizoroga-ike in Yamashiro ; Ikejiri-ike in Tanba. **Kiushiu** : Ahira in Ôsumi. (New to Asia) (Pl. XXII, f. 21)

Distr. British Isles, Germany.

var. **hyalinum** SKVORTZOW in Journ. Bot. **64**, 126, 1926.

Semicellulae plus trapeziformes quam in forma typica, angulis in basim paullo rotundis, marginibus lateralibus plus convergentibus. Long. 11.2-13.4 μ , Lat. 12-12.7 μ , Lat. isth. 4.2 μ .

Hab. **Hondo** : Izu-numa in Rikuzen ; Umaushi-numa in Iwaki ; Kotsutsumi-nishi-ike, Suhara-ike, Ô-numa in Mikawa ; Fuse-ike in Oomi ; Rokujiô, Ko-ike in Yamashiro. (New to Japan) (Pl. XXII, f. 22)

Distr. Manchuria.

Cosmarium incertum SCHMIDLE in BORGE Ark. Bot. **23A**, 39, 1930 ; HIRANO Act. Phytotax. Geobot. **12**, 159, 1943.

Cellulae submediocres, circiter 1½ duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato ; semicellulae subpyramidatae, marginibus lateralibus inferioribus inflatis et late rotundis, et superioribus distincte retusis infra angulos, apicibus convexis cum angulis apicalibus rotundis ; membrana glabra ; a latere visae obverse ovatae. Long. 22.4 μ , Lat. 16.8 μ , Lat. isth. 4.8 μ .

Hab. **Hondo** : Mt. Hira in Oomi. (Pl. XXII, f. 25)

Distr. Japan, Sweden.

Cosmarium Hammeri REINSCH in WOLLE Desm. U. S. 79, 1884 ; WEST Monogr. Brit. Desm. **2**, 181, 1905 ; MIGULA Krypt. Fl. **2**, 432, 1907 ; SCHULZ Bot. Arch. **2**, 130, 146, 1922 ; TAFT Oklah. Biol. Surv. **3**, 295, 1932 ; HIRANO Act. Phytotax. Geobot. **12**, 91, 1943.

Cellulae modicae, subhexagonales, circiter 1.5 longiores quam latae, profunde constrictae, sinu angusto-lineari extremo dilatato et exterius leviter aperto ; semicellulae truncato-pyramidatae, angulis basalibus bene rotundis, marginibus lateralibus inferioribus convexis, marginibus lateralibus superioribus subito convergentibus et leviter retusis, angulis apicalibus rotundis, apicibus rectis leviter convexis raro in medio leviter retusis ; a latere visae

elliptico-ovatae; a vertice visae ellipticae; membrana glabra; chromatophoris axialibus cum pyrenoidibus in unoquaque semicellula. Long. 33.6-50.4 μ , Lat. 25.2-34 μ , Lat. isth. 7.3-15 μ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu; Hakuryu-ko, Ôishita, Mazawano-naga-numa in Uzen; Kagamiishi-mura in Iwashiro; Oze-numa, Ômine-numa in Kôzuke; Ashinota-ike, Daimon-pass in Shinano; Mt. Hira in Oomi; Shakuhachi-ike in Yamashiro. (Pl. XXII, f. 19)

Distr. Japan, Siberia, China, Burma, India, Ceylon, Borneo, Europe, Greenland, N. & S. America, Australia, Africa.

Cosmarium Hammeri is sparsely distributed at the sphagnum-bogs of the mountaineous region in the central and northern Japan, and well coincides with the European description but the forms from Daimon-pass and Ôishita are fairly small by having the cells of Long. 34-35 μ , Br. 25-27 μ , Isthm. 7-7.3 μ however small the form, is already recorded by SIMMER (1901). I have met with a curious form from Imuta-ike that resembles this species but is smaller size and retuse apex. This form resembles the original figure given by BERNARD from Java under the name of *Cosmarium subtumidum* var. *angustius* but his form does not belong to *subtumidum* by the much elongated form of semicell and has a retuse lateral margin. NORDSTEDT has already recorded a *Cosmarium Hammeri* var. *subbinale* from New Zealand and this form and BERNARD's var. *angustius* will probably be of the same species.

var. **protuberans** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 246, 1896; Monogr. Brit. Desm. 2, 62, 1905; OKADA Journ. Imp. Fish. Inst. 30, 167, 1934; FUJISAWA Journ. Jap. Bot. 10, 445, 1934; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 12, 1942.

Cellulae raro minores, circiter 1½ duplo longiores, marginibus lateralibus subito convergentibus et retusis in partem superiorem; a vertice visae ellipticae, lateribus in medio utrobique paullo inflatione; membrana punctata. Long. 25-31 μ , Lat. 19.6-22.4 μ , Lat. isth. 6.2-8.4 μ .

Hab. **Hokkaido**: Notoro-ponto in Kitami; Toyokoro in Tokachi; Nakano near Sapporo, Minenobu, Horomui in Ishikari; Yûfutsu, Numahata in Iburi; Ko-numa, Junsai-numa, Shizukari in Oshima. **Hondo**: Kurobô-numa, Benze-numa, Naga-numa in Mutsu; Naga-numa on Mt. Hachimantai, Hizume in Rikuchû; Hirumo-numa, Moritake-ôtsutsumi, Megata in Ugo; Hakuryu-ko, Ô-numa, Ôishita, Chûkawa-ike in Uzen; Izu-numa, Naga-numa, Kirifushi-numa in Rikuzen; Kagamiishi-mura, Kôriyama, Nogiwanno-kannon-ike, Akaiyachi in Iwashiro; Nanko, Kashima-cho, Umaushi-numa in Iwaki; Ozegahara in Kôzuke; Gôno-ike, Kitaura in Hitachi; Mohara, Onjaga-ike in Kamifusa; Higusa-numa in Shimofusa; Togakushi, Lake Nakatsuna,

Ashinota-ike, Kanori-ike, Ôhanami-ike, Happô-ridge, Yashima-ike of Kirigamine (FUJISAWA) in Shinano; Kotsutsumi-nishi-ike, Suhara-ike, Takashihara in Mikawa; Tamaru, Jôdo-ike, Kanashôzu in Ise; Matsubara-naiko, Shinohara-ike, Fuse-ike in Oomi; Ariga-ike, Mizoroga-ike, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku** : Yodo-mura, Dôgo in Iyo. **Kiushiu** : Yabakei in Bunzen; Imuta-ike, Fukiageno-hama, Kagami-ike, Nakahama of Lake Ikeda in Satsuma; Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XXII, f. 20)

Distr. Japan, Kuriles, Europe, N. America.

Our forms in front view are somewhat different from the WEST's description and figure by having the broad lateral margin and straight apex but the side view of semicell quite coincides with the European form.

var. homalodermum (NORDST.) W. & G. S. WEST in Monogr. Brit. Desm. 2, 182, 1905; ALLORGE Rev. Alg. 5, 356, 1930; CEDERGREN Ark. Bot. 25, 47, 1933; TAYLOR Pap. Mich. Acad. Sci. 19, 253, 1934; INSAM & KRIEGER Hedw. 76, 100, 1937; HIRANO Act. Phytotax. Geobot. 12, 92, 1943.

Cellulae maiores, $1\frac{1}{4}$ - $1\frac{1}{2}$ longiores quam latiores; a vertice visae ellipticae, lateribus in medio utrobique cum inflatione mediana; membrana fine punctata. Long. 64.4μ , Lat. 50.4μ , Lat. isth. 18.2μ .

Hab. **Hondo** : Jiuemon-ike in Kôzuke. (Pl. XXII, f. 21)

Distr. Japan, India, N. Siberia, Europe, Spitzbergen, Greenland, N. America.

Cosmarium Nymanianum GRUN. in WEST Monogr. Brit. Desm. 2, 184, 1905; HIRANO Journ. Jap. Bot. 20, 37, 1944.

Cellulae submediocres, circiter $1\frac{1}{3}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari; semicellulae truncato-pyramidatae, angulis basalibus late rotundis, marginibus lateralibus convexis in parte inferiori et subito retusis in parte superiori, apicibus truncatis leviter convexis, angulis apicalibus rotundis; membrana distincte punctata et scrobiculis magnis conspicue in medio semicellularum ornata; a latere visae subellipticae; a vertice visae rhomboido-ellipticae, lateribus in medio utrobique scrobiculis magnis conspicue ornatis. Long. $31-45\mu$, Lat. $25-34\mu$, Lat. isth. $4-8.4\mu$.

Hab. **Hondo** : Mt. Hakkoda in Mutsu; Megata in Ugo; Hijiori-nagano-uma in Uzen; Kashima-cho in Iwaki; Ôhanami-ike in Shinano; Ishigaki-ike in Ise. **Kiushiu** : Yabakei in Bunzen. (Pl. XXII, f. 31)

Distr. Japan, Ceylon, Europe, N. America.

Cosmarium Nymanianum from Misumi-daira of Mt. Hakkoda is somewhat different from the European forms by having the almost flattened apex (not retuse) and central scrobiculation is not so large as WEST's figure.

Cosmarium quadratum (GAY) De TONI in WEST Monogr. Brit. Desm. 3, 121, 1908; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 39, 1921; SKUJA Act. Horti Bot. Univ. Latv. 3, 169, 1934; INSAM & KRIEGER Hedw. 76, 106, 1937.

Cellulae parvae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari; semicellulae transverse subrectangulares vel subhexagonales, marginibus lateralibus superioribus longioribus quam inferioribus et aliquando paene aequalibus, marginibus lateralibus superioribus leviter setusis convergentibus, angulis apicalibus et basalibus ambobus oblique truncatis, apicibus convexis et retusis in medio; a latere visae circulares; a vertice visae ellipticae; membrana glabra. Long. 15-19.6 μ , Lat. 11.6-16.8 μ , Lat. isth. 3.5-4.2 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro in Tokachi; Tomakomai in Iburi. **Hondo**: Ôishita in Uzen; Izu-numa in Rikuzen; Rokujizo in Yamashiro; Ikejiri-ike in Tanba. (New to Japan) (Pl. XXII, f, 26)

Distr. China, Europe, Australia, Canada.

Cosmarium quadratum from Ikejiri-ike, near Kyoto is somewhat different from the WEST's explanation pl. 72, f. 33 by the narrowly linear sinus, rectangularly hexagonal semicell and more larger size but the form from Rokujizo quite coincides with the WEST's figure of pl. 93, f. 4.

Cosmarium granatum BRÉB. in RALFS Brit. Desm. 96, 1848; NORDSTEDT K. Sv. Vet. Akad. Handl. 22, 56, 1888; WEST Monogr. Brit. Desm. 2, 186, 1905; MIGULA Krypt. Fl. 2, 429, 1907; SMITH Wisc. Bull. 57, 31, 1924; SKUJA Act. Horti Bot. Univ. Latv. 3, 158, 1928; ALLORGE Rev. Alg. 5, 356, 1930; FUJISAWA Journ. Jap. Bot. 10, 443, 1934; OKADA Journ. Imp. Fish. Inst. 30, 166, 1934; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 3, 420, 1936; INSAM & KRIEGER Hedw. 76, 100, 1937; TAFT Ohio Journ. Sci. 45, 195, 1945.

Cellulae parvae, circiter 1½ longiores quam latae, profunde constrictae, sinu angusto-lineari extremo subampliato; semicellulae parum truncato-pyramidatae, angulis basalibus subrectangularibus, marginibus lateralibus inferioribus leviter convexis et paene parallelis, marginibus lateralibus superioribus convexis vel rectis aliquando concavis et convergentibus, apicibus angustis truncatis et leviter convexis; a vertice visae ellipticae; a latere visae elliptico-ovatae; membrana subtiliter punctata. Long. 22.4-38.7 μ , Lat. 15.4-23.7 μ , Lat. isth. 5.6-8.6 μ .

Hab. **Hokkaido**: Chôboshi-numa in Nemuro; Minenobu, Horomui in Ishikari; Yûfutsu in Iburi; Junsai-numa in Oshima. **Hondo**: Benze-numa in Mutsu; Hizume in Rikuchû; Hoso-numa, Kotomo-numa, Karaso-numa, Megata, Hirumo-numa, Nishi-numa in Ugo; Hakuryu-ko, Tamamushi-numa, Kaibai-ike, Chûkawa-ike, Ôishita in Uzen; Kirifushi-numa, Izu-numa in Rikuzen; Kagami-ishi-mura in Iwashiro; Nanko, Umaushi-numa in Iwaki; Gôno-ike in Hitachi: Onjaga-ike, Hakkaku-ike, Mohara in Kamifusa; Higusa-

numa in Shimofusa; Kamaga-ike near Otari, Togakushi, Lake Kizaki, Kanori-ike, Ôhanami-ike, Daizahôshi-ike, Ina (FUJISAWA) in Shinano; Kotsutsumi-nishi-ike, Ônuma, Takashihara in Mikawa; Biwa-ike in Owari; Ishigaki-ike, Jôdo-ike, Tamaru in Ise; Fuse-ike, Matsubara-naiko, Shinohara-ike in Oomi; Takara-ga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamauchi-mura in Sanuki; Matsuyama in Iyo. **Kiushiu**: Yabakei in Bunzen; Nakahama of Lake Ikeda in Satsuma. (Pl. XXII, f. 23)

Distr. Japan, Siberia, China, Manchuria, India, Pamir, Ceylon; Burma, Java, Afghanistan, whole Europe, Iceland, Spitzbergen, Greenland, N. & S. America, Australia, New Zealand, Africa, Madagascar.

var. **subgranatum** NORDST. in WEST Monogr. Brit. Desm. 2, 188, 1905; MIGULA Krypt. Fl. 2, 429, 1907; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 46, 1935; TAFT Ohio Journ. Sci. 45, 195, 1945; IRENÉE-MARIE Nat. Canad. 75, 152, 1948.

Semicellulae cum marginibus lateralibus superioribus distincte 2-undulatis, marginibus lateralibus inferioribus leviter divergentibus vel paene verticalibus, apicibus angustis et rectis. Long. 26.6μ , Lat. 18.7μ , Lat. isth. 6.2μ .

Hab. **Hondo**: Onjaga-ike in Kamifusa. (New to Japan) (Pl. XXII, f. 24)

Distr. Manchuria S. China, Europe, N. and S. America, Sandwich Island, New Zealand.

Cosmarium trilobulatum REINSCH in WEST Monogr. Brit. Desm. 2, 185, 1905; HYLANDER Conn. Bull. 42, 87, 1928; SKVORTZOW Phillip. Journ. Sci. 49, 150, 1932.

Cellulae parvae, circiter 1.5 duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae paullo trilobo-ovatae, incisuris inter lobos retusis, angulis basalibus bene rotundis, apicibus rectis vel leviter convexis cum angulis apicalibus rotundis; a latere visae late subellipticae; a vertice visae ellipticae; membrana glabra. Long. $32\text{--}36.4\mu$, Lat. $21\text{--}22.4\mu$, Lat. isth. 7μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Kôriyama in Iwashiro; Ômine-numa in Kôzuke. (New to Japan) (Pl. XXII, f. 17)

Distr. Korea, Manchuria, whole Europe, U. S. A., Africa, Madagascar, New Caledonia, Brazil.

var. **Printzii** MESSIK. in Viertelj. Naturf. Ges. Zurich. 74, 156, 1929.

Cellulae 1.5 plus longiores quam latiores, ut in euastriforma typica, lobis distinctioribus, sinu angusto-lineari et in apice non aperto, apicibus semicellularum leviter retusis in medio; a latere visae circulares, lateribus non inflatis. Long. $21\text{--}25\mu$, Lat. $14.8\text{--}16.8\mu$, Lat. isth. $4.2\text{--}5.6\mu$.

Hab. **Hokkaido**: Akan-Junsai-numa, Tokotan, Kiritappu in Kushiro;

Nikuru-numa, Shimo-yûbetsu in Kitami; Toyokoro in Tokachi; Tomakomai, Tôasa-numa in Iburi. **Hondo**: Nagatai of Mt. Iwaki in Mutsu; Hachimantai-naga-numa in Rikuchû; Saigo-mura, Ôishita, Chûkawa-ike in Uzen; Kesho-numa, Kobuchi-numa, Naga-numa in Rikuzen; Oze in Kôzuke; Onjaga-ike, Mohara in Kamifusa; Inago of Kitamaki-mura, Kizaki, Lake Nakatsuna in Shinano; Takashihara in Mikawa; Nukigawa near Lake Biwa in Oomi; Shakuhachi-ike, Takaraga-ike, Ariga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Matsuyama in Iyo. (Pl. XXII, f. 18)

Distr. Japan, Switzerland, Norway.

Our form of var. *Printzii* well coincide with the MESSIKOMMER's original description. Prof. SKUJA has reported a smaller form (length $16\text{--}19\mu$, breadth $12\text{--}14\mu$, isthmus $4\text{--}5\mu$) from the westonian island. *Cosmarium urceum* is similar to the *Cosm. tetricum* var. *novizelandicum* but is for smaller than that species.

Cosmarium tetrachondrum LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 38, 1871; BORGE Ark. Bot. 6, 38, 1906; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 35, 1921; DICK Bot. Arch. 3, 221, 1923.

Cellulae parvae, leviter latiores quam longiores, profunde constrictae, sinu angusto-lineari; semicellulae late trapeziformes, angulis basalibus obtuse rotundis, marginibus lateralibus convergentibus leviter convexis et subtiliter crenulato-undulatis, apicibus latis truncatis et rectis; membrana glabra sed granulo parvo singulo supra sinum utrobique ordinata; a vertice visae oblongae, lateribus cum granulis duobus utrobique; a latere visae circulares, lateribus cum granulo parvo ad basim utrobique. Long. 19.6μ , Lat. 22.4μ , Lat. isth. 5.6μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. (New to Asia) (Pl. XXI, f. 9)

Distr. Europe.

Cosmarium galeritum NORDST. var. **minus** WILLE in Bih. K. Sv. Vet. Akad. Handl. 8, 48, 1884; REINSCH Contr. Alg. Fung. 88, 1875; ROY & BISSET Journ. Bot. 24, 195, 1886.

In var. cellulæ dimidiores quam in forma typica. Long. $29\text{--}34\mu$, Lat. $20\text{--}24\mu$, Lat. isth. $5.6\text{--}11\mu$.

Hab. **Hokkaido**: Junsai-numa, Ko-numa in Oshima. **Hondo**: Bora-numa, Kotsutsumi, Nagatai of Mt. Iwaki in Mutsu; Nishi-numa, Megata, Moritake-ôtsutsumi in Ugo; Hizume in Rikuchû; Ôishitano-junsaisutsumi in Uzen; Kôriyama in Iwashiro; Kesho-numa, Izu-numa, Naga-numa in Rikuzen; Kitaura in Hitachi; Jôdo-ike in Ise; Shinohara-ike, Oku-ike of Higashikusano-mura in Oomi. **Shikoku**: Yamada in Tosa. **Kiushiu**: Miyazaki in Hiuga. (Pl. XXII, f. 38, 39)

Distr. Japan, Europe, Argentine.

Cosmarium crispatum HIRANO in Act. Phytotax. Geobot. **14**, 35, 1950.

Cellulae submediocres, subhexagonales, circiter tam longae quam latae, profunde constrictae, sinu angusto-lineari; semicellulae trapeziformes, angulis basalibus rectangularibus cum denticulis minutis ordinatis, marginibus lateralibus convexis leviter undulis in parte inferiori, apicibus truncatis rectis vel paulo convexis cum angulis apicalibus rotundis; membrana glabra cum serie verticalibus crispulorum infra apicem, in centro semicellularum paulo inflata; a latere visae truncato-subcirculares, apice truncato et recto vel leviter retuso, lateribus cum paulo inflatione ad medium utrobique; a vertice visae rhomboides, lateribus cum crenato-inflatione ad medium utrobique, polis truncatis cum denticulis minutis utrobique. Long. et Lat. 28μ , Lat. isth. 8.4μ , Crass. 16.8μ .

Hab. **Hondo**: Fuse-ike in Oomi. (Pl. XXII, f. 37)

Distr. Japan.

Cosmarium subtumidum NORDST. in SCHMIDLE Flora **78**, 52, 1894; WEST Monogr. Brit. Desm. **2**, 192, 1905; KAISER Krypt. Forsch. **1**, 226, 1919; SKUJA Act. Horti Bot. Univ. Latv. **4**, 66, 1929; SKVORTZOW Phillip. Journ. Sci. **49**, 153, 1932; TAYLOR Pap. Mich. Acad. Sci. **19**, 268, 1934; INSAM & KRIEGER Hedw. **76**, 109, 1937.

Cellulae submediocres, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subdilatato; semicellulae pyramidato-semicirculares, marginibus lateralibus convexis, angulis basalibus bene rotundis, angulis apicalibus late rotundatis, apicibus truncatis rectis vel leviter convexis; a latere visae circulares; a vertice visae ellipticae. Long. $28\text{-}39\mu$, Lat. $21\text{-}33.6\mu$, Lat. isth. $8.4\text{-}14\mu$.

Hab. **Hokkaido**: Kiritappu in Kushiro; Kamikoshi-ukishimahara, Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Mt. Iwaki in Mutsu; Hijiori-naga-numa in Uzen; Nanko, Umaushi-numa in Iwaki, Akaiyachi in Iwashiro; Oze in Kôzuke; Kitaura in Hitachi; Mt. Naeba, Kurosawano-ike, Kôyano-ike of Mt. Myôko in Echigo; Shiga-kôgen, Daimon-pass, Kirigamine, Inago of Kitamaki-mura in Shinano; Takashihara, Kotsutsumi-nishi-ike, Ô-numa in Mikawa; Fuse-ike, Matsubara-naiko, Mt. Hira in Oomi; Mizoroga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. (Pl. XXII f. 7)

Distr. Japan, Korea, Siberia, Europe, Greenland, N. & S. America, central Africa.

forma **minor** KRIEGER in Arch. Hydrobiol. Suppl. **11**, 187, 1932; HIRANO Act. Phytotax. Geobot. **12**, 161, 1943.

