

Flora Desmidiarum Japonicarum V

Auctore

Minoru HIRANO

Gen. **Euastrum** EHRENB.

in RALFS Brit. Desm. 78, 1848; RABENHORST Flor. Europ. Alg. 3, 179, 1838; WEST Monogr. Brit. Desm. 2, 1, 1905; SMITH Wisc. Bull. 57, 21, 1924; WEST & FRITSCH Treat. Brit. Freshw. Alg. 274, 1927; PRINTZ in ENGLER's Pflanzenfam. 3, 358, 1927; SMITH Freshw. Alg. U.S. 576, 1933; KRIEGER in Krypt. Fl. XIII. Abt. 1, 460, 1937.

Cellulae variabiles, longae quam latae, profunde constrictae ad medium, sinu generalis angusto-lineari vel raro aperto; semicellulae communiter truncato-pyramidatae, 3-5 lobatae, apicibus lobo polorum semper cum incisura mediana profunda ornatis, variabile aperta vel linea aliquando leviter depressione vel nulla, marginibus lateralibus integris, sinuatis vel diverse lobatis; membrana glabra, punctata, scrobiculata vel granulata, aliquando in margine exteriori spina vel granula acuta, ad basin semicellulae cum tumoribus hemisphaericis singulis vel plus praeditis, aliquando tumoribus aliis ad centrum vel intra marginem lobi lateralis praeditis; a vertice visae leviter ellipticae, lateribus utrobique cum tumoribus singulis vel plus ornatis; a latere visae anguste truncato-pyramidatae cum tumoribus basalibus; chromatophoris axialibus in cellulas parvas et pyrenoidibus singulis centralibus ornatis, in cellulas magnas pyrenoidibus multis irregularibus; zygosporae globosae vel ellipsoides, cum spinis numerosis simplicis vel papillis conicis numerosis.

- 1a. Lobis polaribus integris vel retusis ad apicem Subgen. **Atomum**
- 1b. Lobis polaribus incisura mediana distincta ornatis..... Subgen. **Entomum**

Subgen. **Atomum** (PRINTZ) HIRANO, stat. nov.

Euastrum sect. *Atomum* PRINTZ in Pflanzenfam. 3, 358, 1927.—subgen. *Eucosmium* NAG. in Gatt. einz. Alg. 120, 1848.—*Eucosmium* (NAG.) CEDERGREN in Ark. Bot. 25A:4, 40, 1933.

Cellulae parvae vel magnae, 3-lobae, lobo polari cum apice retuso; membrana glabra, scrobiculata vel granulata.

- 1a. Cellulae parvae, 10-40 μ in longitudinem.
- 2a. Membrana glabra, generaliter marginibus sine spina..... Sect. **Simplicia**

- 2b. Membrana cum granulis vel denticulis, marginibus cum granulis, denticulis vel spinis ordinatis Sect. **Ornata**
- 1b. Cellulae modicae, 40-67 μ in longitudinem; membrana cum tumore mediano glabro vel projectione ordinata Sect. **Glabra**
- 1c. Cellulae modice magnae, 45-135 μ in longitudinem; membrana cum tumore granulato ordinata Sect. **Retusa**

Sect. **Simplicia** (OKADA) HIRANO, stat. nov.

Euastrum sect. *Retusa* OKADA ser. *Simplicia* OKADA in Mem. Fac. Fish. Kagoshima Univ. 3, 226, 1953.

Semicellulae trilobae, lobo polari sine spinis apicalibus ad angulos et apice retuso ad medium, marginibus lateralibus sinuatis et retusis; membrana glabra; cellulae generaliter parvae.