Forma tertia pars quam in forma typica, sinu non profundiore. Long.

$11-25\mu$, Lat. $11-19.6\mu$, Lat. isth. $4.2-5.6\mu$.

Hab. **Hokkaido**: Mt. Daisetsu in Ishikari. **Hondo**: Moritake-ôtsutsumi, Kawashiri in Ugo; Oze in Kôzuke; Gôno-ike, Kitaura in Hitachi; Kanori-ike in Shinano; Mt. Hira in Oomi. (Pl. XXII, f. 10)

Distr. Japan, Java, Sumatra.

var. **rotundum** HIRANO in Act. Phytotax. Geobot. 14, 70, 1951.

Semicellulae subtrapeziformi-semicirculares, apice convexo raro leviter recto. Long. 29.4μ , Lat. 21μ , Lat. isth. 7μ .

Hab. **Hondo**: Chûkawa-ike in Uzen. (Pl. XXII, f. 8)

Distr. Japan.

var. **Klebsii** (GUTW.) W. & G. S. WEST in Monogr. Brit. Desm. 2, 193, 1905; KAISER Krypt. Forsch. 1, 381, 1924; SKVORTZOW Arch. Hydrobiol. 19, 168, 1928; TAYLOR Pap. Mich. Acad. Sci. 20, 162, 1935; TAFT Ohio Journ. Sci. 45, 200, 1945.

Semicellulae plus reniforme-semicirculares, angulis basalibus bene rotundioribus, lateribus convergentibus, apicibus angustis leviter convexis. Long. $30.8-47.3\mu$, Lat. $30.8-43\mu$, Lat. isth. $8.4-12\mu$.

Hab. **Hokkaido**: Kiritappu, Lake Tôro, Tokotan in Kushiro; Koetoi-konuma in Kitami; Yasuushi in Teshio. **Kiushiu**: Kagami-ike in Satsuma. (New to Japan) (Pl. XXII, f. 9)

Distr. Siberia, Europe, New Foundland.

Cosmarium nitidulum De NOT. var. **pseudorectangulare** MESSIK. in Hedw. 78, 172, 1938.

Cellulae longiores; semicellulae plus rotundo-pyramidatae vel subrectangulari-reniformes, marginibus lateralibus inferioribus convexis, superioribus valide convergentibus, angulis apicalibus late rotundis apicibus angustis leviter convexis. Long. 50.4μ , Lat. 34.3μ , Lat. isth. 16.8μ .

Hab. **Hondo**: Kurobo-numa in Mutsu. (New to Asia) (Pl. XXII, f. 28)

Distr. Switzerland.

var. **subundatum** SCHMIDLE in DICK Mitt. Pfälz Ver. Nat. Pollichia 3, 130, 1930.

Semicellulae semicirculares, marginibus leviter undulatis; a vertice visae oblongo-ellipticae, lateribus in medio utrobique cum inflatione; membrana distincte punctata. Long. $40-45\mu$, Lat. $29-34\mu$, Lat. isth. $8.5-13.7\mu$.

Hab. **Hondo**: Kitaura in Hitachi; Hakkaku-ko in Kamifusa; Ôniu-ike on Mt. Norikura in Etchû. (Pl. XXIII, f. 1)

Distr. Switzerland.

Cosmarium nitidulum var. *subundatum* from the Ôniu-ike, Japanese

Alps, is somewhat variable in apex. The apex of semicell is sometimes broadly biundulate and is sometimes equally 4-undulated.

Cosmarium variolatum LUND. var. **foraminum** HIRANO in Act. Phytotax. Geobot. 14, 36, 1950.

Cellulae truncato-ellipticae; semicellulae truncato-pyramidatae, apice truncato-recto non rotundo, marginibus lateralibus convexis convergentibus; membrana cum ocella mediana; a latere visae ellipticae. Long. 28 μ , Lat. 18.2 μ , Lat. isth. 5.6 μ .

Hab. **Hondo** : Ishigaki-ike in Ise. (Pl. XXII, f. 27)

Distr. Japan.

Cosmarium pseudopyramidatum LUND. in NORDSTEDT K. Sv. Vet. Akad. Handl. 22, 54, 1888; WEST Monogr. Brit. Desm. 2, 201, 1905; HOMFELD Pflanz. 12, 51, 1929; ALI. ORGE Rev. Alg. 5, 359, 1930; TAYLOR Pap. Mich. Acad. Sci. 19, 261, 1934; BORGE Ark. Bot. 28A, 36, 1936; KRIEGER Ber. Dtsch. Bot. Ges. 54, 85, 1936; INSAM & KRIEGER Hedw. 76, 106, 1937.

Cellulae mediocres, circiter 1½ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae truncato-pyramidatae vel truncato-semiellipticae, angulis in basim rotundis, marginibus lateralibus convexis, apicibus anguste truncatis, angulis apicalibus obtusis; a latere visae ellipticae; membrana punctata; chromatophoris axialibus cum pyrenoide singulo in unaquaque semicellula. Long. 42-61 μ , Lat. 25.3-41 μ , Lat. isth. 12.6-14 μ .

Hab. **Hokkaido** : Chôbushi-numa, Okineppe in Nemuro; Tôro-ko, Kirittappu in Kushiro; Sarufutsu in Kitami; Toyokoro-konuma in Tokachi; Horomui in Ishikari; Tomakomai, Shiraoi-poroto-numa, Tôasa-numa, Yûfutsu, Numanohata in Iburi. **Hondo** : Kurobo-numa, Kotsutsumi, Benze-numa in Mutsu; Hosono-numa, Kotomo-numa, Megata, Moritake-ôtsutsumi, Mt. Komagatake in Ugo; Hakuryu-ko, Kaibai-ike, Hijiori-naga-numa, Ôishita in Uzen; Izu-numa, Kesho-numa in Rikuzen; Hibushi-numa, Kashima-cho, Nanko, Ojiroi, Umaushi-numa in Iwaki; Mt. Azuma, Numano-taira of Mt. Bandai, Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Mt. Akagi, Ômine-numa in Kôzuke; Senjôgahara in Shimotsuke; Kôridonono-ike in Echigo; Mt. Tateyama, Kumono-taira, Mt. Kaminotake in Etchû; Inago of Kitamakimura, Happô-ridge, Ôhanami-ike, Karuisawa, Shirouma-ôike, Tengunohara, Mt. Kazafuki, Ashinota-ike, Kizaki in Shinano; Hichimenzan in Kai; Tanukinuma in Suruga; Takashihara, Kotsutsumi-nishi-ike in Mikawa; Kanashôzu, Ishigaki-ike in Ise; Shinohara-ike, Fuse-ike in Oomi. **Kiushiu** : Yabakei in Bunzen; Imuta-ike in Satsuma; Koshiki-ike, Byakushi-ike of Mt Kirishima in Hiuga. (Pl. XXIII, f. 5, 8)

Distr. Japan, Siberia, Thailand, India, Ceylon, Java, whole Europe, Spitzbergen, N. & S. America, Australia, Africa, Madagascar.

var. **stenonotum** NORDST. forma **minor** RACIB. in WEST Linn. Soc. Bot. **30**, 267, 1894.

Cellulae minores. Long. 28-42 μ , Lat. 23.8-25.4 μ , Lat. isth. 9.8-11.3 μ .

Hab. **Hondo**: Sugigamine of Mt. Zawo in Uzen; Mt. Tateyama in Etchū; Ishigaki-ike in Ise. **Shikoku**: Yamauchi-mura in Sanuki. (Pl. XXIII, f. 7)

Distr. West India.

var. **carniolicum** LÜTKEM. in MIGULA Krypt. Fl. **2**, 427, 1907; INSAM & KRIEGER Hedw. **76**, 106, 1937.—*Cosm. pseudopyramidatum* LUND. in DICK Bot. Arch. **3**, 220, 1923.

Cellulae 1.5 longiores quam latiores, marginibus lateralibus leviter recurvatis in medio, apicibus late rotundis vel leviter convexis, raro rectis. Long. 46-59 μ , Lat. 29-34 μ , Lat. isth. 12.6-14 μ .

Hab. **Hondo**: Koke-numa in Ugo; Chūkawa-ike in Uzen; Oze in Kōzuke; Daimon-pass, Kirigamine in Shinano; Mizoroga-ike in Yamashiro. (Pl. XXIII, f. 6)

Distr. Japan, Europe.

This variety is sparsely distributed in *sphagnum* bogs of mountain areas in Japan.

Cosmarium pseudonitidulum NORDST. var. **validum** W. & G. S. WEST in Monogr. Brit. Desm. **2**, 196, 1905; TAYLOR Pap. Mich. Acad. Sci. **19**, 261, 1934; HIRANO Bot. Mag. **66**, 131, 1953.

In var. cellulae maiores, ellipticae; angulis basalibus subrectangularibus non rotundis; a latere visae ellipticae; membrana punctata. Long. 56-70 μ , Lat. 39-48 μ , Lat. isth. 14-17 μ .

Hab. **Hokkaido**: Akan-junsai-numa in Kushiro; Tomakomai in Iburi. **Hondo**: Moritake-ōtsutsumi, Koke-numa, Mt. Komagatake in Ugo; Ojiroi, Kashima-cho, Umaushi-numa in Iwaki; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Oze in Kōzuke; Usagishima in Shimotsuke; Tarobei-daira in Etchū; Happō-ridge, Ōhanami-ike, Daimon-pass, Kirigamine, Inago of Kitamaki-mura in Shinano; Ishigaki-ike in Ise; Matsubara-naiko, Fuse-ike, Mt. Hira in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXIII, f. 9)

Distr. Japan, India, Ceylon, Malay, Borneo, Europe, Canada, Azores, W. Africa.

Cosmarium pyramidatum BRÉB. in RALFS Brit. Desm. 94, 1848; WEST Monogr. Brit. Desm. **2**, 199, 1905; MIGULA Krypt. Fl. **2**, 426, 1907; TAYLOR Pap. Mich. Acad. Sci. **19**,

264, 1934; INSAM & KRIEGER Hedw. 76, 106, 1937; PRESCOTT Pap. Mich. Acad. Sci. 23, 209, 1938; HIRANO Jap. Journ. Bot. 14, 228, 1954.

Cellulae submagnae, truncato-ellipticae, 1.5 longiores quam latae, profunde constrictae, sinu angusto-lineari superius leviter dilatato: semicellulae truncato-pyramidatae, angulis basalibus rotundis, marginibus lateralibus convexis, angulis apicalibus obtusis, apicibus angusto-truncatis vel leviter convexis; a latere et vertice visae ellipticae; membrana punctata; chromatophoris axialibus cum pyrenoidibus binis in unaquaque semicellula. Long. 64.4-95 μ , Lat. 42-56 μ , Lat. isth. 14-19.6 μ .

Hab. **Hokkaido**: Kiritappu, Akan-junsai-numa in Kushiro. **Hondo**: Mt. Hakkoda in Mutsu; Hosono-numa, Hirumo-numa in Ugo; Hachimantai-nagano-numa in Rikuchû; Kesho-numa in Rikuzen; Ojiroi in Iwaki; Ômine-numa, Jiuemon-ike in Kôzuke; Kitaura in Hitachi; Daimon-pass, Ôhanami-ike, Inago of Kitamaki-mura in Shinano; Ishigaki-ike, Kanashôzu in Ise; Mt. Hira in Oomi; Ko-ike, Takaraga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Kôga-muta of Aso in Higo. (Pl. XXIII, f. 10-12)

Distr. Japan, India, Ceylon, whole Europe, N. & S. America, W. Africa, Azores.

Cosmarium lapponicum BORGE var. **undulatum** BORGE in Bot. Notis. 19, 1913.

Semicellulae obverse subtrapeziformes, marginibus lateralibus convexis convergentibus; membrana cum punctulis in serie radiali ordinata. Long. 26.6 μ , Lat. 22.4 μ , Lat. isth. 8.4 μ .

Hab. **Hondo**: Mt. Akagi in Kôzuke; Takayachi of Mt. Myôko in Echigo. (New to Asia) (Pl. XXIII, f. 20)

Distr. Sweden.

var. **granulatum** HIRANO in Act. Phytotax. Geobot. 14, 36, 1950.

Membrana granulata, granulis in serie transversalibus ordinatis, granulis medianis leviter magnis. Long. 20.2 μ , Lat. 18.2 μ Lat. isth. 5.6 μ .

Hab. **Hondo**: Midoriga-ike on Mt. Yatsugatake in Shinano. (Pl. XXIII, f. 17)

Distr. Japan.

Cosmarium venustum (BRÉB.) ARCH. in WEST Monogr. Brit. Desm. 3, 8, 1908; INSAM & KRIEGER Hedw. 76, 110, 1937; OKADA ASAHIKA's Inkwa. 165, 1939.

Cellulae submediocres, circiter 1.5 duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae truncato-pyramidatae, marginibus lateralibus 3-undulatis cum angulis basali-

bus et apicalibus rotundatis, apicibus truncatis et retusis; a latere visae elliptico-oblongae, lateribus aliquando paene parallelis in parte inferiore, partibus superioribus late rotundatis et conicis; a vertice visae ellipticae; membrana subtiliter punctata. Long. 25-37.8 μ , Lat. 17-23.8 μ , Lat. isth. 5.6-7.8 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Ômine-numa in Kôzuke. (New to Japan) (Pl. XXII, f. 32)

Distr. Kuriles, Siberia, India, Java, whole Europe, U. S. A., S. America, Australia, Azores.

forma minor WILLE in WEST Monogr. Brit. Desm. 3, 10, 1908; STRÖM Nyt. Mag. Naturv. 57, 31, 1919; HIRANO Jap. Journ. Bot. 14, 228, 1954.

Forma minor; membrana subtiliter punctata. Long. 23 μ , Lat. 16.8 μ , Lat. isth. 5.6 μ .

Hab. **Hokkaido**: Horomui, Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari; Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Hachiman-numa of Mt. Hachimantai in Mutsu; Moritake-ôtsutsumi, Hirumonuma, Mt. Komagatake, Mt. Kurikoma in Ugo; Yatsumanako of Mt. Iwate in Rikuchû; Mt. Gassan, Ôishitano-junsaitsumi in Uzen; Numano-taira of Mt. Bandai in Iwashiro; Oze, Ômine-numa in Kôzuke; Kurosawano-ike, Takayachi of Mt. Myôko, Mt. Naeba in Echigo; Mt. Eboshi, Kumonotaira, Kurobe-gorodake, Sennin-ike in Etchû; Shigakôgen, Daimon-pass, Kirigamine, Inago of Kitamaki-mura, Happô-ridge, Mt. Kazafuki, Shirouma-ôike, Tenguno-hara in Shinano; Ô-numa in Mikawa; Ariga-ike in Yamashiro. **Kiushiu**: Miyazaki in Hiuga. (Pl. XXII, f. 34, 35)

Distr. Japan, Siberia, India, Sumatra, Europe, U. S. A., Africa, Australia.

var. brevius BERNARD in Dep. agr. Indes. Néerl. 92, 1908—*Cosm. Meneghinii* BRÉB. forma MÖBIUS in Flora 75, 443, 1892.

Semicellulae undulato-trapeziformes, apice truncato recto vel leviter convexo, marginibus lateralibus 4-undulatis. Long. 26.6 μ , Lat. 18.2 μ , Lat. isth. 4.2 μ .

Hab. **Hondo**: Akaiyachi in Iwashiro. (New to Japan) (Pl. XXII, f. 33)

Distr. Java, Australia.

Cosmarium garrolense ROY & BISSET in WEST Monogr. Brit. Desm. 3, 12, 1908; KAISER Krypt. Forsch. I, 379, 1924; DICK Mitt. Pfälz. Ver. Pollichia. 3, 127, 1930; MESSIKOMMER Viertelj. Naturf. Ges. Zurich. 80, 46, 1935.

Cellulae submediocres, leviter longae quam latae, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae subsemicirculares, marginibus subundulatis, undulis lateralibus 5 (cum angulis basalibus et

apicalibus), apicibus truncatis et rectis aliquando leviter retusis, angulis apicalibus et basalibus obtuse rotundis; membrana delicatissime punctata; a latere visae subcirculares; a vertice visae ellipticae. Long. 35μ , Lat. 28μ , Lat. isth. 9.8μ .

Hab. **Hokkaido**: Okineppe in Nemuro; Toyokoro in Tokachi. **Hondo**: Higusa-numa in Shimofusa; Onjaga-ike in Kamifusa; Gôno-ike in Hitachi. (New to Japan) (Pl. XXIII, f. 2)

Distr. S. China, India, Europe, U. S. A.

Cosmarium sublatere-undatum W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 60, 1895.—*forma* WEST in Ann. Roy. Bot. Gard. Calcutta 6, 202, 1907.

Cellulae submediocres, circiter longae quam latae, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae semicirculari-subpyramidatae, marginibus lateralibus convexis undulis circ. 6–7 utrobique ordinatis, apicibus paene rectis vel leviter biundulatis, angulis basalibus rotundis; a vertice visae ellipticae, polis aliquantum undulatis; a latere visae circulares. Long. $39\text{--}43\mu$, Lat. $35\text{--}43\mu$, Lat. isth. $11\text{--}13\mu$.

Hab. **Hondo**: Hizume in Rikuchû; Nogiwano-kwannon-ike in Iwashiro; Kamaga-ike of Otari, Lakes Kizaki and Nakatsuna in Shinano. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Japan) (Pl. XXIII, f. 14, 15)

Distr. Burma, Madagascar.

Cosmarium cymatopleurum NORDST. var. **tyrolicum** NORDST. in WEST Monogr. Brit. Desm. 3, 6, 1908; SKUJA Symb. Sinica 1, 88, 1937; MESSIKOMMER Viertelj. Naturf. Ges. Zurich. 80, 45, 1935; HIRANO Act. Phytotax. Geobot. 12, 89, 1943.

Cellulae leviter maiores; semicellulae subpyramidato-ellipticae, marginibus aequalibus undulatis, undulis granulato-formibus in seriebus concentricis ad marginem, minoribus et indistincte in medio ordinatis, apicibus non productis et angustis leviter retusis; membrana distincte punctata; a latere visae elliptico-ovatae. Long. $89\text{--}90\mu$, Lat. $64\text{--}65\mu$, Lat. isth. $22\text{--}23\mu$, Crass. 40μ .

Hab. **Hokkaido**: Numanohata in Iburi. **Hondo**: Oze-numa in Kôzuke. (Pl. XXIII, f. 3, 4)

Distr. Japan, China, Europe.

Cosmarium raeticum MESSIKOMMER in Viertelj. Naturf. Ges. Zurich. 80, 49, 1935; HIRANO Jap. Journ. Bot. 14, 228, 1954.

Cellulae parvae, leviter longiores quam latae, modice constrictae, sinu angusto-lineari exterius leviter aperto; semicellulae subpyramidatae vel subellipticae, marginibus undulatis, undulis lateralibus 4 (cum angulis apicalibus et basalibus), apicibus truncatis 4-undulatis (cum duobus angulis apicalibus) et undulis medianis duabus leviter depresso, angulis ad apicem et ad basim rotundis; a latere visae subcirculares vel rotundato-ovatae; a

vertice visae ellipticae; membrana glabra. Long. 16.8-25 μ , Lat. 14.8-21 μ , Lat. isth. 5.6-6 μ .

Hab. **Hokkaido**: Tokotan, Tôro in Kushiro. **Hondo**: Mt. Hakkoda, Nagatai in Mutsu; Koke-numa in Ugo; Chûkawa-ike in Uzen; Akaiyachi in Iwashiro; Ozegahara in Kôzuke; Kirigamine in Shinano; Takashihara in Mikawa. (Pl. XXIII, f. 13)

Distr. Japan, Switzerland.

Cosmarium fuseense HIRANO in Act. Phytotax. Geobot. 14, 36, 1950.

Cellulae minutae, leviter longae quam latae, profunde constrictae, sinu angusto-lineari; semicellulae crenato-trapeziformes, marginibus lateralibus tricrenatis cum angulis apicalibus et basalibus rotundis, apicibus truncatis rectis et 4-crenatis; membrana serie horizontalibus leviter curvatis scrobiculorum trans medium semicellularum ordinata, scrobiculis medianis in centro supra isthmum; a latere visae circulares; a vertice visae ellipticae; chromatophoris axialibus cum pyrenoidibus singulis. Long. 14 μ , Lat. 12.6 μ , Lat. isth. 3.6 μ .

Hab. **Hondo**: Fuse-ike in Oomi. (Pl. XXV, f. 44)

Distr. Japan.

Cosmarium subortogonum RACIB. in Pamietn. Wydz. mat-przyr. Akad. Um. Krakow. 17, 13, 1889; HIRANO Jap. Journ. Bot. 14, 228, 1954.

Cellulae parvae, circiter 1.5 longiores quam latores, profunde constrictae, sinu angusto-lineari; semicellulae late octagono-ovatae, marginibus et apicibus aequalibus crenatis, crenis 7 in toto marginem, angulis omnibus leviter rotundis, apicibus retusis, crenis lateralibus infimis divergentibus, partibus latissimis semicellularum prope medium ornatis; membrana glabra; a latere et vertice visae ellipticae. Long. 21-22.4 μ , Lat. 15.4-16.8 μ , Lat. isth. 4.3-5.6 μ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi. **Hondo**: Mt. Kurikoma in Ugo; Ôishita in Uzen; Gôno-ike in Hitachi; Ishigaki-ike, Jôdo-ike in Ise. **Shikoku**: Yodo-mura, Matsuyama in Iyo; Sumiyoshi-ike in Tosa. (Pl. XX, f. 31)

Distr. Japan, Switzerland, Poland.

Cosmarium crenatum RALFS var. **bicrenatum** NORDST. in MIGULA Krypt. Fl. 2, 444, 1907; INSAM & KRIEGER Hedw. 76, 98, 1987.

Var. semicellulae cum crenis marginibus lateralibus duabus utrobique ordinatae; membrana cum prominentis scrobiculis tribus irregulariter ordinata. Long. 16.8 μ , Lat. 12.6 μ , Lat. isth. 7 μ .

Hab. **Hondo**: Mt. Kanpu in Ugo. (New to Japan) (Pl. XXIII, f. 19)

Distr. Central Europe, N. Siberia, Spitzbergen.

Cosmarium crenatum var. *bicrenatum* in our country is different from the European forms represented by INSAM & KRIEGER in possession of distinct three scrobiculations which are disposed irregularly and asymmetrically on the face of semicell.

Cosmarium notabile BRÉB. forma **arcticum** KOSSINSKAJA in Act. Inst. Bot. Acad. Sci. URSS, II: 1, 41, 51, 1933; HIRANO Bot. Mag. 66, 132, 1953.

In forma cellulæ maiores, marginibus lateralibus 6-undulatis (cum angulis apicalibus et basalibus), apicibus convexo-biundulatis (sine angulis apicalibus). Long. 35μ , Lat. 23.8μ , Lat. isth. 12.6μ .

Hab. **Hondo**: Ôniu-ike on Mt. Norikura in Etchû. (Pl. XXIII, f. 18)
Distr. Japan, Siberia.

Cosmarium humile (GAY) NORDST. var. **striatum** (BOLDT) SCHMIDLE in WEST Monogr. Brit. Desm. 3, 223, 1908; TAYLOR Pap. Mich. Acad. Sci. 19, 254, 1934; TAFT Ohio Journ. Sci. 45, 195, 1945. —— *Cosm. striatum* BOLDT in ROY & BISSET Journ. Bot. 24, 195, 1886.

Var. membrana sine granulis, angulis apicalibus non emarginatis, in centro glabra. Long. 30μ , Lat. 28μ , Lat. isth. 8.6μ .

Hab. **Hondo**: Aka-numa in Ugo. (Pl. XXIII, f. 16)
Distr. Japan, Siberia, Malay, Europe, N. America, Patagonia.

Sect. Quadratiformes CEDERGREN emend. HIRANO

Cosmarium Sect. **Quadratiformes** CEDERGREN in Ark. Bot. 25A: 4, 44, 1933 (pro parte)
— Sect. **Teragoni** CEDERGREN in l. c. 25A: 4, 52, 1933 (pro parte)

Cellulæ quadratae, profunde constrictæ; semicellulae rectangulares vel subrectangulares.

- 1a. Margine semicellularum integro.
- 2a. Margine laterali concavo, raro recto.
- 3a. Cellulæ tam longæ quam latae vel leviter longiores quam latores.
 - *C. norimbergense*
 - 4a. Cellulæ circiter 1.5 plus longiores quam latores f. *typica*
 - 4b. Cellulæ circiter tam longæ quam latae f. *depressa*
- 3b. Cellulæ circiter duplo longiores quam latores.
 - 4a. Margine laterali distincte concavo, apice dilatato.
 - 5a. Cellulæ $38-58\mu$ in longitudinem, in vertice visae elongato-ovatae cum apice rotundo *C. decedens*
 - 6a. Membrana punctata, angulis apicalibus acute rotundis f. *typica*
 - 6b. Membrana glabra, angulis apicalibus rotundioribus var. *sinuosum*
 - 5b. Cellulæ $25-35\mu$ in longitudinem, in vertice visae ovato-quadratae cum apice truncato *C. anceps*
- 4b. Margine laterali paulo retuso, raro recto, apice attenuato.
 - 5a. Cellulæ modice constrictæ *C. quadratum*

- 6a. Margine laterali retuso supra sinum f. *typica*
 6b. Margine laterali non retuso supra sinum f. *Willei*
 5b. Cellulae profunde constrictae.
 6a. Margine laterali magnopere biundulato, infra apicem glabro
 C. *tetragonum* var. *Lundellii*
 6b. Margine laterali integro, infra apicem cum linea horizontali
 C. *pseudobinerve*
 4c. Margine laterali bicrenulato, crenis superioribus minoribus
 C. *Holmiense* var. *integrum*
- 2b. Margine laterali convexo vel recto.
 3a. Angulis apicalibus rotundis.
 4a. Cellulae magnae, 110-120 μ in longitudinem C. *divergentiforme*
 4b. Cellulae modicae, 48-60 μ in longitudinem C. *plicatum*
 4c. Cellulae parvae, 14-40 μ in longitudinem.
 5a. Margine cellularum integro.
 6a. Membrana glabra.
 7a. Cellulae circiter 1.5-1.8 plus longiores quam latiores, sinu paulo aperto
 C. *exiguum*
 8a. Cellulae angustae f. *typica*
 8b. Cellulae latae var. *subrectangulum*
 7b. Cellulae circiter duplo longiores quam latiores, sinu angusto-lineari
 C. *pseudoexiguum*
- 6b. Membrana punctata.
 7a. Membrana cum punctulis in serie transversali ordinata
 C. *difficile* var. *sublaeve*
 7b. Membrana cum punctulis duriter et irregulariter ordinata
 C. *synthlibomenum* var. *montanum*
- 5b. Margine cellularum undulato C. *pericymatium*
- 3b. Angulis apicalibus non rotundis.
 4a. Cellulae sine papilla ad medium semicellularum.
 5a. Semicellulae rectangulares, apice recto C. *minimum*
 6a. Angulis apicalibus et basalibus non rotundis, sinu linearis aperto
 f. *typica*
 6b. Angulis apicalibus et basalibus rotundis, sinu angusto-lineari
 var. *rotundatum*
 5b. Semicellulae pyramidato-rectangulares, apice late retuso C. *pusillum*
 4b. Cellulae cum papilla mediana ordinata C. *geometricum*
 5a. Semicellulae truncato-pyramidae, in vertice visae ellipticae ... f. *typica*
 5b. Semicellulae subhexagonales, in vertice visae hexagonae ... var. *sueicum*
- 3c. Angulis apicalibus oblique truncatis.
 4a. Cellulae parvae, 14-30 μ in longitudinem.
 5a. Margine laterali inferiori recto et parallelo C. *angulosum*
 6a. Cellulae longae, 14-28 μ in longitudinem f. *typica*
 6b. Cellulae breves, 10-13 μ in longitudinem var. *concinnum*
 5b. Margine laterali inferiori divergente
 C. *pseudoexiguum* var. *hexagonum*
 5c. Margine laterali inferiori leviter convergente var. *retusum*
 4b. Cellulae magnae, 37-47 μ in longitudinem C. *rectangulare*
 5a. Margine laterali inferiori recto et parallelo f. *typica*
 5b. Margine laterali inferiori leviter divergente, apice angustiore quam
 forma typica var. *africanum*

- 1b. Margine semicellularum undulato vel crenato.
 2a. Sinu rotundo et excavato, apice triundulato cum denticulis ordinato C. Regnési
 2b. Sinu acuto conico, apice 4-undulato sine denticulis ... C. cymatonotophorum

Cosmarium norimbergense REINSCH in WEST Monogr. Brit. Desm. 3, 52, 1908;
 ALLORGE Rev. Alg. 5, 357, 1930; HIRANO Journ. Jap. Bot. 20, 37, 1944.

Cellulae parvae, circiter $1\frac{1}{4}$ longiores quam latae, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae subquadratae, angulis apicalibus et basalibus rotundis, marginibus lateralibus distincte retusis, apicibus rectis vel leviter retusis; a vertice visae ellipticae; membrana glabra. Long. $14-18\mu$, Lat. $12-14\mu$, Lat. isth. $4.5-5\mu$.

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi; Kumoigahara of Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Lake Kizaki in Shinano; Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Bôgatsuru of Mt. Kujû in Bungo. (Pl. XXIV, f. 10)

Distr. Japan, Thailand, Ceylon, Europe, New Zealand, central Africa.

forma **depressa** W. & G. S. WEST in Journ. Bot. 35, 119, 1897; Monogr. Brit. Desm. 3, 53, 1908; KAISER Krypt. Forsch. 1, 437, 1926; HUBER-PESTALOZZI Arch. Hydrobiol. 19, 697, 1928; PRESCOTT & MAGNOTTA Pap. Mich. Acad. Sci. 20, 160, 1935.

Cellulae minores, circiter tam longae quam latae; semicellulae depressae. Long. $11-15.4\mu$, Lat. $9.8-12.6\mu$, Lat. isth. $3.6-4.2\mu$.

Hab. **Hokkaido**: Toyokoro in Tokachi. **Hondo**: Kurobo-numa in Mutsu; Onjaga-ike in Kamifusa; Hichimenzan-ôike in Kai; Biwa-ike in Owari. **Shikoku**: Matsuyama in Iyo. (New to Japan) (Pl. XXIV, f. 8, 9)

Distr. Thailand, Burma, Ceylon, Corsica, British Isles, Germany, central Africa, U. S. A.

Cosmarium decedens (REINSCH) RACIB. in Pam. Wydz. Mat.-Przyr. Akad. Umiej. 17, 8, 1889 (repr.); WEST Monogr. Brit. Desm. 3, 43, 1908; KAISER Krypt. Forsch. 1, 378, 1924; MESSIKOMMER Viertelj. Naturf. Ges. Zurich. 73, 207, 1928; ALLORGE Rev. Alg. 5, 355, 1930; OKADA Bot. Mag. 50, 315, 1936; KRIEGER Ber. Dtsch. Bot. Ges. 54, 84, 1936; INSAM & KRIEGER Hedw. 76, 100, 1937; HIRANO Jap. Journ. Bot. 14, 227, 1954. — *Didymidium (Cosmarium) plicatum* REINSCH in Abh. Naturh. Ges. Nurnb. 3, 109, 1867.

Cellulae modicae, circiter duplo longiores quam latiores, modice constrictae, sinu paullo aperto sed in apice angusto-lineari; semicellulae subrectangulares, marginibus lateralibus concavis, angulis basalibus leviter protuberantibus et rotundis, angulis apicalibus rotundis, apicibus latis et concavis; a latere visae elongato-ellipticae, non constrictae in medio vel leviter retusis; a vertice visae late ellipticae vel subcirculares cum polis distincte productis; membrana punctata; chromatophoris axialibus cum pyrenoidibus

centralibus in unoquaque semicellula. Long. 42-56 μ , Lat. 21-27 μ , Lat. isth. 12.6-19.6 μ .

Hab. **Hokkaido**: Kamikoshi-ukishimaga-hara, Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Ôyachi of Hachimantai in Rikuchû; Mt. Komagatake in Ugo; Mt. Gassan in Uzen; Mt. Azuma in Iwashiro; Ozegahara in Kôzuke; Mt. Eboshi, Kumonotaira, Kurobe-goro-dake, Tarobei-daira, Tsuruga-ike of Mt. Norikura, Mt. Tateyama in Etchû; Happô-ridge, Shirouma-ôike, Tengunohara in Shinano. (Pl. XXIV, f. 13)

Distr. Japan, Java, Europe, Faeroes, Nova Zembla.

The apical angle of our forms of *Cosmarium decedens* is sometimes more prominent and rounded and also produced than the form of European species. This species is found only on the moors of alpine and subalpine regions in our country.

var. **sinuosum** (LUND.) RACIB. in WEST Monogr. Brit. Desm. 3, 44, 1908.

Var. **angulis** apicalibus rotundioribus, constrictione profundioribus, membrana glabra. Long. 39 μ , Lat. 23 μ , Lat. isth. 14 μ .

Hab. **Shikoku**: Yamada in Tosa. (New to Asia) (Pl. XXIV, f. 14)

Distr. Europe, Nova Zembla, U. S. A.

Cosmarium anceps LUND. in WEST Monogr. Brit. Desm. 3, 47, 1908; SKUYA Act. Horti Bot. Univ. Latv. 4, 55, 1929; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 1, 41, 1933, INSAM & KRIEGER Hedw. 76, 97, 1937; HIRANO Bot. Mag. 66, 132, 1953.

Cellulae parvae, circiter 1.5 longiores quam latae, modice constrictae, sinu aperto acutangulo; semicellulae subquadratae, marginibus lateralibus valide retusis, parte basali et apicali semicellularum dilatatis, angulis basali-bus rotundis, angulis apicalibus subacute rotundis, apicibus convexis et in medio retusis; a latere visae quadratae, lateribus et apicibus paene rectis, sed leviter convexis. Long. 25 μ , Lat. 16.8 μ , Lat. isth. 12 μ .

Hab. **Hondo**: Ôniu-ike on Mt. Norikura in Etchû. (Pl. XXIV, f. 22)

Distr. Japan, Europe, Spitzbergen, Greenland, Nova Zembla, N. America.

Cosmarium anceps of our country especially from the Japanese Alps, is somewhat different from the European form given by W. & G. S. WEST because the semicell is dilated and somewhat produced at its apex which is reuse or flattened, while in British form the semicell is narrowed toward the apex. The vertical view of cell almost narrowly rectangular and with a faint notch at the middle on each side.

Cosmarium quadratum RALFS in Brit. Desm. 92, 1848; BORGE Bih. K. Sv. Vet. Akad. Handl. III, 19, 23, 1894; WEST Monogr. Brit. Desm. 3, 57, 1908; DICK Bot. Arch. 3,

220, 1923; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 1, 41, 1933; TAYLOR Pap. Mich. Acad. Sci. 19, 264, 1934; OKADA Journ. Imp. Fish. Inst. 30, 171, 1934; INSAM & KRIEGER Hedw. 76, 107, 1937; HIRANO Bot. Mag. 66, 133, 1953.

Cellulae mediocres, circiter duplo longiores quam latiores, modice constrictae, sinu angusto-lineari in vertice leviter ampliato et superius leviter aperto; semicellulae subquadratae, angulis basalibus rotundis, marginibus lateralibus prope angulos inferiores leviter retusis, angulis apicalibus late rotundis, apicibus convexis; a latere visae subellipticae vel ovatae; a vertice visae ellipticae; membrana glabra. Long. 50-73 μ , Lat. 28-40 μ , Lat. isth. 20-26 μ .

Hab. **Hokkaido**: Okineppe, Chôbushi-numa in Nemuro; Kiritappu, Tokotan, Tôrô in Kushiro; Yûfutsu, Numanohata, Tomakomai, Shiraoi-poroto-numa in Iburi; Shizukari in Oshima. **Hondo**: Kurobo-numa in Mutsu; Hosonuma, Megata in Ugo; Hijiori-naga-numa in Uzen; Keshonuma, Izu-numa in Rikuzen; Akaiyachi, Nogiwano-kwannon-ike in Iwashiro; Kashima-cho in Iwaki; Jiuemon-ike, Mt. Akagi in Kôzuke; Senjôgahara in Shimotsuke; Higusa-numa in Shimofusa; Mt. Tateyama in Etchû; Daimon-pass, Inago of Kitamaki-mura, Hoppo-ridge, Kamikôchi, Lake Nakatsuna, Ôhanami-ike in Shinano; Kanashôzu, Ôkaguchi in Ise; Shinohara-ike in Oomi. **Kiushiu**: Kôga-muta of Aso in Higo. (Pl. XXIV, f. 5, 6)

Distr. Japan, Siberia, Kuriles, China, whole Europe, Iceland, Spitzbergen, Nova Zembla, Greenland, N. America, W. Indies.

Cosmarium quadratum in our country has almost parallel lateral margins in lower parts and the margin is slightly retuse just above the basal angle.

forma **Willei** W. & G. S. WEST in Monogr. Brit. Desm. 3, 59, 1908; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 1, 41, 1933; WHELDEN Nat. Mus. Canad. Bull. 97, 87, 1947; HIRANO Act. Phytotax. Geobot. 14, 171, 1952.

Forma marginibus lateralibus semicellularum paene rectis leviter convexis, sinu acuto aperto. Long. 55-82 μ , Lat. 30-36.5 μ , Lat. isth. 22.4-25.8 μ .

Hab. **Hondo**: Umaushi-numa in Iwaki; Gôno-ike, Kitaura in Hitachi; Kamaga-ike near Otari in Shinano; Tanuki-numa in Suruga; Ishigaki-ike in Ise. **Kiushiu**: Ôhata-yama of Kirishima in Hiuga. (Pl. XXIV, f. 23, 24)

Distr. Japan, Siberia, Europe, Greenland, N. America.

Cosmarium tetragonum (NÄG.) ARCH. var. **Lundellii** COOKE in WEST Monogr. Brit. Desm. 3, 18, 1908; BORGE Bot. Notis 20, 1913; INSAM & KRIEGER Hedw. 76, 109, 1937; HIRANO Bot. Mag. 66, 132, 1953.

Var. undulatio lateralis semicellularum est prominentior, ita ut margo

lateralis sit convexior quam in forma typica; pars superior marginis lateralis oblique retusa; apex angustior quam in forma typica. Long. 47-50 μ , Lat. 26-28 μ , Lat. isth. 8.6-11 μ .

Hab. **Hondo**: Mt. Kanpu in Ugo; Kaibai-ike in Uzen; Kesho-numa in Rikuzen; Kashima-cho in Iwaki; Hoppo-ridge in Shinano. (Pl. XXIV, f. 2, 3)
Distr. Japan, Siberia, Europe, Greenland, U. S. A.

Cosmarium tetragonum var. *Lundellii* is somewhat variable in marginal undulations, especially in the apical part of semicell and I have often met with a individual having two different forms of semicell in the same individual. The one of semicell is distinctly prominent and with a produced apex which is narrow and retuse while the other of semicell has broad, truncate and retuse apex. I have hitherto only found this variety in the swamps of the subalpine region or in the mountain-spring.

Cosmarium pseudobinerve GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 47, 46, 1920;
DICK Bot. Arch. 3, 220, 1923; SKUYA Act. Horti Bot. Univ. Latv. 7, 73, 1932.

Cellulae parvae, circiter duplo longiores quam latiores, profunde constictae, sinu angusto-lineari; semicellulae subrectangulares cum partibus basalibus leviter inflatis, gradatim attenuatae ad apicem, angulis basalibus rotundis, marginibus lateralibus retusis in medio, apicibus leviter convexis vel inflationibus cum angulis apicalibus bene rotundis; membrana glabra sed cum linea horizontali infra apicem; a latere visae subovatae, apicibus leviter convexis cum angulis apicalibus bene rotundis et tuberculis parvis ad angulos utrobique instructis, et infra tuberculos juxta lineam verticalem instructis. Long. 45-50 μ , Lat. 22-23.7 μ , Lat. isth. 8-11 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Hirumo-numa in Ugo; Hijiori-naga-numa in Uzen; Ishigaki-ike, Kanashōzu in Ise; Shinohara-ike in Oomi; Takaraga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. (New to Asia) (Pl. XXIV, f. 1)

Distr. Europe.

Cosmarium holmiense LUND. var. **integrum** LUND. in Nov. Act. Regn. Soc. Ups. III, 8, 49, 1871; WEST Monogr. Brit. Desm. 3, 2, 1908; BORGE Bot. Notis 16, 1913.

Var. cellulis cum marginibus lateralibus distincte retusis infra apicem et marginibus lateralibus inferioribus duplo longioribus quam superioribus, ambo marginibus et apicibus convexis non undulatis. Long. 47-52 μ , Lat. 29-30 μ , Lat. isth. 16.7-18 μ .

Hab. **Hokkaido**: Tokotan in Kushiro; Numahata in Iburi. (New to Asia) (Pl. XXIV, f. 33)

Distr. Europe, Spitzbergen, Nova Zembla, U. S. A.

Cosmarium divergentiforme HIRANO in Act. Phytotax. Geobot. 14, 36, 1950.

Cellulae submagnae, duplo longiores quam latiores, modice constrictae, sinu acuto ad verticem acuminato et extrorsum rapide aperto; semicellulae obverse ovato-subquadratae, angulis basalibus obtuse rotundis, marginibus lateralibus convexis vel aliquando rectis et divergentibus, angulis apicalibus late rotundis, apice convexo non recto; a latere visae ellipticae; a vertice visae late ellipticae vel subcirculares; membrana punctata. Long. 84 μ , Lat. 44.8 μ , Lat. isth. 26.6 μ .

Hab. **Hondo**: Daimon-pass in Shinano. (Pl. XXIV, f. 7)

Distr. Japan.

Cosmarium plicatum REINSCH in WEST Monogr. Brit. Desm. 3, 60, 1908; HOMFELD Pflanz. 12, 49, 1929; KRIEGER Hedw. 70, 144, 1930; TAYLOR Pap. Mich. Acad. Sci. 19, 260, 1934; PRESCOTT & MAGNOTTA l. c. 20, 160, 1935.

Cellulae modicae, circiter 1 $\frac{3}{4}$ duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae truncato-subpyramidatae, marginibus lateralibus leviter convexis, angulis basalibus rectangulari-rotundis, angulis apicalibus late rotundis, apicibus leviter convexis; a latere visae ellipticae; a vertice visae ellipticae; membrana minute punctata. Long. 50–59 μ , Lat. 30–31 μ , Lat. isth. 17–20 μ .

Hab. **Hondo**: Nanko, Kashima-cho in Iwaki. (New to Asia) (Pl. XXIV, f. 25)

Distr. Europe, Azores, N. America.