- 1a. Cellulae circiter $1\frac{1}{2}$ -2 longiores quam latiores.
 - 2a. Parte basali semicellularum rectangulari; cellulae sine foramine mediano **E. insulare**
 - 3a. Cellulae $1\frac{1}{2}$ longiores quam latiores f. **typica**
 - 3b. Cellulae latae, $1\frac{1}{2}$ longiores quam latiores var. **silesiacum**
 - 2b. Parte basali semicellularum trapeziformi; cellulae cum foramine mediano.
 - 3a. Cellulae cum foramine mediano ordinatae, apice retuso **E. Lütkenmülleri** var. **carnolicum**
 - 3b. Cellulae sine foramine mediano, apice cum incisura ordinato **E. crassicole** var. **incisum**
- 1b. Cellulae circiter $1\frac{1}{2}$ -1 $\frac{3}{4}$ longiores quam latiores.
 - 2a. Lobo lateralis distincte bilobulato.
 - 3a. Semicellulae semicirculares, lobulis lateralibus superioribus et inferioribus aequalibus **E. montanum**
 - 3b. Semicellulae trapeziformes, lobulis lateralibus superioribus minoribus quam inferioribus, interdum paene aequalibus.
 - 4a. Margine laterali inferiori parallelo **E. binale** var. **parallellum**
 - 4b. Margine laterali inferiori non parallelo var. **sectum**
 - 2b. Lobo laterali non bilobulato, integro vel leviter retuso.
 - 3a. Angulo apicali loborum polarium rectangulare **E. binale**
 - 4a. Angulo apicali integro.
 - 5a. Cellulae 12-25 μ in longitudinem.
 - 6a. Cellulae $1\frac{1}{2}$ -1 $\frac{3}{4}$ longiores quam latiores, marginibus loborum lateralium rotundis f. **typica**
 - 6b. Cellulae breves, circiter $1\frac{1}{10}$ longiores quam latiores, marginibus inferioribus loborum lateralium truncatis et divergentibus var. **hians**
 - 5b. Cellulae 10-12 μ in longitudinem var. **minus**
 - 4b. Angulo apicali cum spina minuta disposito.
 - 5a. Semicellulae cum distincta inflatione mediana magna ordinatae **E. binale** var. **papilliferum**
 - 5b. Semicellulae cum indistincte inflatione mediana ordinatae.
 - 6a. Apice semicellularum paene aequali a parte basali var. **Koreana**
 - 6b. Apice semicellularum angustiore quam parte basali var. **Cutwinskii**

- 3b. Angulo apicali loborum polarium rotundo **E. sublobatum**
- 4a. Cellulae latiores **f. typica**
- 4b. Cellulae angustiores.
- 5a. Apice non dilatato; cellulae in vertice visae oblongae.... **var. obtusatum**
- 5b. Apice dilatato; cellulae in vertice visae ovatae.....**var Kriegeri**

Euastrum insulare (WITTR.) ROY in West Monogr. Brit. Desm. 2, 68, 1905; HOM-FELD Pflanzenf. 12, 30, 1929; TAYLOR Pap. Mich. Acad. Sci. 20, 204, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 555, 1937; MESSIKOMMER Hedw. 78, 161, 168, 1938; HIRANO Act. Phytotax. Geobot. 12, 42, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 229, 1953.

Cellulae minutae, $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae 3-lobatae, incisuris laterali-bus retusis vel concavis, lobis polaribus late rectangularibus cum angulis rotundis, apice truncato vel leviter convexo in medio retuso-emarginato, parte inferiori semicellulae paene transverse rectangulares, marginibus paralle-lis et leviter retusis, angulis basalibus subrectangularibus; a latere visae ovatae, lateribus cum tumore paulo in mediana utrobique; membrana glabra. Long. $25\ \mu$, Lat. $17\ \mu$, Lat. isth. $5.6\ \mu$.