Cosmarium exiguum ARCH. in NORDSTEDT K. Sv. Vet. Akad. Handl. 22, 58, 1888; BORGE Ark. Bot. 1, 94, 1903; MIGULA Krypt. Fl. 2, 424, 1907; WEST Monogr. Brit. Desm. 3, 63, 1908; HOMFELD Pflanzenf. 12, 43, 1929; HIRANO Act. Phytotax. Geobot. 12, 90, 1943.

Cellulae parvae, duplo longiores quam latiores, profunde constrictae, sinu angusto leviter aperto; semicellulae subquadratae, gradatim attenuatae ad apicem, marginibus lateralibus paene rectis vel leviter convexis, apicibus late rotundis; a latere visae ellipticae; a vertice visae ellipticae; membrana glabra; chromatophoris axialibus cum pyrenoidibus centralibus in unoquaque semicellula. Long. 16–23.8 μ , Lat. 12–15.4 μ , Lat. isth. 2.8–4.8 μ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Nikuru-numa in Kitami; Toyokoro-konuma in Tokachi; Kamikoshi-ukishimahara in Ishikari; Tôasa-numa in Iburi; Ko-numa in Oshima. **Hondo**: Kurobo-numa in Mutsu; Mt. Hachimantai, Mt. Kurikoma in Rikuchû; Megata, Hirumo-numa in Ugo; Mt. Azuma, Eboshi-numa, Mt. Gassan, Hijiori-naga-numa, Ôishita in Uzen; Hibushi-numa, Nanko in Iwaki; Kôriyama in Iwashiro; Oze, Mt. Akagi, Ômine-numa in Kôzuke; Sanpoga-ike in Musashi; Takayachi, Kuro-

sawano-ike, Kôridonono-ike, Mt. Naeba in Echigo; Mt. Tateyama, Gakintonbo in Etchû; Daimon-pass, Kirigamine, Kanori-ike, Karuisawa, Daizahôshi-ike in Shinano; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise; Higashi-kusano-mura, Mt. Hira, Fuse-ike, Shinohara-ike in Oomi; Sawano-ike, Mizoroga-ike, Takaraga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu:** Imuta-ike, Lake Ikeda in Satsuma; Mt. Ôhata of Kirishima in Hiuga. (Pl. XXIV, f. 29)

Distr. Japan, Thailand, Burma, India, Ceylon, Abyssinia, whole Europe, U. S. A. Paraguay, W. Africa, New Zealand.

var. **subrectangulum** W. & G. S. WEST in Monogr. Brit. Desm. 3, 64, 1908.

Cellulae latiores; semicellulae late subrectangulares, sinu leviter linearis-aperto. Long. 19.6-21 μ , Lat. 15-16.8 μ , Lat. isth. 4-5.6 μ .

Hab. **Hokkaido:** Tomakomai, Yûfutsu in Iburi. **Hondo:** Nagatai of Mt. Iwaki in Mutsu; Hosonuma in Ugo; Inago of Kitamaki-mura in Shinano; Shakuhachi-ike in Yamashiro. (New to Asia) (Pl. XXV, f. 6)

Distr. British isles.

Cosmarium pseudoexiguum RACIB. in WEST Monogr. Brit. Desm. 3, 61, 1908; KRIEGER Arch. Hydrobiol. suppl. 11, 183, 1932.

Cellulae parvae, circiter duplo longiores quam latae vel plus longiores, profunde constrictae, sinu angusto-lineari in vertice leviter dilatato; semicellulae subquadratae, angulis basalibus rectangulari-rotundis, marginibus lateribus convexis, angulis apicalibus perfecte rotundis, apicibus leviter convexis; a latere visae subellipticae; a vertice visae ellipticae. Long. 18-20 μ , Lat. 10-11 μ , Lat. isth. 2-3 μ .

Hab. **Hokkaido:** Hisago-numa of Mt. Daisetsu in Ishikari; Tomakomai, Shiraoi-poroto-numa in Iburi. **Hondo:** Koke-numa in Ugo; Shiga-kôgen, Kirigamine, Tengunohara in Shinano; Fuse-ike in Oomi. (Pl. XXIV, f. 37)

Distr. Japan, Sumatra, Ceylon, Europe, Porto Rico.

var. **hexagonum** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. 55, 11, 1924.

Semicellulae sexangulatae, leviter dilatatae apicem versus. Long. 18-19.6 μ , Lat. 10.7-12.6 μ , Lat. isth. 2.8-4.3 μ .

Hab. **Hokkaido:** Kiritappu in Kushiro. **Hondo:** Kotsutsumi-nishi-ike in Mikawa; Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. (Pl. XXIV, f. 36)

Distr. Finland.

var. **retusum** HIRANO in Mem. Coll. Sci. Univ. Kyoto, B, **19**, 66, 1948.

Semicellulae trapezoido-subquadratae, marginibus lateralibus fere rectis et leviter convergentibus versus apicem sed prope apicem oblique truncatis et retusis, apicibus truncatis et retusis in medio, angulis apicalibus leviter rotundatis. Long. 22.4μ , Lat. 12.6μ , Lat. isth. 3.4μ .

Hab. **Hondo**: Takaraga-ike in Yamashiro. (Pl. XXIV, f. 35)

Distr. Japan.

Cosmarium difficile LÜTKEM. var. **sublaeve** LÜTKEM. in W. & G. S. WEST Monogr. Brit. Desm. **3**, 97, 1908; INSAM & KRIEGER Hedw. **76**, 100, 1937; TAFT Ohio Journ. Sci. **45**, 194, 1945.

Var. semicellulis paulo angularibus, marginibus lateralibus superioribus non retusis et late rotundis, partibus superioribus semicellularum non productis, apicibus relative late rectis, serie transversalibus scrobiculorum numerosioribus; membrana glabra inter scrobiculos. Long. 25.8 - 26.6μ , Lat. 15 - 16.8μ , Lat. isth. 4.2 - 4.4μ .

Hab. **Hondo**: Akaiyachi, Nogiwano-kwannon-ike in Iwashiro. (New to Japan) (Pl. XXIV, f. 27)

Distr. whole Europe, U. S. A. Australia.

The variety from a pond Nogiwano-kwannon-ike has a flattened apex and has an almost parallel side.

Cosmarium synthliborense WEST var. **montanum** HIRANO in Act. Phytotax. Geobot. **14**, 38, 1950.

Semicellulae oblongo-quadratae, apice recto interdum paulo retuso, sinu non profundo extremo obtuse rotundo; membrana punctata, punctulis delicatis et evidenter irregulariter ordinatis. Long. 19.6μ , Lat. 18.2μ , Lat. isth. 15.4μ .

Hab. **Hondo**: Hachimantai in Rikuchū; Mt. Gassan in Uzen. (Pl. XXIV, f. 15)

Distr. Japan.

Cosmarium pericymatum NORDST. in WEST Monogr. Brit. Desm. **3**, 34, 1908.

Cellulae mediocres, circiter $1\frac{3}{4}$ duplo longiores quam latiores, modice constrictae, sinu aperto et acutangulo ad verticem; semicellulae subquadratae, angulis superioribus late rotundatis, angulis basalibus subrectangularibus, marginibus lateralibus et apicibus paullo undulatis, undulis circa 15 in toto marginem; membrana punctata; a latere visae oblongo-ellipticae, lateribus et apicibus paullo undulatis; a vertice visae ellipticae cum polis leviter productis. Long. 41μ , Lat. 23.7μ , Lat. isth. 16μ .

Hab. **Hondo**: Izu-numa in Rikuzen (New to Asia) (Pl. XXIV, f. 28)
 Distr. Europe, Spitzbergen, United States.

Cosmarium minimum W. & G. S. WEST in Monogr. Brit. Desm. 3, 66, 1908;
 ALIORGE Rev. Alg. 5, 357, 1930; SKVORTZOW Philip. Journ. Sci. 49, 150, 1932; CARTER Journ.
 Linn. Soc. Bot. 50, 165, 1935; HIRANO Act. Phytotax. Geobot. 14, 171, 1952.

Cellulae minutae, circiter tam longae quam latae, profunde constrictae,
 sinu angusto-lineari; semicellulae transverse subrectangulares, marginibus
 lateralibus convexis, angulis obtuse rotundis, apicibus truncatis rectis; a
 latere visae subcirculares; a vertice visae ellipticae; membrana glabra.
 Long. 8.4-16.8 μ , Lat. 8.4-15.4 μ , Lat. isth. 2.8-4.2 μ .

Hab. **Hokkaido**: Tôroko in Kushiro; Junsai-aka-numa in Oshima;
 Benten-numa in Iburi. **Hondo**: Hachimantai-ônuma, Hizume in Rikuchû;
 Moritake-ôtsutsumi in Ugo; Sugigamine of Mt. Zawo in Uzen; Izu-numa
 in Rikuzen; Akaiyachi, Kôriyama in Iwashiro; Kanazuka-mura, Mt. Myoko
 in Echigo; Mt. Eboshi-dake in Etchû; Kamikôchi, Ashinota-ike in Shinano;
 Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise. **Kiushiu**: Byakushi-
 ike of Mt. Kirishima in Hiuga. (Pl. XXIV, f. 30, 32)

Distr. Japan, Ceylon, England, W. Africa, Madagascar.

var. **rotundatum** MESSIK. in Hedw. 78, 176, 1938.

Var. cellulæ leviter longiores quam latiores, sinu angusto-lineari, angu-
 lis apicalibus et basalibus rotundis, apice paulo convexo. Long. 16.2 μ , Lat.
 14 μ , Lat. isth. 2.8 μ .

Hab. **Hokkaido**: Mt. Daisetsu in Ishikari. **Shikoku**: Dôgo in Iyo.
 (New to Asia) (Pl. XXIV, f. 31)

Distr. Europe.

Cosmarium pusillum (BRÉB.) ARCH. in WEST Monogr. Brit. Desm. 3, 66, 1908;
 LÜTKEMÜLLER Ver. Zool.-Bot. Ges. Wien 60, 493, 1910; HIRANO Act. Phytot. 11, Geob. 79, 1953.

Cellulae minutae, leviter longae quam latae, profunde constrictae, sinu
 lineari aperto; semicellulae transverse pyramidatae, marginibus lateralibus
 rectis vel leviter retusis, angulis basalibus acute-rotundis, angulis apicalibus
 rotundis, apicibus leviter retusis; a latere visae circulares; a vertice visae
 ellipticae; membrana glabra. Long. 6.4-9.8 μ , Lat. 6.4-8.4 μ , Lat. isth. 2.5-
 3.4 μ .

Hab. **Hokkaido**: Ko-numa in Oshima. **Hondo**: Oze-numa in Kôzuke;
 Ko-ike in Yamashiro. (Pl. XXV, f. 37)

Distr. Japan, Thailand, Bengal, Ceylon, Europe, Greenland, New Zealand.
Cosmarium pusillum is rarely found among the water plants at the

margins of swamps. The form from Oze-district is somewhat different from the European description by the possession of a retuse and convergent lateral margin while the form from Ko-ike, Kyoto has a convex side and retuse apex.

Cosmarium geometricum W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 58, 1895; Monogr. Brit. Desm. 3, 67, 1908.

Cellulae minutae, leviter longiores quam latores, profunde constrictae, sinu acutangulo aperto; semicellulae late truncato-pyramidatae vel subhexagonales, marginibus lateralibus rectis, apicibus truncatis rectis vel levissime concavis, angulis acutis, in centro semicellularum papilla singula ornatis; a latere visae circulares, lateribus cum papilla singula in medio utrobique; a vertice visae ellipticae, papilla singula mediana in lateris utrobique ornatae; membrana glabra. Long. 7.8–11.2 μ , Lat. 7–10.5 μ , Lat. isth. 2.8–3.2 μ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi. **Hondo**: Ôishitano-Junsai-numa in Uzen. **Shikoku**: Matsuyama in Iyo. (New to Asia) (Pl. XXV, f. 22)

Distr. British Isles, Madagascar.

var. **sueicum** BORGE in MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 46, 1935; TAFT Ohio Journ. Sci. 45, 195, 1945; HIRANO Bot. Mag. 66, 205, 1953.

Semicellulae subhexagonales, non truncato-pyramidatae, lateribus rectis, marginibus lateralibus superioribus longius quam inferioribus, apicibus latioribus; a latere visae ovatae; a vertice visae hexagonales, non ellipticae ut in forma typica et polis truncatis. Long. 8.6 μ , Lat. 7.7 μ , Lat. isth. 3.4 μ .

Hab. **Hondo**: Mt. Mitsumata-renge in Shinano. (Pl. XXV, f. 10)

Distr. Japan, Switzerland, Sweden, U. S. A.

I have not seen the BORGE'S original paper but judging from the figure given by MESSIKOMMER as to the Swiss form there are some differences. The sinus is acute and open while in European form it is narrowly linear. The semicell in vertical view is hexagonal instead of elliptical and has truncate poles. This variety is distinguished from *Cosmarium adoxum* by the broad apex of semicell, hexagonal semicell in vertical view and ovate in side view.

Cosmarium angulosum BRÉB. in WEST Monogr. Brit. Desm. 3, 93, 1908; HOMFELD Pflanzenf. 12, 37, 1929; HIRANO Act. Phytotax. Geobot. 11, 82, 1943; TAFT Ohio Journ. Sci. 45, 192, 1945.

Cellulae parvae, circiter 1.5 longiores quam latae, profunde constrictae, sinu angusto-lineari; semicellulae subquadratae vel rotundo-subhexagonales, angulis basalibus paulo rotundis, marginibus lateralibus in parte inferiore

parallelis vel subparallelis, in parte superiore convergentibus et leviter convexis, angulis apicalibus leviter rotundis, apicibus angustis rectis vel leviter convexis; a latere visae subcirculares; a vertice visae ellipticae; membrana glabra. Long. 14-31 μ , Lat. 12.6-21 μ , Lat. isth. 3.4-6 μ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Kiritappu, Akan-junsai-numa in Kushiro; Toyokoro in Tokachi; Minenobu, Horomui in Ishikari; Tôasa-numa, Tomakomai in Iburi; Shizukari, Junsai-numa in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Komaga-take, Mt. Kurikoma, Aka-numa, Futatsumegata, Moritake-ôtsutsumi in Ugo; Saigo-mura, Izu-numa, Naga-numa, Kesho-numa in Rikuzen; Akai, Kôriyama in Iwashiro; Inago of Kitamaki-mura, Hoppo-ridge, Shiromâ-ôike, Kamikôchi, Lake Kizaki in Shinano; Oze in Kôzuke; Goda-numa in Shimofusa; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike, Ô-numa in Mikawa; Biwaike in Owari; Jôdo-ike, Toba, Tamaru in Ise; Matsubara-naiko, Nukigawa in Oomi; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Shiramizu-pass near Matsuyama in Iyo. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma; Kirishima-koike, Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XXIV, f. 16, 17)

Distr. Japan, Formosa, Burma, Thailand, Siberia, whole Europe, N. America, Australia, central Africa.

var. concinnum (RABENH.) W. & G. S. WEST in WEST Monogr. Brit. Desm. 3, 94, 1908; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 55, 7, 1924; KAISER Krypt. Forsch. 1, 222, 1919; MESSIKOMMER Viertelj. Naturf. Ges. Zurich. 80, 45, 1935; HIRANO Act. Phytotax. Geobot. 11, 83, 1943.—*Cosm. concinnum* REINSCH in TURNER K. Sv. Vet. Akad. Handl. 25, 48, 1893; WEST Trans. Linn. Soc. 5, 59, 1895; MIGUIA Krypt. Fl. II, 431, 1907.

Cellulae minores, cellulis 1½ duplo longius quam latis, marginibus lateribus superioribus conspicue retusis, sinu angusto et lineari sed exterius aperto. Long. 11-12 μ , Lat. 9.5-10 μ , Lat. isth. 2.8-3.7 μ .

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro; Tôroko in Kushiro; Nakano near Sapporo, Moere-numa in Ishikari. **Hondo**: Kurobo-numa, Mt. Hakkoda in Mutsu; Megata in Ugo; Chûkawa-ike in Uzen; Izu-numa, Naga-numa in Rikuzen; Oze-numa in Kôzuke; Gôno-ike in Hitachi; Hakkaku-ike, Onjaga-ike in Kamifusa; Higusa-numa in Shimofusa; Kanori-ike, Nata-ike near Otari in Shinano; Shinohara-ike, Fuse-ike, Nukigawa, Matsubara-naiko in Oomi; Takaraga-ike in Yamashiro. **Kiushiu**: Nakahara-ike near Fukiagenohama in Satsuma; Miyazaki in Hiuga. (Pl. XXIV, f. 18-21)

Distr. Japan, Manchuria, India, Europe, Greenland, N. & S. America, Australia, New Zealand, central Africa, Madagascar.

Cosmarium rectangulare GRUN. in MIGULA Krypt. Fl. II, 431, 1907; WEST Monogr. Brit. Desm. 3, 54, 1908; TAYLOR Pap. Mich. Acad. Sci. 19, 265, 1934; INSAM & KRIEGER Hedw. 76, 107, 1937; TAFT Ohio Journ. Sci. 45, 198, 1945.

Cellulae modicae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae subhexagono-semicirculares, marginibus lateralibus inferioribus paene parallelis leviter convexis, marginibus lateralibus superioribus oblique truncato-rotundis, apicibus rectis, angulis basalibus rectangulari-rotundis; membrana subtiliter punctata; a latere visae paene ovato-circulares; a vertice visae paene ellipticae. Long. 37.8-44.8 μ , Lat. 29.4-33.6 μ , Lat. isth. 9.8-11.2 μ .

Hab. **Hondo**: Daiza-hôshi-ike in Shinano; Ikejiri-ike in Tanba. **Kiushiu**: Kôga-muta of Aso in Higo. (Pl. XXIV, f. 4)

Distr. Japan, Siberia, Europe, Greenland, N. America.

I have met with an interesting form of *Cosmarium rectangulare* from Aso that has a slightly divergent lower lateral margin and faintly retuse upper ones.

var. **africanum** W. & G. S. WEST in Journ. Bot. 34, 379, 1896.

Var. altioribus, marginibus lateralibus inferioribus brevioribus quam superioribus et leviter divergentibus, apicibus angustioribus. Long. 28-32 μ , Lat. 22.4-23.8 μ , Lat. isth. 5.6-8.4 μ .

Hab. **Hokkaido**: Tokotan in Kushiro. (New to Asia) (Pl. XXIV, f. 11, 12)

Distr. Central Africa.

Cosmarium Regnesi REINSCH in Contr. Alg. Fung. 89, 1875; ROY & BISSET Journ. Bot. 24, 195, 1886; WEST Trans. Linn. Soc. Bot. 5, 59, 1895; WEST Journ. Linn. Soc. Bot. 34, 387, 1899; MIGULA Krypt. Fl. II, 419, 1907; WEST Monogr. Brit. Desm. 3, 36, 1908; KRIEGER Hedw. 70, 148, 1930; SKVORTZOW Philip. Journ. Sci. 49, 151, 1932.

Cellulae minutae, circiter tam longae quam latae, profunde constrictae, sinu aperto rectangulari-rotundis et excavato; semicellulae transverse oblongo-rectangulares vel subhexagonales, marginibus cum dentibus 6-8 minutis, apicibus cum dentibus duobus et in latere cum dentibus duobus utrobique; a latere visae subcirculari-ellipticae; a vertice visae ellipticae; membrana glabra. Long. 11-13 μ , Lat. 10.8-12.6 μ , Lat. isth. 4.2-5.6 μ .

Hab. **Hokkaido**: Onne-numa, Okineppe in Nemuro; Kiritappu, Tokotan in Kushiro; Horomui in Ishikari; Junsai-numa (ROY & BISSET), Ko-numa in Oshima. **Hondo**: Megata, Aka-numa in Ugo; Chûkawa-ike in Uzen; Akai in Iwashiro; Ozegahara in Kôzuke; Mohara in Kamifusa; Ashinota-ike,

Ôhanami-ike in Shinano; Ô-numa in Mikawa; Matsubara-naiko, Nukigawa in Oomi; Ariga-ike in Yamashiro; Ikejiri-ike in Tanba. (Pl. XXV, f. 36)

Distr. Japan, Europe, N. America, Brazil, Australia, Madagascar.

Cosmarium cymatonotophorum WEST in Monogr. Brit. Desm. 3, 40, 1908;
INSAM & KRIEGER Hedw. 76, 99, 1937.

Cellulae minutae, leviter longiores quam latae, profunde constrictae, sinu aperto acutangulo ad verticem obtuso; semicellulae transverse rectangulares, angulis basalibus leviter rotundis, marginibus lateralibus truncatis rectis vel leviter retusis et leviter convergentibus, apicibus late truncatis vel aliquantum convexis (aliando leviter undulis quaternis ornatis), angulis apicalibus leviter rotundis; a laterc visae leviter ovato-circulares, lateribus cum papilla parva in medio utrobique; a vertice visae ellipticae, lateribus cum papilla parva in medio utrobique. Long. 14.6-17.3 μ , Lat. 12-16.8 μ , Lat. isth. 6.2-7 μ .

Hab. Hondo: Hakuryu-ko in Uzen; Akai in Iwashiro; Kurosawa-ike on Mt. Myôko in Echigo; Daimon-pass, Kirigamine in Shinano. (New to Asia) (Pl. XXIV, f. 38, 39)

Distr. Europe.

Cosmarium cymatonotophorum in our country especially from Daimon-pass is somewhat different from the European form by having a flattened apex of semicell while in European form apex is slightly 4-undulate.

Sect. **Microcosmarium** CEDERGREN emend. HIRANO

Cosmarium Sect. *Microcosmarium* CEDERGREN in Ark. Bot 25A: 4, 50, 1933 (pro parte)
—Subgen. *Gonatidium* TURNER in K. Sv. Vet. Akad. Handl. 25, 74, 1893.

Cellulae polygonales, profunde constrictae; semicellulae hexagonales vel subhexagonales.

- 1a. Semicellulae distincte hexagonae.
- 2a. Cellulae in vertice visae cum prominente tumore mediano ordinatae.
- 3a. Angulis lateralibus non productis, apice recto.
 - 4a. Sinu aperto et in extremo rotundo; semicellulae elliptico-hexagonae **C. staurastroides**
 - 4b. Sinu acuminato vel angusto-lineari ad extreum.
 - 5a. Angulis lateralibus sine mucro.
 - 6a. Angulis apicalibus rotundis; semicellulae elliptico-hexagonae **C. bireme**
 - 6b. Angulis apicalibus oblique truncatis et leviter retusis.
 - 7a. Cellulae in vertice visae ellipticae cum polis rotundis, 10-11×9-10 μ ; semicellulae suboctagonae **C. adoxum**
 - 7b. Cellulae in vertice visae ellipticae cum polis acutis, 9-14×11-17 μ ;

- semicellulae hexagonae *C. sinostegos* var. *obtusius*
- 5b. *Angulis lateralibus cum mucro; semicellulae oblongo-rectangulares vel oblongo-hexagonae* *C. pygmaeum*
- 3b. *Angulis lateralibus productis* *C. prominulum*
- 4a. *Apice recto* *f. typica*
- 4b. *Apice undulato* var. *subundulatum*
- 2b. *Cellulae in vertice visae sine tumore mediano.*
- 3a. *Angulis apicalibus sine mucro.*
- 4a. *Cellulae leviter longiores quam latiores; semicellulae elliptico-hexagonae* *C. sexangulare*
- 5a. *Cellulae 42×34-36 μ* *f. typica*
- 5b. *Cellulae 13-15×11-12 μ* *f. minima*
- 4b. *Cellulae tam longae quam latae vel leviter latiores quam longiores; semicellulae transverse elongato-hexagonae* *C. abbreviatum*
- 5a. *Semicellulae angusto-hexagonae, angulis superioribus acutis.*
- 6a. *Cellulae 12-22×13-22 μ* *f. typica*
- 6b. *Cellulae 8×9 μ* *f. minor*
- 5b. *Semicellulae subhexagonae, angulis superioribus rotundis.*
- 6a. *Apice convexo vel recto.*
- 7a. *Semicellulae reniforme-hexagonae, apice convexo; cellulae 19-29×22-30 μ* *f. planctonicum*
- 7b. *Semicellulae subpyramidalo-hexagonae, apice recto; cellulae 15×15 μ* *f. pygmaea*
- 6b. *Apice retuso; cellulae 12.6×11 μ* *f. germanica*
- 3b. *Angulis apicalibus cum mucro ordinatis* *C. subrectangulare*
- 1b. *Semicellulae subhexagonae, marginibus lateralibus inferioribus divergentibus.*
- 2a. *Cellulae sine angulis lateralibus productis.*
- 3a. *Cellulae sine apice protracto; in vertice visae oblongo-ellipticae.*
- 4a. *Cellulae cum marginibus lateralibus superioribus convexis ordinatae* *C. repandum* f. *minor*
- 4b. *Cellulae cum marginibus lateralibus superioribus oblique truncatis ordinatae* *C. scopulorum*
- 3b. *Cellulae cum apice protracto; in vertice visae cum tumore mediano utrobique* *C. Clepsydra*
- 2b. *Cellulae cum angulis lateralibus productis ordinatae* *C. Regnelli*
- 3a. *Cellulae 14-22×15-22 μ* *f. typica*
- 3b. *Cellulae 11-12×11-14 μ* *f. minima*
- 1c. *Semicellulae subhexagonae, marginibus lateralibus inferioribus rectis verticaliter ordinatae.*
- 2a. *Cellulae parvae, 13-36 μ in longitudinem.*
- 3a. *Margine laterali superiori convergente et retuso.*
- 4a. *Cellulae 13-25 μ in longitudinem* *C. Meneghinii*
- 5a. *Margine laterali biundulato* *f. typica*
- 5b. *Margine laterali triundulato, marginibus inferioribus leviter divergentibus* var. *Reinschii*
- 4b. *Cellulae 35-40 μ in longitudinem* *C. Braunii*
- 3b. *Margine laterali superiori convergente et biundulato.*
- 4a. *Semicellulae sine ocella mediana* *C. impressulum*
- 4b. *Semicellulae cum ocella mediana* *C. subreinschii* var. *ocellatum*

- 2b. Cellulae magnae, 75-80 μ in longitudinem *C. bengalense*
 1d. Semicellulae polygonae.
 2a. Semicellulae cum apice retuso ordinatae *C. laeve*
 3a. Semicellulae cum marginibus lateralibus rotundis ordinatae,
 pyramidalo-subcirculares f. *typica*
 3b. Semicellulae septagonae var. *septentrionale*
 3c. Semicellulae octagonae var. *octangularis*
 3d. Semicellulae subreniformi-hexagonales var. *reniforme*
 2b. Semicellulae cum apice recto ordinatae.
 3a. Semicellulae elliptico-hexagonales var. *rotundatum*
 3b. Semicellulae octangulares *C. impressulum* var. *octangularis*

Cosmarium staurastroides EICHL. & GUTW. in MIGULA Krypt. Fl. II, 416, 1907; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 50, 1935.

Cellulae minutae, leviter longiores quam latae, profunde constrictae, sinu acuto aperto ad verticem obtuso; semicellulae transverse hexagono-oblongae, angulis basalibus et apicalibus obtusis, marginibus lateralibus superioribus et inferioribus parum truncatis, angulis lateralibus parum subacutis, apicibus truncatis rectis; a latere visae subcirculares, lateribus utrobique papilla singula in medio ornatis; a vertice visae ellipticae, cum papilla mediana in lateribus utrobique ornatis; membrana glabra. Long. 12-13 μ , Lat. 11.2-12 μ , Lat. isth. 4-4.2 μ .

Hab. **Hokkaido**: Akan Junsai-numa in Kushiro. **Hondo**: Koke-numa in Ugo. (New to Asia) (Pl. XXV, f. 34)

Distr. Switzerland, Germany.

Cosmarium bireme NORDST. in WEST Trans. Linn. Soc. Bot. 6, 165, 1902; MIGULA Krypt. Fl. II, 450, 1907; WEST Monogr. Brit. Desm. 3, 77, 1908; TAFT Ohio Journ. Sci. 45, 192, 1945.

Cellulae subparvae, leviter latores quam longiores, profundissime constrictae, sinu acutangulo aperto; semicellulae oblongo-subhexagonales, angulis basalibus obtusis, in ventrali longiore quam dorsali, marginibus lateralibus ventralibus et dorsalibus leviter convexis, angulis lateralibus bene rotundis, apicibus truncatis rectis; a latere visae circulares cum papilla prominenti in medio utrobique; a vertice visae ellipticae, lateribus cum prominenti papilla mediana. Long. 15-16 μ , Lat. 16-16.8 μ , Lat. isth. 3.4-5.2 μ .

Hab. **Hokkaido**: Ko-numa in Oshima. **Hondo**: Mizoroga-ike in Yamashiro. (New to Japan) (Pl. XXV, f. 12)

Distr. Bengal, Ceylon, Abyssinia, Europe, U. S. A., Port Rico, Brazil, Australia.

Cosmarium adoxum W. & G. S. WEST in Monogr. Brit. Desm. 3, 78, 1908; DICK Bot. Arch. 3, 218, 1923; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 46, 1935.

Cellulae parvae, tam longiores quam latores, profunde const-

rictae, sinu aperto ad apicem angusto-lineari; semicellulae truncato-subpyramidatae, marginibus lateralibus inferioribus truncatis et leviter divergentibus, marginibus lateralibus superioribus oblique truncatis, apicibus truncatis et rectis, angulis basalibus vix rotundis; a vertice visae ellipticae, lateribus in medio utrobique cum papillis acutis distinctibus; a latere visae subcirculares, lateribus cum papillis prominentibus ordinatis; membrana glabra. Long. 8.6-11.8 μ , Lat. 8.6-11.2 μ , Lat. isth. 4 μ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa; Mizoroga-ike in Yamashiro. (New to Asia) (Pl. XXV, f. 11)

Distr. England.

Cosmarium sinostegos SCHAARSCHM. var. **obtusius** GUTW. in WEST Monogr. Brit. Desm. 3, 79, 1908; SKVORTZOW Philip. Journ. Sci. 49, 150, 1932; HIRANO Jap. Journ. Bot. 14, 228, 1954.

Semicellulae late subpyramidatae, angulis inferioribus vix rotundis; a vertice visae ellipticae, in medio utrobique papilla parva instructae. Long. 8.4-15 μ , Lat. 12.6-13.8 μ , Lat. isth. 4-6 μ .

Hab. **Hokkaido**: Junsai-akanuma in Oshima. **Hondo**: Mt. Hachimantai in Mutsu; Shinohara-ike in Oomi. (Pl. XXV, f. 8, 9)

Distr. Japan, Europe, U. S. A., Madagascar.

Cosmarium pygmaeum ARCH. in ROY & BISSET Journ. Bot 24, 196, 1886; WEST. Journ. Linn. Soc. Bot. 29, 146, 1892; Monogr. Brit. Desm. 3, 73, 1908; SCHULZ Bot. Arch. 2, 133, 1922; SKVORTZOW Philip. Journ. Sci. 49, 150, 1932; TAYLOR Pap. Mich. Acad. Sci. 19, 1934; INSAM & KRIEGER Hedw. 76, 106, 1937.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari ad apicem et exterius rapide aperto; semicellulae obverse subsemicirculares, angulis basalibus bene rotundis, marginibus lateralibus inferioribus convexis, superioribus oblique truncatis et leviter retusis, apicibus truncatis rectis, angulis lateralibus mucronatis directe oblique et alte ordinatis, angulis apicalibus obtusis cum parvo mucrone ad angulos apicales infra marginem sed raro visible nisi in fronte; a latere visae circulares; a vertice visae ellipticae; membrana glabra. Long. 14 μ , Lat. 13.3 μ , Lat. isth. 2.8 μ .

Hab. **Hokkaido**: Junsai-numa (ROY & BISSET) in Oshima. **Hondo**: Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. (Pl. XXV, f. 7)

Distr. Japan, China, Siberia, Burma, India, Ceylon, Europe, Greenland, N. America, Patagonia, Australia.

Cosmarium pygmaeum from Ikejiri-ike has a minute mucro at each lateral angle. This nature is different from the WEST's description that is projecting angle and also with a granule at each lateral angle within the margin.

Cosmarium prominulum RACIB. in WEST Monogr. Brit. Desm. 4, 46, 1911.

Cellulae minutae, tam longae quam latae, profunde constrictae, sinu aperto et acutangulo sed isthmo leviter obtuso; semicellulae subhexagonales, angulis lateralibus mamillatis, apice late truncato et recto; a latere visae rhomboides, augulis lateralibus et apicibus rotundatis, marginibus lateralibus superioribus retusis, isthmo excavato; a vertice visae rhomboido-ellipticae, lateribus in medio utrobique cum prominente tumore magno; membrana glabra, chromatophoris axialibus cum pyrenoidibus in unoquaque semicellulae. Long. 15.4μ , Lat. 15.8μ , Lat. isth. 7μ .

Hab. **Hondo**: Koke-numa in Ugo (New to Asia) (Pl. XXV, f. 42)

Distr. British Isles, Austria.

var. **subundulatum** W. & G. S. WEST in Monogr. Brit. Desm. 4, 47, 1911; ALLORGE Rev. Alg. 5, 358, 1930; HIRANO Act. Phytotax. Geobot. 12, 160, 1943.

Var. apicibus leviter 3-4 undulatis, marginibus lateralibus superioribus biundulatis; cellulae a vertice visae cum conicis inflationibus in medio. Long. 15.4 - 18.2μ , Lat. 15.4 - 16.8μ , Lat. isth. 7 - 9.8μ .

Hab. **Hokkaido**: Tôrô in Kushiro; Kumoihara of Mt. Daisetsu in Ishikari. **Hondo**: Mt. Komagatake, Koke-numa in Ugo; Nogiwano-kwannon-ike in Iwashiro; Ozegahara in Kôzuke; Kirigamine in Shinano; Kanashôzu, Ishigaki-ike in Ise; Mt. Hira in Oomi. (Pl. XXV, f. 23)

Distr. Japan, Europe.

Cosmarium sexangulare LUND. in Nov. Act. Regn. Soc. Ups. 3, VIII, 35, 1871; MIGULA Krypt. Fl. II, 432, 1907; WEST Monogr. Brit. Desm. 3, 81, 1908; WHELDEN Nat. Mus. Canada. Bull. 97, 89, 1947.

Cellulae mediocres, circiter $1\frac{1}{5}$ duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari; semicellulae transverse elliptico-hexagonales, marginibus lateralibus rotundis, marginibus lateralibus superioribus leviter retusis, apicibus truncatis rectis; a latere visae subcircularis; a vertice visae ellipticae; membrana subtiliter punctata. Long. 25 - 36.4μ , Lat. 22.6 - 28μ , Lat. isth. 7 - 9.8μ .

Hab. **Hondo**: Kitaura in Hitachi; Ariga-ike in Yamashiro. (New to Japan) (Pl. XXV, f. 5)

Distr. Europe, N. America, Australia, E. Africa.

Our form of *Cosmarium sexangulare* is generally smaller than the European description.

forma **minima** NORDST. in K. Sv. Vet. Akad. Handl. 22, 60, 1888; BORGE Bih. K. Sv. Vet. Akad. Handl. 19, 28, 1894; WEST Monogr. Brit. Desm. 3, 82, 1908; BERNARD Dep. agr. Indes Néerl. 117, 1908; SKUYA Act. Horti Bot. Univ. Latv. 3, 171, 1928; KRIEGER Arch. Hydrobiol. suppl. 11, 185, 1932; PRESCOTT Pap. Mich. Acad. Sci. 23, 210, 1938; HIRANO Act. Phytotax. Geobot. 12, 161, 1943.

Forma minus dimidior quam in forma typica, cum margine dorsali longiore quam ventrali et conspicue retuso, apice paene recto vel leviter retuso. Long. 7.8-16.8 μ , Lat. 7.8-12.6 μ , Lat. isth. 2.8-4.8 μ .

Hab. **Hokkaido**: Sarufutsu in Kitami; Horomui, Moseushi in Ishikari; Yūfutsu in Iburi; Ko-numa in Oshima. **Hondo**: Nagatai of Mt. Iwaki; Hizume, Begoyachi of Mt. Hachimantai in Rikuchū; Koke-numa, Moritake-ōtsutsumi in Ugo; Kirifushi-numa, Kobuchi-numa, Izu-numa in Rikuzen; Mazawano-naga-numa, Ôishita, Chūkawa-ike in Uzen; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Ojiroi in Iwaki; Oze-numa in Kōzuke; Sanpōji-ike in Musashi; Kagami-ike of Matsunoyama in Echigo; Hoppo-ridge, Daizahōshi-ike, Kirigamine in Shinano; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise; Nukigawa, Fuse-ike, Mt. Hira in Oomi; Ariga-ike, Mizoroga-ike in Yamashiro. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXV, f. 14, 15)

Distr. Japan, Java, Sumatra, Arctic Canada, Argentine, E, Africa, Australia, New Zealand.

Cosmarium abbreviatum RACIB. in MIGULA Krypt. Fl. II, 432, 1907; WEST Monogr. Brit. Desm. 3, 84, 1908; SKVORTZOW Philip. Journ. Sci. 49, 150, 1932; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 44, 1935; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 3, 425, 1936; HIRANO Bot. Mag. 66, 131, 1953.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae transverse elongato-hexagonales, apicibus truncatis, angulis apicalibus et lateralibus leviter rotundis; a latere visae subcirculares; a vertice visae angusto-ellipticae; membrana glabra; chromatophoris axialibus cum pyrenoidibus singulis unoquaque semicellula. Long. 11-15 μ , Lat. 11-14.5 μ , Lat. isth. 4.2-5.6 μ .

Hab. **Hondo**: Hoppo-ridge in Shinano; Sawano-ike in Yamashiro. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (Pl. XXV, f. 19)

Distr. Japan, Corea, Siberia, Europe, Australia.

forma minor W. & G. S. WEST in Monogr. Brit. Desm. 3, 85, 1908; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 44, 1935; HIRANO Act. Phytotax. Geobot. 12, 82, 1943.

Forma dimidior quam forma typica, de cetero prorsus similis. Long. 8.4 μ , Lat. 8.9 μ , Lat. isth. 3.2 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Ko-numa in Oshima. **Hondo**: Ôyachi of Mt. Hachimantai in Rikuchū; Oze-numa in Kōzuke; Kirigamine in Shinano; Jōdo-ike, Ishigaki-ike in Ise; Matsubara-naiko in Oomi. (Pl. XXV, f. 18)

Distr. Japan, England, Switzerland.

forma **pygmaea** MESSIK. in Viertelj. Naturf. Ges. Zurich **80**, 44, 1935; HIRANO Jap. Journ. Bot. **14**, 226, 1954.

In forma cellulæ minores, margine dorsali longiore quam ventrali et subito retuso, angulis lateralibus plus rotundis. Long. $10.8\text{-}14\mu$, Lat. $12\text{-}14\mu$, Lat. isth. $4.2\text{-}6\mu$.

Hab. **Hokkaido**: Nikuru-numa in Kitami; Tokotan in Kushiro; Horomui in Ishikari; Junsai-aka-numa in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Naga-numa, Kesho-numa in Rikuzen; Ôishitano-junsai-numa, Chûkawa-ike in Uzen; Kôriyama, Akai in Iwashiro; Ômine-numa in Kôzuke; Gôno-ike in Hitachi; Mt. Eboshi in Etchû; Kanori-ike in Shinano. (Pl. XXV, f. 48, 49)

Distr. Japan, Switzerland.

Our form is slightly larger than the form of MESSIKOMMES'S original dimension and the length of cells are almost equal to the breadth, while in European form the cell is a little broader than the length.

forma **germanica** RACIB. in GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **49**, 36, 1921.

Var. apicibus et marginibus lateralibus superioribus et inferioribus retusis, angulis lateralibus mamillatis, sinu acuto et aperto. Long. 12.6μ , Lat. 11.2μ , Lat. isth. 3.4μ .

Hab. **Hondo**: Takashihara in Mikawa (New to Asia) (Pl. XXV, f. 38)
Distr. Germany, Finland.

var. **planctonicum** W. & G. S. WEST in Trans. Roy. Soc. Edingh. **41**, 500, 1905; Monogr. Brit. Desm. **3**, 85, 1908. — *Cosm. abbreviatum* RACIB. var. WEST in Journ. Linn. Soc. Bot. **35**, 541, 1903.

Var. angulis superioribus semicellularum bene rotundis, angulis quoque inferioribus retundis, in ventrali margine convxiore quam dorsali, apicibus convexis. Long. 14μ , Lat. 14μ , Lat. isth. 3μ .

Hab. **Hondo**: Rokujizo in Yamashiro. (New to Asia) (Pl. XXV, f. 21)
Distr. Europe, Arctic Canada.

Var. *planctonicum* from Rokujizo is somewhat indistinct between superior lateral margin and apex, and in other words an inferior lateral margin longer than the superior ones so that the semicell looks like the depressed reniform, while in European form it is depressed and somewhat rounded hexagonally.

Cosmarium subrectangulare GUTW. in GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **55**, 12, 1924; ALI. ORGE Rev. Alg. **1**, 467, 1924; DICK Krypt. Forsch. **1**, 450, 1926.

Cellulae submediocres, leviter longiores quam latiores, profunde constictae, sinu angusto-lineari ad apicem leviter dilatato; semicellulae sub-

rectangulares vel subhexagonales, angulis basalibus obtusis, marginibus lateralibus inferioribus convexis leviter divergentibus, marginibus lateralibus superioribus retusis, apicibus paene rectis, angulis apicalibus et lateralibus aliquantum cum mucro minuto ordinatis; a latere visae circulares; a vertice visae ellipticae cum mucro 8 minuto in seriebus intra marginem utrobique. Long. 30.8-33.6 μ , Lat. 26.9-28 μ , Lat. isth. 7-8.4 μ .

Hab. **Hokkaido**: Horomui, Nakano near Sapporo in Ishikari. **Hondo**: Chûkawa-ike in Uzen; Biwa-ike in Owari. (New to Asia) (Pl. XXV, f. 33)
Distr. Europe.

Cosmarium repandum NORDST. forma **minor** W. & G. S. WEST in Journ. Linn. Soc. Bot. 33, 303, 1898; Monogr. Brit. Desm. 3, 54, 1908; HYLANDER Conn. Bull. 42, 87, 1928.

Forma dimidia quam in forma typica; semicellulae late subhexagono-reniformes, marginibus lateralibus inferioribus divergentibus. Long. 25 μ , Lat. 21 μ , Lat. isth. 8.4 μ .

Hab. **Hondo**: Ariga-ike in Yamashiro. **Kiushiu**: Kagami-ike in Satsuma. (New to Asia) (Pl. XXV, f. 27)
Distr. British Isles, U. S. A.

Cosmarium scopulorum BORGE in Ark. Bot. 18, 12, 1923; SKUJA Act. Horti Bot. Univ. Latv. 4, 64, 1929.

Cellulae parvae, suboctagonales, circiter 1 $\frac{2}{5}$ longiores quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae subhexagonales, partibus inferioribus subquadratis, angulis basalibus rectangularibus, marginibus lateralibus inferioribus divergentibus et leviter breviroribus quam lateralibus superioribus, superioribus valide convergentibus et leviter retusis, apicibus truncatis paulo convexis, angulis apicalibus et lateralibus leviter rotundis; membrana glabra; a latere visae ellipticae, lateribus in medio utrobique paulo inflatione ornatis; a vertice visae ellipticae, lateribus in medio utrobique cum paulo inflatione. Long. 23.8 μ , Lat. 17.6 μ , Lat. isth. 5.6 μ .