Hab. **Hokkaido**: Sarufutsu in Kitami; Kamikoshi-ukishimahara in Ishi-kari. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai in Rikuchu; Oze, Mt. Akagi in Kôzuke; Takayachi of Mt. Myoko, Mt. Naeba in Echigo; Gakino-tanbo in Etchû; Shigakôgen, Mt. Kirigamine, Tsugadaira in Shinano; Mt. Hira in Oomi. **Kiushiu**: Ôhatayama of Mt. Kirishima in Hiuga. (Pl. XXXIV, fig. 10)

Distr. Japan, Siberia, Thailand, Ceylon, Europe, N. & S. America.

var. silesiacum GRÖNBL. in KRIEGER Krypt. Fl. XIII, Abt. 1, 557, 1937; HIRANO Act. Phytotax. Geobot. 12, 42, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 230, 1953.—
forma *silesiaca* GRÖNBLAD in MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 43, 1935.

Var. cellulis brevioribus latioribusque, minus $1\frac{1}{2}$ plo longius quam latis, angulis apicalibus in lobum polarem paene rectangulari-rotundis, a latere visae paene circulares cum tumore utrobique. Long. $23-25\ \mu$, Lat. $19-19.6\ \mu$, Lat. isth. $5-5.6\ \mu$.

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Hibushi-numa in Iwaki; Oze in Kôzuke. (Pl. XXXVI, fig. 11)

Distr. Japan, Germany.

Euastrum Lütkenmülleri DUC. **var. carniolicum** (LÜTKEM.) KRIEGER in Krypt. Fl. XIII, Abt. 1, 561, 1937.

Var. lobis polaribus cum prominenti scrobiculis singulis in medio semicel-lularum, marginibus apicalibus leviter incrassatis; a latere visae ovatae, prominentibus scrobiculis in latere superiore utrobique; a vertice visae elli-

pticae, lateribus cum inflationibus utrobique. Long. 25–31 μ , Lat. 16.8–20 μ , Lat. isth. 4–6.4 μ .

Hab. **Hokkaido**: Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Hizume in Rikuchû; Mt. Kurikoma in Ugo; Ômine-numa in Kôzuke; Ishigaki-ike in Ise; Fuse-ike in Oomi. (New to Asia) (Pl. XXXIII, fig. 13)

Distr. Europe.

Euastrum crassicole LUND. var. **incisum** HIRANO, var. nov.

Semicellulae cum incisuris apicalibus angusto-linearis ordinatae, ceterae ut in forma typica. Long. 26 μ , Lat. 15.4 μ , Lat. isth. 6.2 μ .

Hab. **Hondo**: Ôniu-ike in Etchû; Inago of Kitamaki-mura in Shinano. (Pl. XXXVI, fig. 19)

Euastrum montanum W. & G. S. WEST in Monogr. Brit. Desm. 2, 58, 1905; LUTKEMÜLLER Verh. k. k. zool. bot. Ges. Wien. 60, 483, 1910; DONAT Pflanzenf. 5, 11, 1926; OKADA Journ. Imp. Fish. Inst. 30, 155, 1934; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 43, 1935; TAYLOR Pap. Mich. Acad. Sci. 20, 205, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 554, 1937; HIRANO Act. Phytotax. Geobot. 12, 43, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 230, 1953.

Cellulae parvae, leviter minus $1\frac{1}{2}$ plo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae oblongo-rectangulares vel late ovatae, leviter 5-lobatae, marginibus lateralibus convexis praesertim biundulatis vel leviter triundulatis, undulatione basali parva, lobo polari latissime rectangulari cum angulis rectangularibus vel rotundis, apice convexo in medio retuso; a latere visae ovatae, lateribus cum tumore utrobique; a vertice visae ellipticae tumore rotundo in medio utrobique; membrana glabra. 21–24 μ , Lat. 16.8–19.6 μ , Lat. isth. 4.2–5.6 μ .

Hab. **Hokkaido**: Numano-taira on Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda, Hachimantai in Mutsu; Sugigamine of Mt. Zawo in Uzen; Hibushinuma in Iwaki; Mt. Azuma in Iwashiro; Oze in Kôzuke; Shimizu-daira of Mt. Nasu in Shimotsuke; Kurosawano-ike, Takayachi of Mt. Myoko, Mt. Naeba in Echigo; Mt. Tateyama, Tarobei-daira, Mt. Kaminotake, Kurobe-goro-daira, Kumono-taira, Mt. Norikura in Etchû; Shigakôgen, Daimon-pass, Midoriga-ike of Mt. Yatsugatake, Mt. Kirigamine, Happo-ridge, Shirouma-ôike, Mt. Kazafuki-dake, Mt. Sanpôgamine, Kamikôchi, Ashinota-ike in Shinano. (Pl. XXXII, fig. 9)

Distr. Japan, Europe, Greenland, New Foundland.