Hab. **Shikoku**: Yodo-mura in Iyo. (New to Asia) (Pl. XXV, f. 30)
Distr. Sweden, Estonia.

Cosmarium Clepsydra NORDST. in ROY & BISSET Journ. Bot. 24, 195, 1886; WEST Trans. Linn. Soc. Bot. 5, 247, 1896; Monogr. Brit. Desm. 3, 98, 1908; GRÖNBELAD Act. Soc. Faun. Flor. Fenn. 47, 40, 1920; BORGE Ark. Bot. 19, 34, 1925; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 72, 342, 1927; CEDERGREN Ark. Bot. 25A, 50, 1933.

Cellulae raro parvae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari alte leviter dilatato; semicellulae parum reniformes cum

apicibus valide convexis, angulis basalibus late rotundis, marginibus laterali-
bus brevibus rapide alte convergentibus; membrana punctata; a latere visae
subcirculares; a vertice visae oblongae, lateribus in medio utrobique protu-
berantibus ornatis. Long. 19.6-29.4 μ , Lat. 19.6-25.2 μ , Lat. isth. 5.6-7 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Junsai-numa (ROY & BISSET) in
Oshima. **Hondo**: Koke-numa in Ugo. (Pl. XXV, f. 13, 47)

Distr. Japan, Manchuria, Europe, U. S. A., Brazil.

Cosmarium Regnelli WILLE in Bih. K. Sv. Vet. Akad. Handl. 8, 16, 1884; MIGULA
Krypt. Fl. II, 439, 1907; WEST Monogr. Brit. Desm. 3, 89, 1908; GRÖNBLAD Act. Soc. Faun.
Flor. Fenn. 49, 40, 1921; DICK Mitt. Pfälz Ver. Pollichia 3, 132, 1930; OKADA Bull. Biogeogr.
Soc. Jap. 3, 51, 1932; FUJISAWA Journ. Jap. Bot. 10, 444, 1934.

Cellulae parvae, leviter longiores quam latae, profunde constrictae, sinu
angusto-lineari in apice leviter ampliato; semicellulae subhexagonales,
marginibus lateralibus inferioribus leviter longioribus quam superioribus et
divergentibus retusisque, marginibus lateralibus superioribus oblique truncatis
retusisque, angulis lateralibus projectis rotundis, apicibus truncatis
rectis; membrana glabra; a latere visae rotundo-ovatae; a vertice visae
ellipticae. Long. 14-18 μ , Lat. 11-16.8 μ , Lat. isth. 4.2-4.5 μ .

Hab. **Hondo**: Hachimantai-naga-numa in Rikuchū; Matsubara-naiko
in Oomi; Shakuhachi-ike in Yamashiro. (Pl. XXV, f. 50)

Distr. Japan, Manchuria, China, Kōtoshō near Formosa, India, Ceylon,
Europe, Greenland, N. & S. America, Africa.

forma minima EICHL. & GUTW. in GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49,
40, 1921; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 49, 1935; TAFT Ohio Journ. Sci. 45,
199, 1945; HIRANO Bot. Mag. 66, 133, 1953.—*Cosmarium Regnelli* WILLE in WEST Monogr.
Brit. Desm. 3, 90, 1908 (as forma).

Cellulae dimidiores, subhexagonales, sinu angusto-lineari sed exterius
aperto; partibus superioribus et inferioribus semicellularum aequaliter
symmetricis, angulis lateralibus exterius productis et non alte directis,
apicibus truncatis vel leviter retusis. Long. 11-14 μ , Lat. 11-12.6 μ , Lat.
isth. 2.8-4 μ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Tokotan in Kushiro; Tomakomai,
Shiraoi-poroto-numa in Iburi; Horomui in Ishikari. **Hondo**: Hachimantai-
naga-numa in Rikuchū; Ogata, Mt. Komagatake in Ugo; Chūkawa-ike,
Hakuryū-ko in Uzen; Kobuchi-numa in Rikuzen; Numano-taira on Mt. Bandai
in Iwashiro; Oze-numa in Kōzuke; Gōno-ike in Hitachi; Mohara in
Kamifusa; Higusa-numa in Shimofusa; Mt. Eboshi in Etchū; Hoppo-ridge,
Kamikōchi, Amaga-ike of Mt. Yatsugatake in Shinano; Ishigaki-ike in Ise;
Oku-ike of Higashi-kusano-mura in Oomi. **Shikoku**: Yodo-mura in Iyo;

Yamauchi-mura in Sanuki. **Kiushiu**: Ahira in Ôsumi. (Pl. XXV, f. 51, 52)
 Distr. Japan, Europe, U. S. A.

Cosmarium Meneghinii BRÉB. in RAIFS Brit. Desm. 96, 1848; ROY & BISSET Journ. Bot. 24, 196, 1886; WEST l. c. 35, 119, 1897; MIGULA Krypt. Fl. II, 445, 1907; WEST Monogr. Brit. Desm. 3, 90, 1908; DICK Mitt. Pfälz Ver. Pollichia 3, 129, 1930; INSAM & KRIEGER Hedw. 76, 102, 1937; PRESCOTT Pap. Mich. Acad. Sci. 23, 207, 1938; HIRANO Act. Phytotax. Geobot. 12, 93, 1943.

Cellulae parvae, suboctangulares, circiter 1.5 longiores quam latae, profunde constrictae, sinu angusto et linearis; semicellulae rectangulares in parte inferiore et truncato-pyramidatae in parte superiore, marginibus lateralibus inferioribus parallelis et retusis vel raro leviter divergentibus, marginibus lateralibus superioribus retusis convergentibus, apicibus truncatis retusis, angulis basalibus et apicalibus rotundis; a vertice visae ellipticae; a latere visae late ellipticae vel subcircularis; membrana glabra; chromatophoris axialibus cum pyrenoidibus in unoquaque semicellula. Long. 15-30 μ , Lat. 12.6-19.6 μ , Lat. isth. 3.4-5.6 μ .

Hab. **Hokkaido**: Junsai-aka-numa in Oshima. **Hondo**: Mt. Komagatake in Ugo; Oze-numa, Jiuemon-ike in Kôzuke; Kitaura in Hitachi; Hoppo-ridge in Shinano; Ikejiri-ike in Tanba. **Kiushiu**: Miyazaki in Hiuga. (Pl. XXV, f. 17)

Distr. Kosmopolitan.

Cosmarium Meneghinii well coincides with the European forms but I have met with an interesting form of this species which have slightly divergent lower lateral margins and an almost straight apex from Jiuemon-ike, near Oze-numa in Nikko National Park. *Cosmarium Meneghinii* is a rather rare species in our country and I have found it on the sphagnum-bogs of the mountains in central and northern Japan and also in swamps and on the lake margins.

var. **Reinschii** ISTV. in GRÖNBI. AD Mem. Soc. Faun. Flor. Fenn. 10, 267, 1934; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 47, 1935; Hedw. 78, 175, 1938.

Cellulae leviter angulares, marginibus lateralibus 3-undulatis, marginibus lateralibus inferioribus divergentibus, duobus superioribus convergentibus, apicibus convexis et retusis in medio. Long. 19 μ , Lat. 14 μ , Lat. isth. 4.2 μ .

Hab. **Hokkaido**: Horomui in Ishikari. (New to Japan) (Pl. XXV, f. 28)
 Distr. Siberia, Switzerland, Finland, S. Patagonia.

Cosmarium Braunii REINSCH in MIGULA Krypt. Fl. II, 437, 1907.

Cellulae modicae, circiter 1½ longiores quam latores, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae subhexa-

gono-rectangulares, angulis basalibus rectangulari-rotundis, marginibus lateralibus inferioribus parallelis et retusis, marginibus lateralibus superioribus convergentibus et retusis, apice truncato retuso, angulis apicalibus rotundis; membrana punctata; chromatophoris axialibus cum pyrenoidibus singulis in unaquoque semicellula; a latere visae ellipticae; a vertice visae ellipticae. Long. 42μ , Lat. 34μ , Lat. isth. 11μ .

Hab. **Hondo**: Higusa-numa in Shimofusa. (New to Asia) (Pl. XXV, f. 16)
Distr. Europe.

Cosmarium impressulum ELFV. in ROY & BISSET Journ. Bot. 24, 195, 1886; MIGULA Krypt. Fl. II, 442, 1907; WEST Monogr. Brit. Desm. 3, 86, 1908; CEDERGREN Ark. Bot. 25A, 51, 1933; OKADA Journ. Imp. Fish. Inst. 30, 167, 1934; TAYLOR Pap. Mich. Acad. Sci. 19, 255, 1934; INSAM & KRIEGER Hedw. 76, 101, 1937.

Cellulae parvae, circiter 1.5 longiores quam latae vel leviter longiores, profunde constrictae, sinu angusto-lineari in capite leviter ampliato; semicellulae subellipticae vel subtrapeziformes, angulis basalibus rectangulari-rotundis, marginibus lateralibus convexis 4-undulatis, undulis aequalibus, apicibus truncatis rectis vel leviter convexis cum angulis apicalibus rotundis; a latere visae oblongo-ellipticae; a vertice visae ellipticae; membrana glabra. Long. $21\text{--}29.4\mu$, Lat. $15.4\text{--}18\mu$, Lat. isth. $5.6\text{--}7\mu$.

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro; Kiritappu, Tokotan in Kushiro; Toyokoro-konuma in Tokachi; Horomui in Ishikari; Tomakomai in Iburi; Shizukari, Ko-numa in Oshima. **Hondo**: Nagatai in Mutsu; Aka-numa, Megata, Hirumo-numa in Ugo; Hizume in Rikuchū; Kobuchi-numa, Naga-numa, Kirifushi-numa in Rikuzen; Chūkawa-ike in Uzen; Hōzawa-ike, Akaiyachi in Iwashiro; Hakkaku-ike, Mohara in Kamifusa; Higusa-numa in Shimofusa; Inago of Kitamaki-mura in Shinano; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike, Jōdo-ike in Ise; Matsubara-naiko, Shinohara-ike, Fuse-ike, Nukigawa in Oomi; Mizoroga-ike, Shakuhachi-ike, Takaraga-ike in Yamashiro. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ōsumi. (Pl. XXV, f. 24-26)

Distr. Japan, Siberia, Manchuria, China, India, whole Europe, Greenland, N. & S. America, Australia, New Zealand, Africa, Azores.

var. **octangularis** HIRANO, var nov.

Semicellulae octangulares, marginibus omnibus non retusis, marginibus lateralibus inferioribus leviter divergentibus. Long. 23.8μ , Lat. 15.4μ , Lat. isth. 4.2μ .

Hab. **Hondo**: Gōno-ike in Hitachi. (Pl. XXV, f. 29)

Cosmarium subreinschii SCHMIDLE var. **ocellatum** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 165, 1902.

Cellulae pyramidato-rectangulares, apice truncato-convexo; semicellulae cum scrobicula magna prominenta in centrum. Long. 21.5μ , Lat. 13.8μ , Lat. isth. 4.3μ .

Hab. **Hokkaido**: Horomui in Ishikari. (New to Japan) (Pl. XXV, f. 39)
Distr. Ceylon.

Cosmarium bengalense (GRUN.) TURNER in K. Sv. Vet. Akad. Handl. 25, 56, 1893; KRIEGER Arch. Hydrobiol. suppl. 11, 171, 1932; HIRANO Act. Phytotax. Geobot. 13, 151, 1943.

Cellulae mediocres, circiter 1½ longiores quam latae, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae subrectangulares in parte inferiore et truncato-pyramidatae in parte superiore, angulis basalibus rectangulari-rotundis, marginibus lateralibus superioribus et inferioribus late retusis, apicibus truncatis et retusis in medio, angulis apicalibus et lateralibus rotundis; membrana subtiliter granulata. Long. $68.8-71\mu$, Lat. $38.7-39\mu$, Lat. isth. $15-17\mu$.

Hab. **Hondo**: Izu-numa in Rikuzen; Kôriyama in Iwashiro; Onjaga-ike in Kamifusa; Takaraga-ike in Yamashiro. **Kiushiu**: Kagami-ike in Satsuma. (Pl. XXV, f. 35)

Distr. Japan, India, Java.

Cosmarium laeve RABENH. in Flor. Europ. Alg. 3, 161, 1868; G. S. WEST Journ. Linn. Soc. Bot. 34, 386, 1899; WEST Bot. Tidsskr. 24, 171, 1901; SKUJA Symb. Sinic. 1, 62, 1937; INSAM & KRIEGER Hedw. 76, 101, 1937; YONEDA Act. Phytotax. Geobot. 11, 206, 1942; TAFT Ohio Journ. Sci. 45, 195, 1945.

Cellulae parvae, paene 1.5 longiores quam latae, profunde constrictae, sinu angusto-lineari ad verticem subampliato et exterius leviter aperto; semicellulae semiellipticae vel rotundo-pyramidal-truncatae, angulis basalibus rotundis, marginibus lateralibus convexis, apicibus angustis et in medio retusis, angulis apicalibus bene rotundis; a latere visae ovato-ellipticae; a vertice visae ellipticae; membrana subtiliter et sparse punctata; chromatophoris axialibus cum pyrenoidibus centralibus in unoquaque semicellula. Long. $18-32\mu$, Lat. $12.6-22.4\mu$, Lat. isth. $2.8-8\mu$.

Hab. **Hondo**: Hakuryu-ko in Uzen; Ômine-numa in Kôzuke; Takashihara in Mikawa; Ariga-ike in Yamashiro. (Pl. XXV, f. 40, 41, 46)

Distr. Japan, Manchuria, China, Thailand, Burma, India, Pamir, Ceylon, Borneo, whole Europe, Nova Zembla, N. & S. America, Australia, Africa, Madagascar, Azores.

var. **septentrionale** WILLE in WEST Journ. Roy. Micr. Soc. 3, 1889 (reprint); Journ. Linn. Soc. Bot. 34, 387, 1899; Monogr. Brit. Desm. 3, 102, 1908; KRIEGER Arch. Hydrobiol. suppl. 11, 178, 1932; SKUJA Hedw. 77, 62, 1937; HIRANO Journ. Jap. Bot. 20, 47, 1944.

Cellulae 1.5 longiores quam latae; semicellulae parum hexagonales, lateribus leviter convexis, angulis leviter rotundis. Long. 19-22.4 μ , Lat. 14-14.5 μ , Lat. isth. 3.4-5 μ .

Hab. **Hokkaido**: Shiraoi-poroto-numa in Iburi. **Hondo**: Hirumo-numa in Ugo; Kobuchi-numa in Rikuzen; Kagami-ike of Matsunoyama in Echigo; Daimon-pass, Kanori-ike in Shinano; Fuse-ike, Shinohara-ike in Oomi; Takaraga-ike in Yamashiro. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXV, f. 45)

Distr. Japan, Siberia, Burma, Ceylon, Europe, Nova Zembla, U. S. A., E. Africa.

var. **octangularis** (WILLE) W. & G. S. WEST in Monogr. Brit. Desm. 3, 101, 1908; TAFT Ohio Journ. Sci. 45, 196, 1945.

Semicellulae suboctangulari-ellipticae, apicibus retusis, duobus marginibus lateralibus inferioribus leviter longioribus quam superioribus infimis; a latere visae oblongo-ellipticae. Long. 18 μ , Lat. 13.4 μ , Lat. isth. 4.2 μ .

Hab. **Hondo**: Kariwano in Ugo; Mizoroga-ike in Yamashiro. (New to Japan) (Pl. XXV, f. 31)

Distr. China, Europe, Nova Zembla, Greenland, U. S. A., Azores.

var. **rotundatum** MESSIK. in Viertelj. Naturf. Ges. Zurich 80, 47, 1935; HIRANO Act. Phytotax. Geobot. 12, 92, 1943.

Semicellulae elliptico-hexagonae cum apice recto vel levissime retuso. Long. 16-17 μ , Lat. 11-12 μ , Lat. isth. 5.6 μ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu; Koke-numa in Ugo; Oze-numa in Kôzuke; Senjôgahara in Shimofusa; Shigakôgen in Shinano; Mt. Hira in Oomi. (Pl. XXV, f. 20)

Distr. Japan, Switzerland.

This variety resembles to *Cosm. contractum* KIRCHN. var. *minutum* (DELP.) W. & G. S. WEST but differs from it by the smaller size and the possession of less open sinus.

var. **reniforme** HIRANO in Mem. Coll. Sci. Kyoto Univ. B, 19, 66, 1948.

Semicellulae subreniformi-hexagonales, marginibus omnibus leviter convexis, angulis apicalibus late rotundis, apicibus retusis. Long. 18.2 μ , Lat. 11.2 μ , Lat. isth. 2.8 μ .

Hab. **Hondo**: Inago in Shinano; Mizoroga-ike in Yamashiro. (Pl. XIX, f. 7, Pl. XXV, f. 32, 43)

Distr. Japan.

Plate XVII.

1. <i>Cosmarium binerve</i> LUND.	91
2. <i>C. zonatum</i> LUND.	90
3. <i>C. moniliforme</i> (TURP.) RALFS f. <i>pandiforme</i> HEIMERL.	89
4. <i>C. moniliforme</i> f. <i>elliptica</i> LAGERH.	89
5. <i>C. moniliforme</i> f. <i>elongata</i> W. & G. S. WEST	90
6. <i>C. moniliforme</i> (TURP.) RALFS	89
7. <i>C. moniliforme</i> f. <i>punctata</i> LAGERH.	89
8. <i>C. connatum</i> BRÉB.	88
9. <i>C. turgidum</i> BRÉB. var. <i>ovatum</i> NORDST.	87
10. <i>C. moniliforme</i> (TURP.) RALFS var. <i>subpyriforme</i> W. & G. S. WEST	90
11. <i>C. microsphinctum</i> NORDST.	121
12-14. <i>C. auriculatum</i> REINSCH	110
15. <i>C. turgidum</i> BRÉB.	87
16. <i>C. turgidum</i> var. <i>ovatum</i> NORDST.	87

1—16. ($\times 600$)

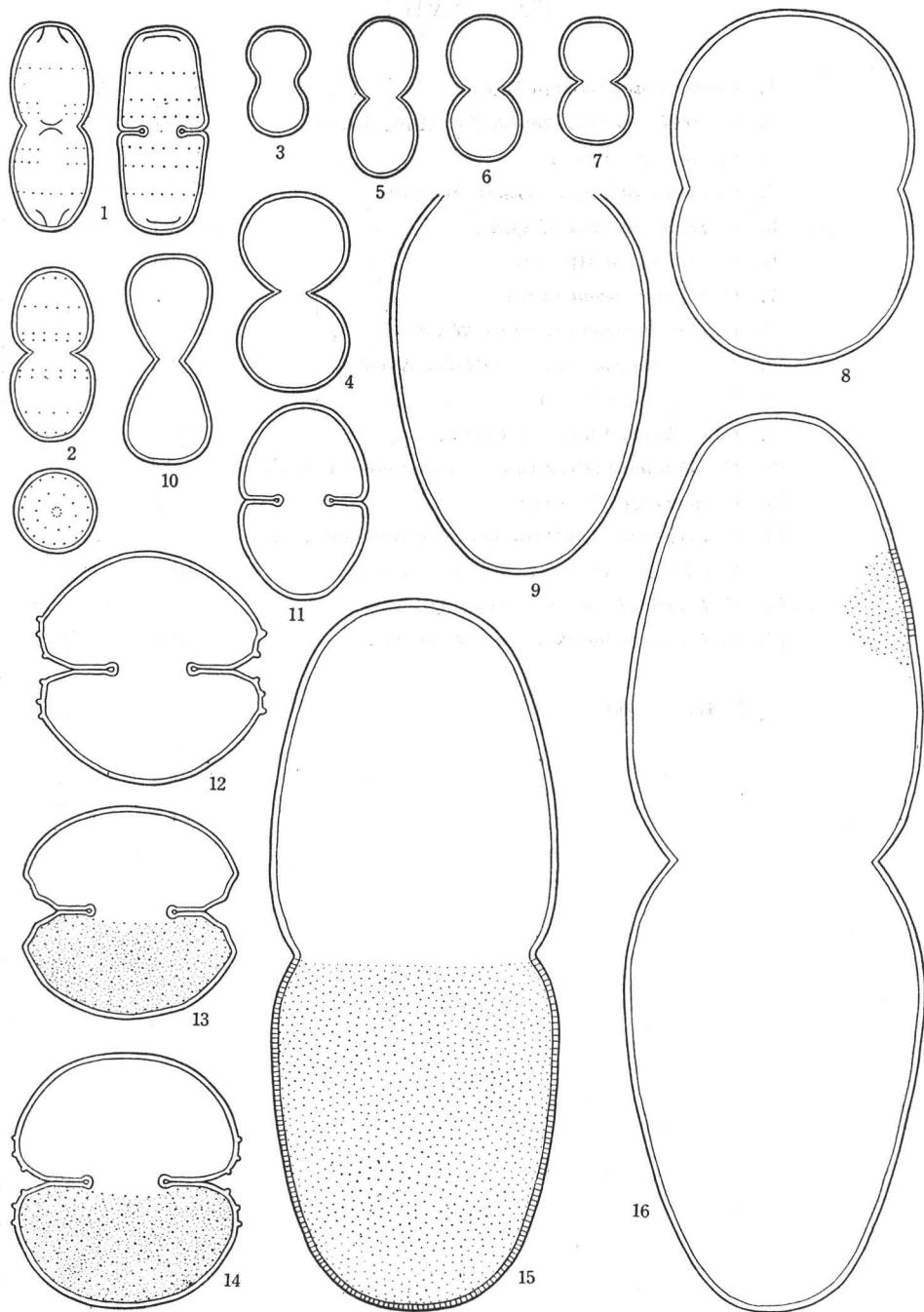


Plate XVIII.