Euastrum binale (Turp.) Ehrenb. in WEST Monogr. Brit. Desm. 2, 51, 1905; ALLORGE Rev. Alg. 5, 349, 1930; KRIEGER Krypt. Fl. XIII, Abt. 1, 548, 1937; PRESCOTT Amer. Midl. Nat. 34, 235, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 227, 1953.

Cellulae minutae, circiter $1\frac{1}{3}$ longiores quam latiores, profunde constrictae,

sinu angusto-lineari; semicellulae subpyramidatae, angulis basalibus rotundis, marginibus lateralibus concavis in parte superiori, apicibus late truncatis in medio retuso-emarginatis cum angulis acutis rotundis; a latere visae ovatae, apice acute rotundo; a vertice visae ellipticae, lateribus cum protuberantiis paulo in medio utrobique; membrana glabra. Long. 19–21 μ , Lat. 13–14.5 μ , Lat. isth. 4.3–5 μ .

Hab. **Hokkaido**: Akan-junsai-numa in Kushiro; Shiraoi-poroto-numa, Tôasa-numa, Tomakomai in Iburi. **Hondo**: Kurobo-numa in Mutsu; Koke-numa, Hoso-numa in Ugo; Hijiori-naga-numa, Ôishita in Uzen; Kanazuka-mura in Echigo; Kumono-taira, Tarobei-daira in Etchû; Kotsutsumi-nishi-ike in Mikawa; Fuse-ike, Mt. Hira in Oomi. **Shikoku**: Yodo-mura in Iyo. (Pl. XXXIV, fig. 5)

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

var. **Koreana** (SKVORTZOW) OKADA in Mem. Fac. Fish. Kagoshima Univ. 3, 228, 1953.
—forma *Koreana* SKVORTZOW in Philip. Journ. Sci. 49, 149, 1932.

Cellulae leviter longiores quam latae; semicellulae subhexagono-pyramidatae, marginibus lateralibus superioribus longioribus quam inferioribus, lateralibus retusis, angulis lateralibus et basalibus subrectangularibus, apice convexo et retuso in medio, angulis apicalibus cum spinis distinctis. Long. 15–18 μ , Lat. 13–16.8 μ , Lat. isth. 4.3–5.6 μ .

Hab. **Hokkaido**: Tomakomai, Tôasa-numa, Yûfutsu in Iburi; Horomui in Ishikari; Junsai-numa, Ko-numa in Oshima. **Hondo**: Mt. Iwaki in Mutsu; Izu-numa, Naga-numa in Rikuzen; Hôzawa-ike, Kôriyama in Iwashiro; Inago of Kitamaki-mura, Kanori-ike in Shinano; Ô-numa in Mikawa; Matsubara-naiko, Nukigawa in Oomi; Ko-ike in Yamashiro. **Kiushiu**: Fukiagenohama in Satsuma. (New to Japan) (Pl. XXXIV, fig. 13)

Distr. Japan, Korea.

var. **parallelum** HIRANO, var. nov.

Var. marginibus lateralibus inferioribus parallelis et leviter retusis, angulis apicalibus rotundis non acutis. long. 18.2 μ , Lat. 12.6 μ , Lat. isth. 2.8 μ .

Hab. **Hondo**: Akaiyachi in Iwashiro; Tsuga-daira in Shinano. (Pl. XXXVII, fig. 10)

var. **sectum** TURNER in WEST Monogr. Brit. Desm. 2, 53, 1905; KRIEGER Krypt. Fl. XIII, Abt. 1, 553, 1937.

Var. lobis lateralibus divicis in duabus partibus. Long. 19.6–25.2 μ , Lat. 15.4–18.2 μ , Lat. isth. 4.2–5.6 μ .

Hab. Hokkaido : Okineppe in Nemuro ; Nikuru-numa in Kitami ; Toyokoro-konuma in Tokachi ; Horomui, Nakano near Sapporo in Ishikari. **Hondo :** Mt. Hakkoda, Nagatai near Mt. Iwaki, Kotsutsumi, Bora-numa in Mutsu ; Hizume in Rikuchû ; Hirumo-numa, Kotomo-numa, Moritake-ôtsutsumi, Megata in Ugo ; Saigo-mura, Chûkawa-ike in Uzen ; Izu-numa, Naganuma, Kesho-numa in Rikuzen ; Kagami-ishi-mura, Akaiyachi in Iwashiro ; Mohara, Onjaga-ike in Kamifusa ; Kagami-ike near Matsunoyama in Echigo ; Okemi-ike, Inago of Kitamaki-mura, Kizaki in Shinano ; Takashihara, Kotsutsumi-nishi-ike, Suhara in Mikawa ; Biwa-ike in Owari ; Jôdo-ike in Ise. **Shikoku :** Yamada in Tosa. **Kiushiu :** Miyazaki, Ôhatayama of Mt. Kiri-shima in Hiuga. (New to Japan) (Pl. XXXI, fig. 8, 14)

Distr. Siberia, Manchuria, India, whole Europe, N. America, Africa.

var. **hians** W. WEST in KRIEGER Krypt. Fl. XIII, Abt. 1, 551, 1937 ; PRESCOTT Amer. Midl. Nat. 34, 235, 1945 ; TAFT Ohio Journ. Sci. 45, 190, 1945 ; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 228, 1953.

Cellulae minores et breviores quam in forma typica, cellulis minute longis quam latum. long. 11.2-14 μ , Lat. 10.6-12 μ , Lat. isth. 3.4-4.8 μ .

Hab. Hondo : Mt. Komagatake in Ugo ; Nishiazumayama, Akaiyachi in Iwashiro ; Gakino-tanbo, Sennin-ike, Mt. Yakushi in Etchû ; Happo-ridge, Tsuga-daira, Mt. Kirigamine in Shinano ; Fuse-ike, Oku-ike of Higashikusano-mura, Matsubara-naiko in Oomi. (New to Japan) (Pl. XXXVI, fig. 15)

Distr. Kuriles, U.S.A.

var. **minus** W. WEST in KRIEGER Krypt. Fl. XIII, Abt. 1, 552, 1937 ; HIRANO Act. Phytotax. Geobot. 12, 33, 1943 ; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 228, 1953.— forma *minor* W. WEST in Journ. R. Micr. Soc. 19, 1889.

Cellulae minores. Long. 11-12 μ , Lat. 10-11 μ , Lat. isth. 2.8-3 μ .

Hab. Hokkaido : Kiritappu in Kushiro. **Hondo :** Mt. Hakkoda in Mutsu ; Mt. Kurikoma in Ugo ; Yatsumanako of Mt. Iwate in Rikuchû ; Sugigamine of Mt. Zawo, Mt. Gassan in Uzen ; Akaiyachi in Iwashiro ; Oze in Kôzuke ; Mt. Tateyama, Tarobei-daira in Etchû ; Kazafuki-koshiki-ike in Shinano. (Pl. XXXVII, fig. 9)

Distr. Japan, Siberia, Europe, Greenland, U.S.A.

var. **papilliferum** GUTW. in MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 41, 1935 ; KRIEGER Krypt. Fl. XIII, Abt. 1, 533, 1937.

Var. lobis lateralibus paulo triundulatis cum granulis parvis acutis in angulo laterale utriusque, in medio semicellularum tumore magno hemispherico, apice cum incisura mediana profunda. Long. 19.3 μ , Lat. 15.6 μ ,

Lat. isth. $4.3\ \mu$.