1. <i>Cosmarium striolatum</i> NÄG.	94
2. <i>C. striolatum</i> var. <i>Mordstedtii</i> (MÖB.) KRIEGER	95
3. <i>C. amoenum</i> BRÉB.	92
4. <i>C. amoenum</i> var. <i>alternans</i> HIRANO	92
5. <i>C. pseudamoenum</i> WILLE	93
6. <i>C. nipponicum</i> HIRANO	93
7. <i>C. elegantissimum</i> LUND.	93
8. <i>C. elegantissimum</i> f. <i>minor</i> WEST	94
9. <i>C. elegantissimum</i> var. <i>simplicius</i> WEST	94
10. <i>C. praegrande</i> LUND.	96
11. <i>C. ocellatum</i> EICHL. & GUTW.	113
12. <i>C. subcucumis</i> SCHMIDLE var. <i>elongatum</i> HIRANO	120
13. <i>C. subcucumis</i> SCHMIDLE	119
14. <i>C. taxichondrum</i> LUND. var. <i>decachondrum</i> (ROY & BISSET) RACIB.	115
15, 16. <i>C. taxichondrum</i> var. <i>nudum</i> TURNER	115
17. <i>C. taxichondriforme</i> EICHL. & GUTW.	114

1—17. ($\times 600$)

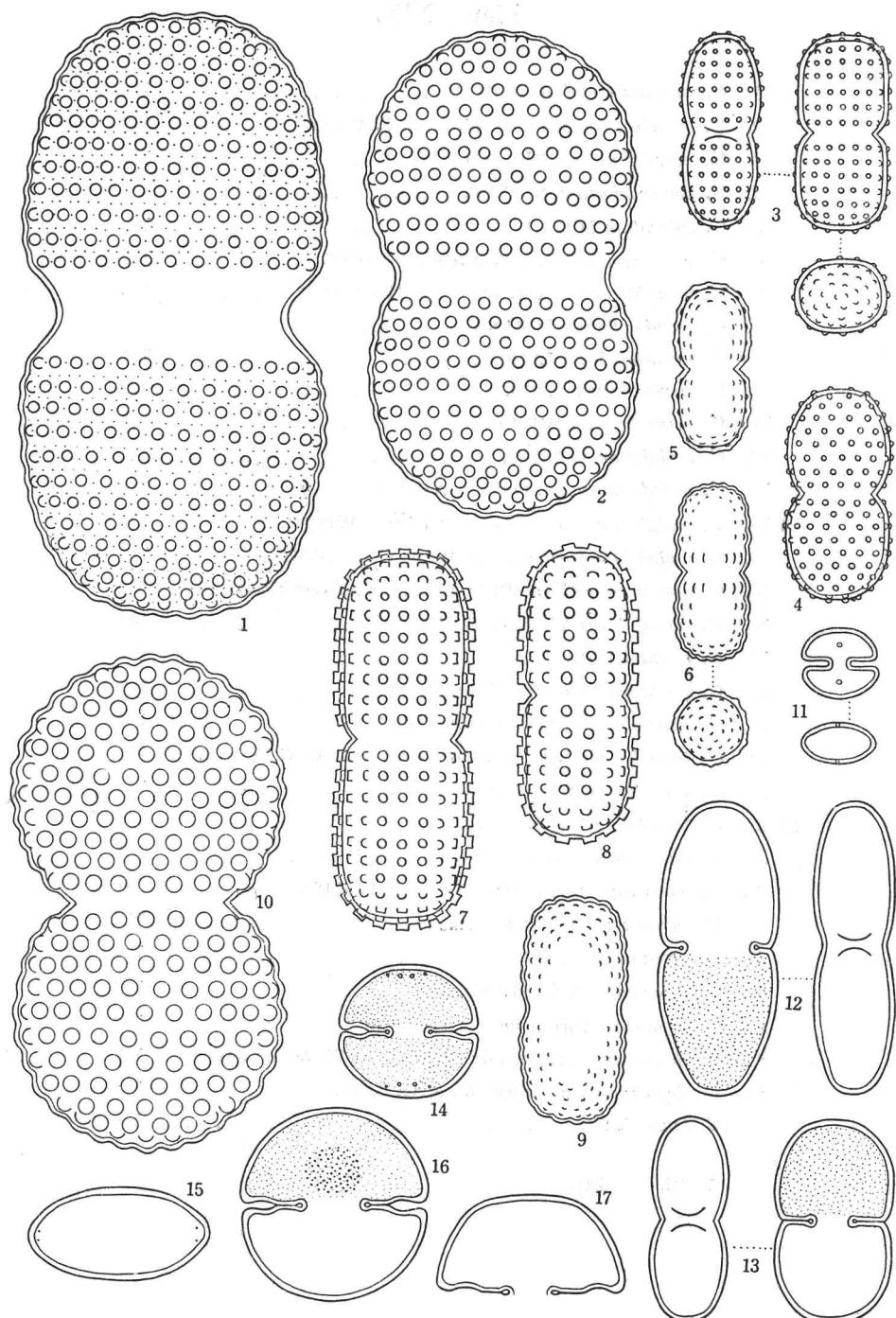


Plate XIX.

1. <i>Cosmarium circulare</i> REINSCH	112
2. <i>C. circulare</i> forma <i>minor</i> W. & G. S. WEST	112
3. <i>C. dorsiruncatum</i> (NORDST.) WEST	111
4. <i>C. microsphinctum</i> NORDST.	121
5. <i>C. obtusatum</i> SCHMIDLE	117
6. <i>C. speciosum</i> LUND. var. <i>simplex</i> NORDST.	122
7. <i>C. laeve</i> RABENH. var. <i>reniforme</i> HIRANO	165
8. <i>C. pseudocellatum</i> HIRANO	114
9. <i>C. tetrachondrum</i> LUND.	131
10. <i>C. inconspicuum</i> ARCH.	99
11. <i>C. obtusatum</i> SCHMIDLE	117
12. <i>C. undulatum</i> CORDA	116
13. <i>C. undulatum</i> var. <i>minutum</i> WITTR.	117
14, 15. <i>C. undulatum</i> var. <i>crenulatum</i> (NÄG.) WITTR.	116
16. <i>C. undulatum</i> forma <i>minor</i> W. & G. S. WEST	116
17. <i>C. petsamoense</i> CEDERCREUTZ var. <i>simplicius</i> KOSSINSK.	122
18. <i>C. subquadrans</i> W. & G. S. WEST	103
19. <i>C. tinctum</i> RALFS	101
20. <i>C. tinctum</i> var. <i>intermedium</i> NORDST.	102
21. <i>C. phaseolus</i> BRÉB. var. <i>minor</i> BOLDT	104
22. <i>C. tithophorum</i> NORDST. var. <i>depressum</i> W. & G. S. WEST	114
23. <i>C. tithophorum</i> forma <i>minor</i> RACIB.	114
24, 25. <i>C. bioculatum</i> BRÉB.	100
26. <i>C. bioculatum</i> var. <i>hians</i> W. & G. S. WEST	101
27. <i>C. bioculatum</i> forma <i>depressa</i> SCHAARSCHM.	101
28. <i>C. subcucumis</i> SCHMIDLE	119
29. <i>C. petsamoense</i> CEDERCREUTZ	121
30. <i>C. depressum</i> (NÄG.) LUND.	102
31. <i>C. depressum</i> forma <i>minuta</i> HEIMERL	102
32. <i>C. depressum</i> var. <i>achondrum</i> (BOLDT) W. & G. S. WEST ..	103
33. <i>C. depressum</i> var. <i>minor</i> W. & G. S. WEST	103
34. <i>C. tenuie</i> ARCH.	100

1—34. ($\times 600$)

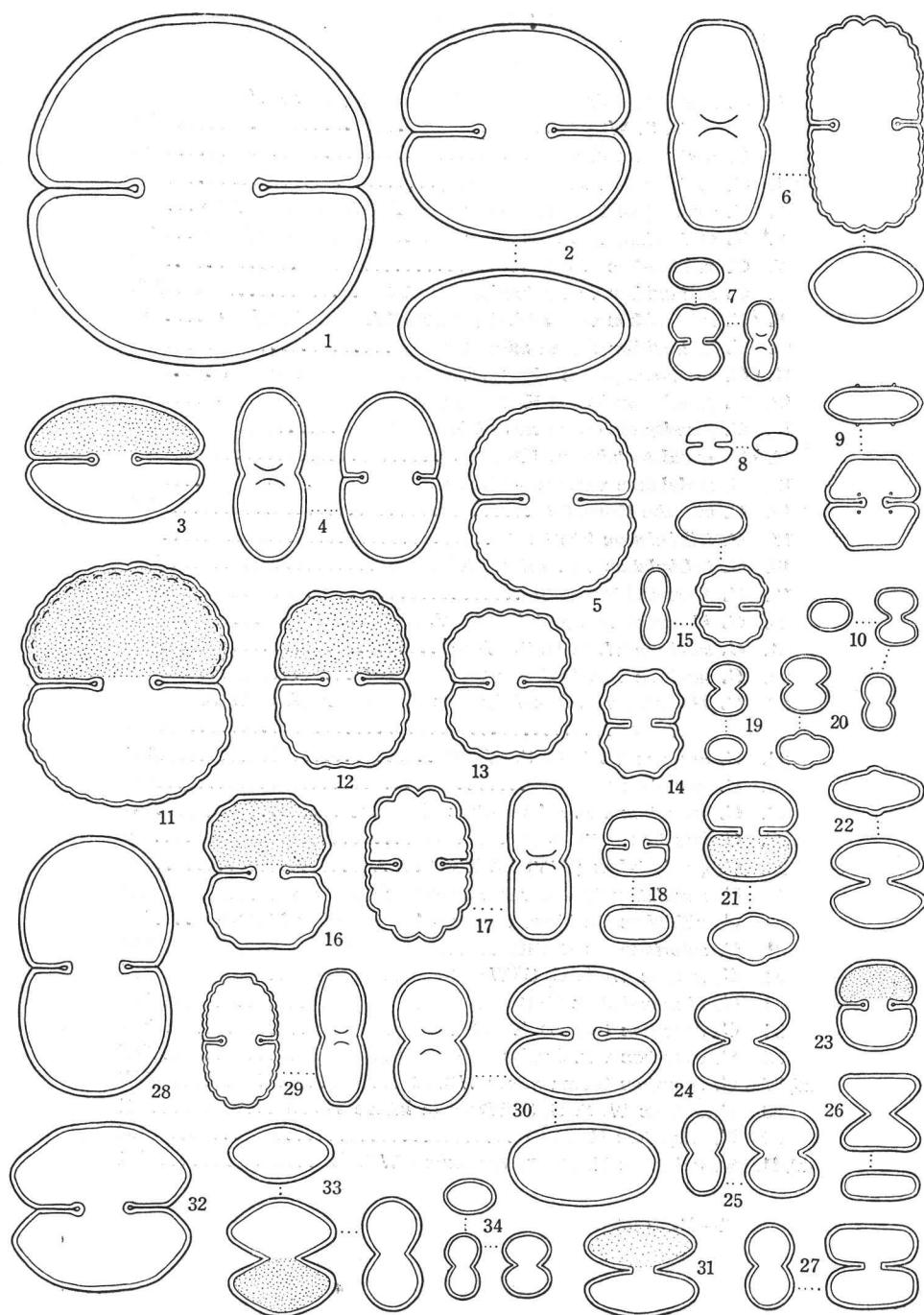


Plate XX.

1. <i>C. contractum</i> KIRCHN. var. <i>ellipsoideum</i> (ELFV.) W. & G. S. WEST	98
2. <i>C. contractum</i> KIRCHN.	98
3, 4. <i>C. contractum</i> var. <i>ellipsoideum</i>	98
5. <i>C. contractum</i> forma <i>Jacobsenii</i> (ROY) W. & G. S. WEST	98
6. <i>C. contractum</i> var. <i>minutum</i> (DELP.) W. & G. S. WEST	99
7. <i>C. subtumidum</i> NORDST.	132
8. <i>C. subtumidum</i> var. <i>rotundum</i> HIRANO	133
9. <i>C. subtumidum</i> var. <i>Klebsii</i> (GUTW.) W. & G. S. WEST	133
10. <i>C. subtumidum</i> forma <i>minor</i> STRÖM	132
11. <i>C. asphaerosporum</i> NORDST. var. <i>strigosum</i> NORDST.	100
12. <i>C. pseudoprotuberans</i> KIRCHN. var. <i>angustius</i> NORDST.	105
13. <i>C. pseudoprotuberans</i> var. <i>alpinum</i> RACIB.	106
14. <i>C. pseudoprotuberans</i> KIRCHN.	105
15. <i>C. undulatum</i> var. <i>crenulatum</i> forma <i>Kriegeri</i> HIRANO	117
16. <i>C. bicardia</i> REINSCH	104
17. <i>C. trilobulatum</i> REINSCH	130
18. <i>C. trilobulatum</i> var. <i>Printzii</i> MESSIK.	130
19. <i>C. Hammeri</i> REINSCH	126
20. <i>C. Hammeri</i> var. <i>protuberans</i> W. & G. S. WEST	127
21. <i>C. succisum</i> W. & G. S. WEST	125
22. <i>C. succisum</i> var. <i>hyalinum</i> SKVORTZOW	126
23. <i>C. Hammeri</i> var. <i>homalodermum</i> (NORDST.) W. & G. S. WEST	128
24. <i>C. aversum</i> W. & G. S. WEST	104
25. <i>C. granatum</i> BRÉB.	129
26. <i>C. granatum</i> var. <i>subgranatum</i> NORDST.	130
27. <i>C. incertum</i> SCHMIDLE	126
28. <i>C. quadratum</i> (GAY) De TONI	129
29. <i>C. variolatum</i> LUND. var. <i>foraminum</i> HIRANO	134
30. <i>C. nitidulum</i> De NOT. var. <i>pseudorectangulare</i> MESSIK.	133
31. <i>C. subortogonum</i> RACIB.	139
32. <i>C. urceum</i> W. & G. S. WEST	124
33. <i>C. Nymannianum</i> GRUN.	128
34. <i>C. venustum</i> (BRÉB.) ARCHI.	136
35. <i>C. venustum</i> var. <i>brevius</i> BERNARD	137
36, 37. <i>C. venustum</i> forma <i>minor</i> WILLE	137
38. <i>C. urceum</i> W. & G. S. WEST (a latere visae)	124
39. <i>C. crispatum</i> HIRANO	132
40, 41. <i>C. galeritum</i> NORDST. var. <i>minus</i> WILLE	131

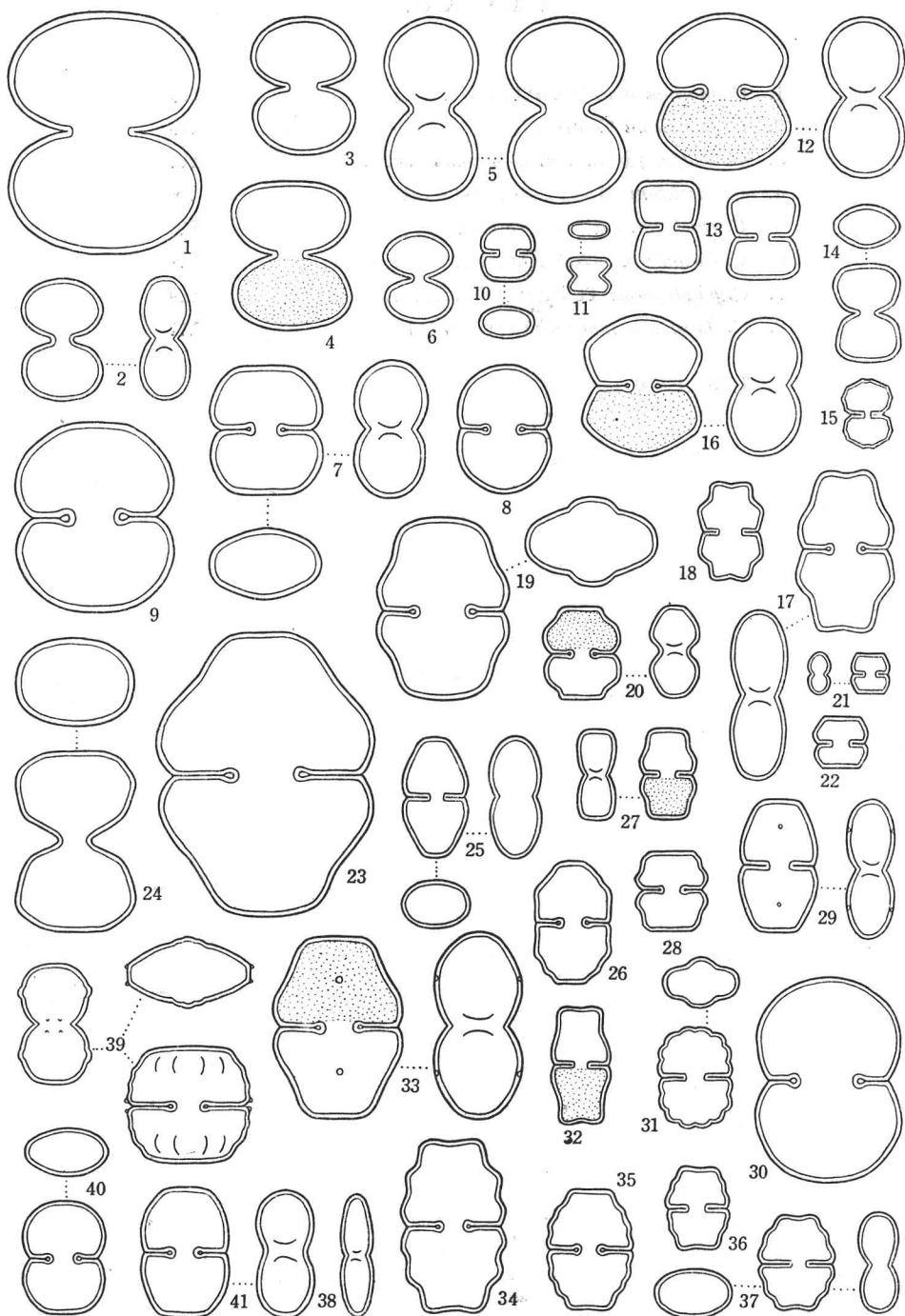


Plate XXI.

1. *Cosmarium maculatum* TURNER 118
2. *C. javanicum* NORDST. 118
3. *C. Ralfsii* BRÉB. var. *montanum* RACIB. 111
4. *C. obsoletum* (HANTZSCH) REINSCH 109
5. *C. obsoletum* var. *sitvense* GUTW. 110
6. *C. cucumis* (CORDA) RALFS 119
7. *C. pandrifforme* TURNER 119
8. *C. dorsitruncatum* (NORDST.) WEST 111

1—8. ($\times 600$)

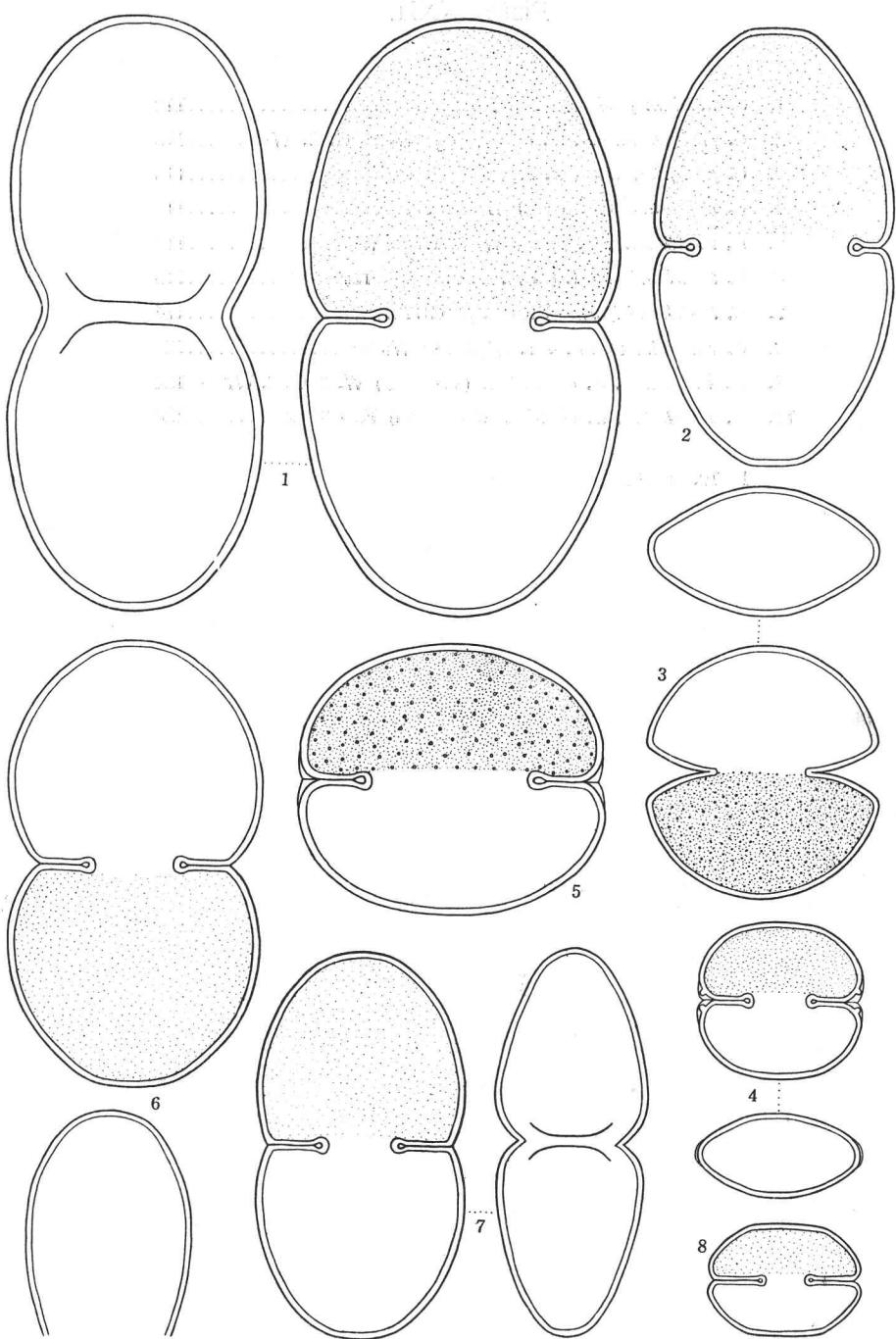


Plate XXII.

1. *Cosmarium pachydermum* LUND. 112
2. *C. pachydermum* var. *aethiopicum* W. & G. S. WEST ... 113
3. *C. pachydermum* var. *heptagonum* GRÖNBL. 113
4. *C. maximum* (BÖRGES.) WEST 110
5. *C. maximum* var. *minor* W. & G. S. WEST 110
6. *C. taxichondrum* LUND. var. *magnum* HIRANO 115
7. *C. taxichondriforme* EICHL. & GUTW. 114
8. *C. Lundellii* DELP. var. *ellipticum* WEST 120
9. *C. Lundellii* var. *corruptum* (TURNER) W. & G. S. WEST 121
10. *C. Lundellii* var. *circulare* (REINSCH) KRIEGER 120

1—10. ($\times 600$)

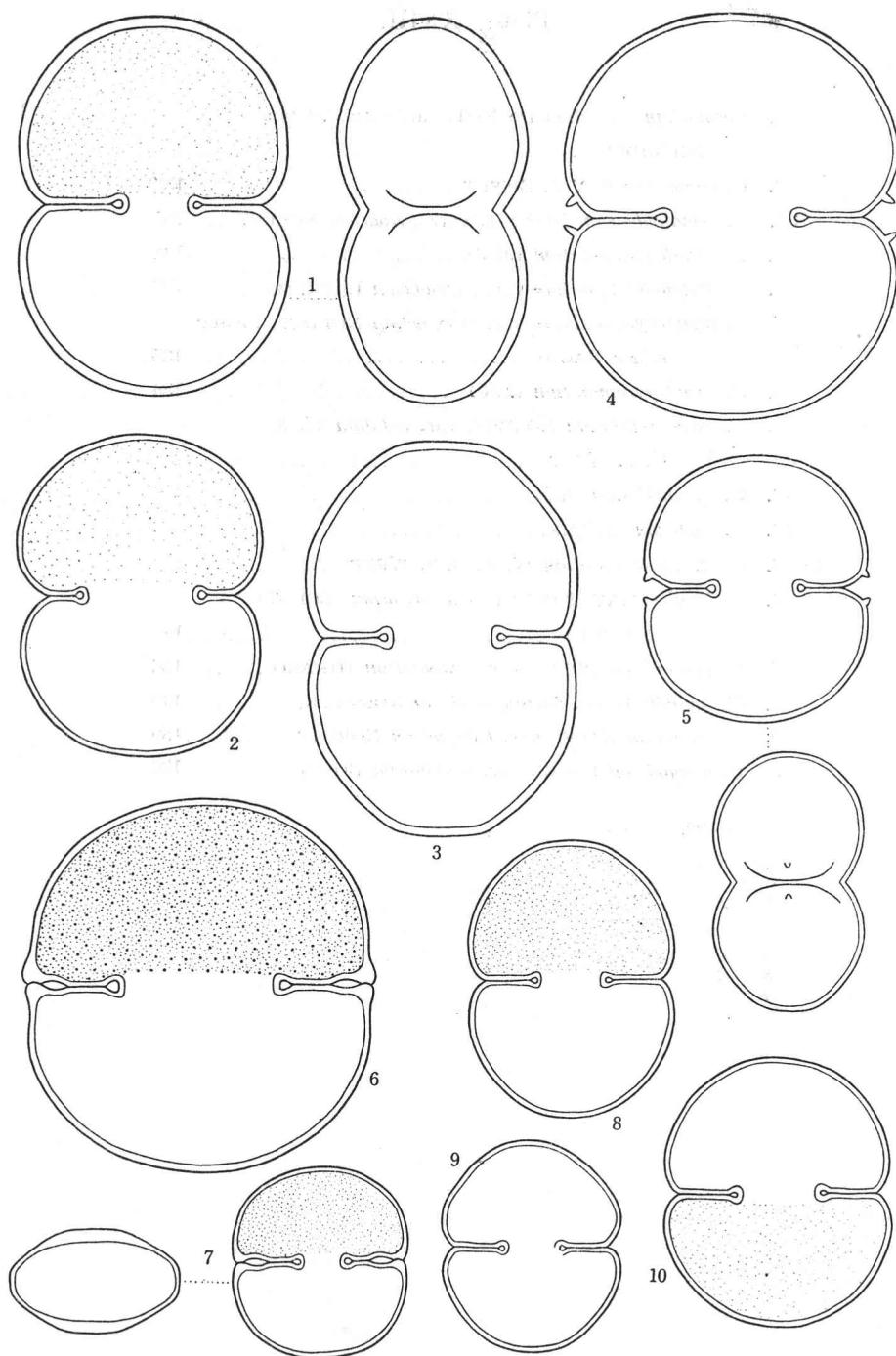


Plate XXIII.

- | | |
|---|-----|
| 1. <i>Cosmarium nitidulum</i> De NOT. var. <i>subundulatum</i> | |
| SCHMIDLE | 133 |
| 2. <i>C. garrolense</i> ROY & BISSET | 137 |
| 3, 4. <i>C. cymatopleurum</i> NORDST. var. <i>Tyrolicum</i> NORDST..... | 138 |
| 5. <i>C. pseudopyramidatum</i> LUND. | 134 |
| 6. <i>C. pseudopyramidatum</i> var. <i>carniolicum</i> LÜTKEM. | 135 |
| 7. <i>C. pseudopyramidatum</i> var. <i>stenonotum</i> NORDST. forma
<i>minor</i> RACIB. | 135 |
| 8. <i>C. pseudopyramidatum</i> LUND. | 134 |
| 9. <i>C. pseudonitidulum</i> NORDST. var. <i>validum</i> W. &
G. S. WEST | 135 |
| 10-12. <i>C. pyramidatum</i> BRÉB. | 135 |
| 13. <i>C. raeticum</i> MESSIK. | 138 |
| 14, 15. <i>C. sublatere-undatum</i> W. & G. S. WEST | 138 |
| 16. <i>C. humile</i> (GAY) NORDST. var. <i>striatum</i> (BOLDT)
SCHMIDI.E | 140 |
| 17. <i>C. lapponicum</i> BORGE var. <i>granulatum</i> HIRANO | 136 |
| 18. <i>C. notabile</i> BRÉB. forma <i>arcticum</i> KOSSINSK. | 140 |
| 19. <i>C. crenatum</i> RALFS var. <i>bicrenatum</i> NORDST. | 139 |
| 20. <i>C. lapponicum</i> BORGE var. <i>undulatum</i> BORGE | 136 |

1—20. (×600)

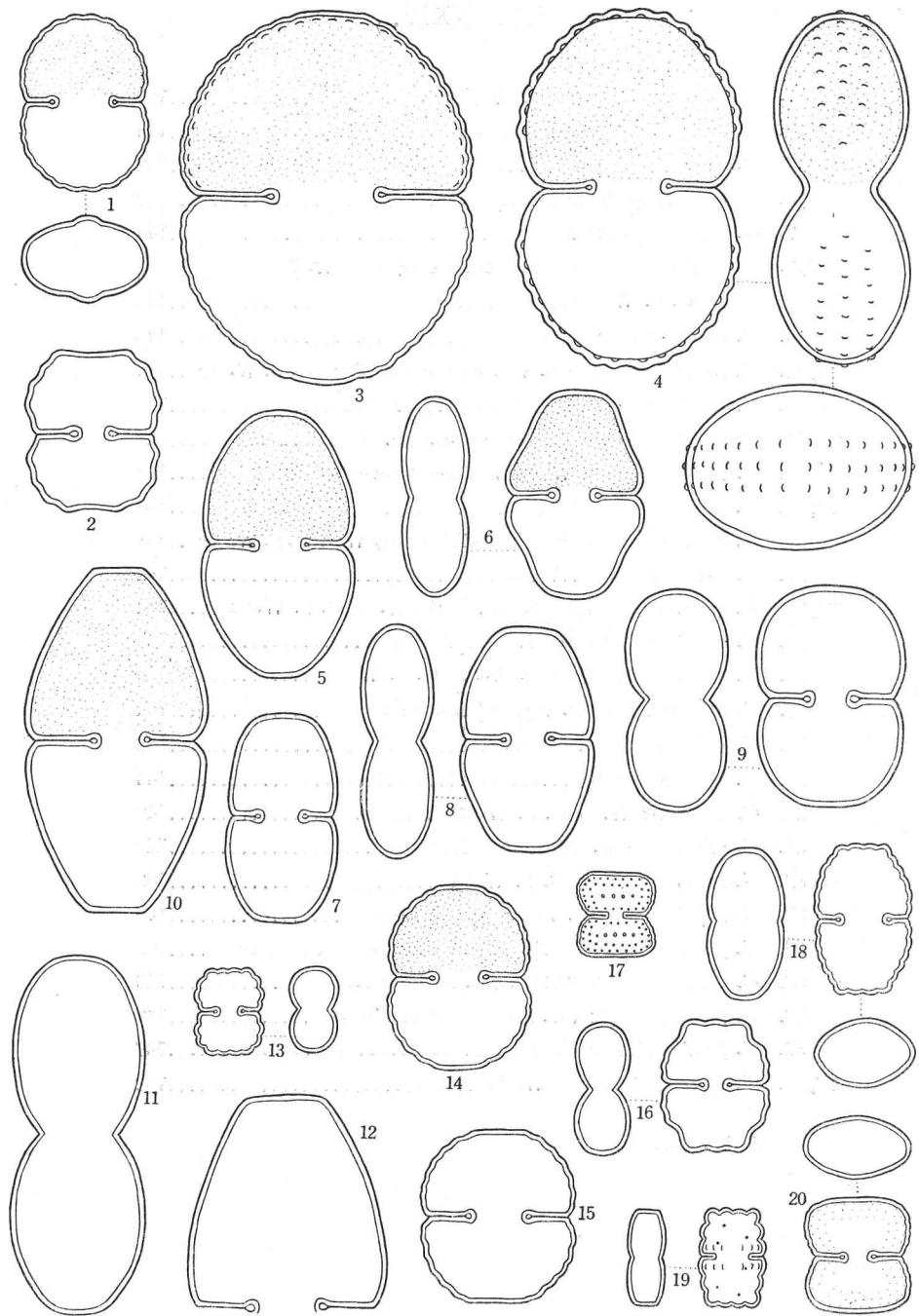


Plate XXIV.

1. <i>Cosmarium pseudobinerve</i> GRÖNBL.	145
2, 3. <i>C. tetragonum</i> (NÄG.) ARCH. var. <i>Lundellii</i> COOCHE	144
4. <i>C. rectangulare</i> GRUN.	152
5, 6. <i>C. quadratum</i> RALFS	143
7. <i>C. divergentiforme</i> HIRANO	146
8, 9. <i>C. norimbergense</i> REINSCH forma <i>depressa</i> W. & G. S. WEST	142
10. <i>C. norimbergense</i> REINSCH	142
11, 12. <i>C. rectangulare</i> GRUN. var. <i>africanum</i> W. & G. S. WEST	152
13. <i>C. decedens</i> (REINSCH) RACIB.	142
14. <i>C. decedens</i> var. <i>sinuosum</i> (LUND.) RACIB.	143
15. <i>C. synthlibomenum</i> WEST var. <i>montanum</i> HIRANO	148
16, 17. <i>C. angulosum</i> BRÉB.	150
18-21. <i>C. angulosum</i> var. <i>concinnum</i> (RABENH.) W. & G. S. WEST	151
22. <i>C. anceps</i> LUND.	143
23, 24. <i>C. quadratum</i> RALFS forma <i>Willei</i> W. & G. S. WEST	144
25. <i>C. plicatum</i> REINSCH	146
26. <i>C. Pokornyanum</i> (GRUN.) W. & G. S. WEST	125
27. <i>C. difficile</i> LÜTKEM. var. <i>sublaeve</i> LÜTKEM.	148
28. <i>C. pericymatium</i> NORDST.	148
29. <i>C. exiguum</i> Arch.	146
30. <i>C. minimum</i> W. & G. S. WEST	149
31. <i>C. minimum</i> var. <i>rotundatum</i> MESSIK.	149
32. <i>C. minimum</i> W. & G. S. WEST	149
33. <i>C. holmiense</i> LUND. var. <i>integrum</i> LUND.	145
34. <i>C. pseudoprotuberans</i> KIRCHN. forma <i>minor</i> SCHMIDLE	105
35. <i>C. pseudoexiguum</i> RACIB. var. <i>retusum</i> HIRANO	148
36. <i>C. pseudoexiguum</i> var. <i>hexagonum</i> GRÖNBL.	147
37. <i>C. pseudoexiguum</i> RACIB.	147
38, 39. <i>C. cymatotrophorum</i> WEST	153

1-39. ($\times 600$)

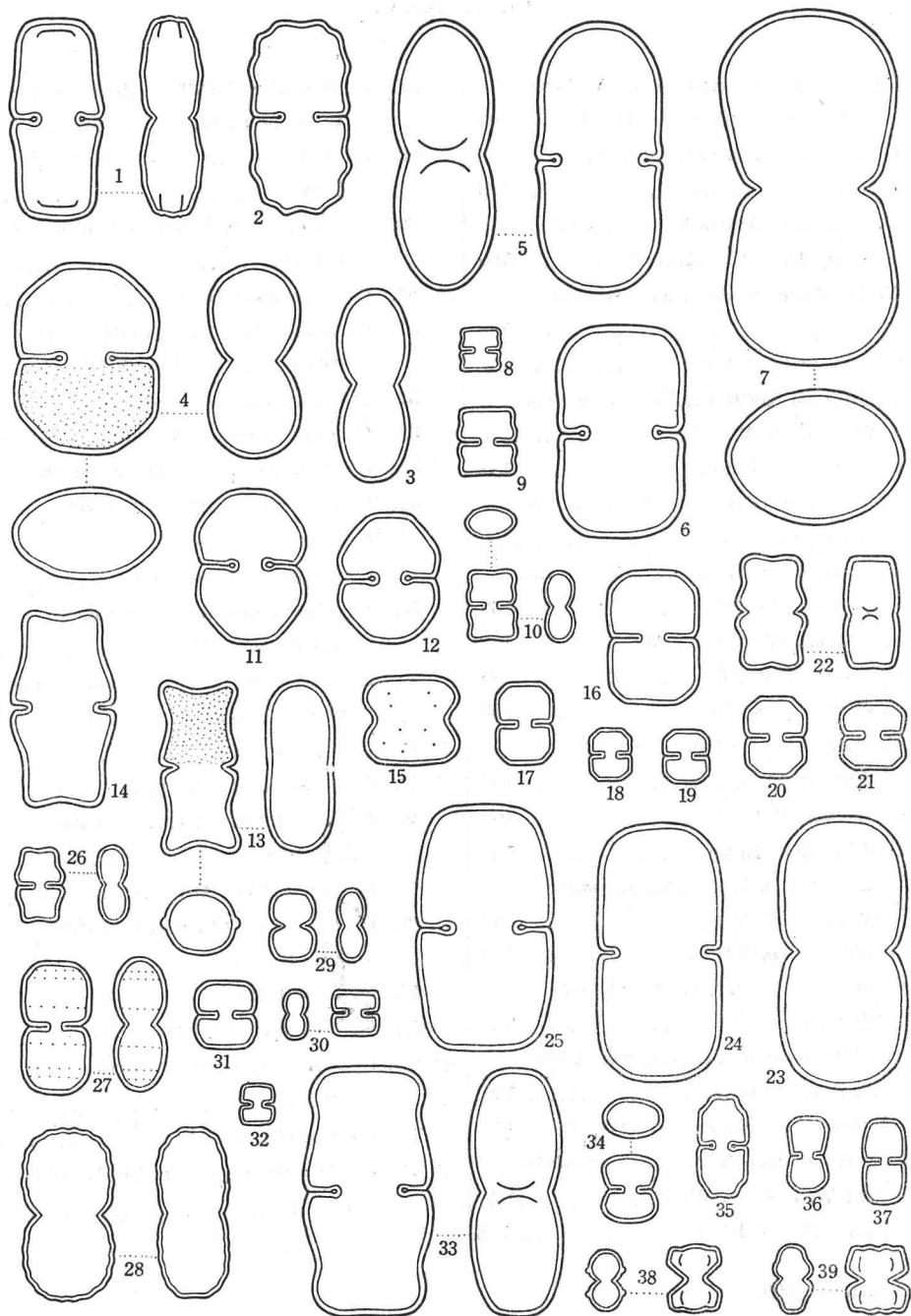


Plate XXV.

- | | | | |
|---|-----|---|-----|
| 1. <i>Cosmarium depressum</i> (NÄG.) LUND.
var. <i>apertum</i> (TURNER) HIRANO | 102 | 27. <i>C. repandum</i> NORDST. forma <i>minor</i>
W. & G. S. WEST | 160 |
| 2. <i>C. depressum</i> var. <i>plancticum</i>
REVERDIN | 103 | 28. <i>C. Meneghinii</i> BRÉB. var. <i>Reinschii</i>
ISTV. | 162 |
| 3. <i>C. pseudoprotuberans</i> KIRCHN. var.
<i>Borgei</i> INSAM & KRIEGER | 106 | 29. <i>C. impressulum</i> ELFV. var. <i>octangularis</i>
HIRANO | 163 |
| 4. <i>C. pseudoprotuberans</i> var. <i>pygmaeum</i>
GUTW. | 106 | 30. <i>C. scopulorum</i> BORGE | 160 |
| 5. <i>C. sexangulare</i> LUND. | 157 | 31. <i>C. laeve</i> RABENH. var. <i>octangularis</i>
(WILLE) W. & G. S. WEST | 165 |
| 6. <i>C. exiguum</i> ARCH. var. <i>subrectangulum</i>
W. & G. S. WEST | 147 | 32. <i>C. laeve</i> var. <i>reniforme</i> HIRANO | 165 |
| 7. <i>C. pygmaeum</i> ARCH. | 156 | 33. <i>C. subrectangulare</i> GUTW. | 159 |
| 8, 9. <i>C. Sinostegos</i> SCHAARSCHM. var. <i>obtusius</i> GUTW. | 156 | 34. <i>C. staurastroides</i> EICHL. & GUTW. | 155 |
| 10. <i>C. geometricum</i> W. & G. S. WEST var.
<i>sueicum</i> BORGE | 150 | 35. <i>C. bengalense</i> (GRUN.) TURNER | 164 |
| 11. <i>C. adoxum</i> W. & G. S. WEST | 155 | 36. <i>C. Regnesi</i> REINSCH | 152 |
| 12. <i>C. bireme</i> NORDST. | 155 | 37. <i>C. pusillum</i> (BRÉB.) ARCH. | 149 |
| 13. <i>C. Clepsydra</i> NORDST. | 160 | 38. <i>C. abbreviatum</i> RACIB. forma
<i>germanica</i> RACIB. | 159 |
| 14, 15. <i>C. sexangulare</i> LUND. forma <i>minima</i>
NORDST. | 157 | 39. <i>C. subreinschii</i> SCHMIDLE var. <i>ocellatum</i>
W. & G. S. WEST | 163 |
| 16. <i>C. Braunii</i> REINSCH | 162 | 40, 41. <i>C. laeve</i> RABENH. | 164 |
| 17. <i>C. Meneghinii</i> BRÉB. | 162 | 42. <i>C. prominulum</i> RACIB. | 157 |
| 18. <i>C. abbreviatum</i> RACIB. forma <i>minor</i>
W. & G. S. WEST | 158 | 43. <i>C. laeve</i> RABENH. var. <i>reniforme</i>
HIRANO | 165 |
| 19. <i>C. abbreviatum</i> RACIB. | 158 | 44. <i>C. fuseense</i> HIRANO | 139 |
| 20. <i>C. laeve</i> RABENH. var. <i>rotundatum</i>
MESSIK. | 165 | 45. <i>C. laeve</i> RABENH. var. <i>septentrionale</i>
WILLE | 164 |
| 21. <i>C. abbreviatum</i> RACIB. var. <i>plancticum</i>
W. & G. S. WEST | 159 | 46. <i>C. laeve</i> RABENH. | 164 |
| 22. <i>C. geometricum</i> W. & G. S. WEST | 150 | 47. <i>C. Clepsydra</i> NORDST. | 160 |
| 23. <i>C. prominulum</i> RACIB. var. <i>subundulatum</i>
W. & G. S. WEST | 157 | 48, 49. <i>C. abbreviatum</i> RACIB. forma <i>pygmaea</i>
MESSIK. | 159 |
| 24-26. <i>C. impressulum</i> ELFV. | 163 | 50. <i>C. Regnellii</i> WILLE | 161 |
| | | 51, 52. <i>C. Regnellii</i> forma <i>minima</i> EICHL. &
GUTW. | 161 |