Hab. **Hondo**: Koke-numa in Ugo; Kurobe-jii-daira, Sennin-ike in Etchû. (New to Asia) (Pl. XXXVI, fig. 16)

Distr. Switzerland.

var. **Gutwinskii** SCHMIDLE in WEST Monogr. Brit. Desm. **2**, 53, 1905; KRIEGER Krypt. Fl. XIII. Abt. **1**, 551, 1937; HIRANO Bot. Mag. **66**, 131, 1953.—forma *Gutwinskii* SCHMIDLE in KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. **2**, 79, 1934.

Cellulae fere maiores quam in forma typica, apicibus retusioribus, lobo laterali paulo tri-diviso, nonnumquam angulis utrinque minute granulatis. Long. $17-28\ \mu$, Lat. $14-20\ \mu$, Lat. isth. $4.2-5\ \mu$.

Hab. **Hondo**: Mt. Eboshi, Mt. Kaminotake in Etchû; Kamino-tanbo, Inago of Kitamaki-mura in Shinano. (Pl. XXXIV, fig. 12)

Distr. Japan, Siberia, whole Europe, N. America, N. Africa, Madagascar.

Euastrum sublobatum BRÉB. in RALFS Brit. Desm. **91**, 1848; WEST Monogr. Brit. Desm. **2**, 73, 1905; OKADA Journ. Imp. Fish. Inst. **30**, 157, 1930; KRIEGER Krypt. Fl. XIII, Abt. **1**, 544, 1937; HIRANO Act. Rhytotax. Geobot. **12**, 159, 1943; PRESCOTT & SCOTT Amer. Midl. Nat. **34**, 245, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 231, 1953.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae trapeziformes, 3-lobae, incisuris lateralibus latis et apertis leviter subrectangularibus, angulis basalibus et apicalibus rotundis, apicibus convexis et retusis in medio, marginibus lateralibus retusis; a latere visae ovatae, lateribus cum distinctis protuberantiis ad basim utrobique; a vertice visae ellipticae cum protuberantiis medianis utrobique. Long. $25-29.4\ \mu$, Lat. $19.6-22.4\ \mu$, Lat. isth. $4.3-8.3\ \mu$.

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu, Kamikoshi-ukishima-hara in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Yatsumanako of Mt. Iwate, Mt. Kurikoma in Rikuchû; Mt. Komagatake in Ugo; Mt. Azuma, Mt. Gassan in Uzen; Nanko in Iwaki; Mt. Naeba in Echigo; Mt. Tateyama, Tarobei-daira, Mt. Eboshi, Kurobe-goro-daira, Kumonotaira, Sennin-ike in Etchû; Mt. Shirouma-ôike, Tenguno-hara, Mt. Kazafuki, Happo-ridge, Okemi-ike, Shigakôgen in Shinano; Mt. Hira in Oomi; Mizoroga-ike in Yamashiro. (Pl. XXXIII, fig. 4)

Distr. Japan, Kuriles, Burma, Java, whole Europe, Greenland, N. America, Colombia.

var. **obtusatum** (GUTW.) KRIEGER in Krypt. Fl. XIII, Abt. **1**, 545, 1937; HIRANO Journ. Jap. Bot. **20**, 45, 1944; PRESCOTT & SCOTT Amer. Midl. Nat. **34**, 245, 1945.

Var. angustioribus, circiter $1\frac{1}{2}$ longiores quam latiores, lobis lateralibus

truncatis nonnumquam leviter retusis, non rotundis, lobis polaribus leviter truncatis et apicibus convexis et retusis in medio. Long. 21.8–22.4 μ , Lat. 12.6–14 μ , Lat. isth. 3.4–4.2 μ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Ôishitano-junsai-tsutsumi in Uzen; Hibushi-numa, Nanko in Iwaki. **Shikoku**: Yamada in Tosa. **Kiu-shiu**: Imuta-ike in Satsuma. (Pl. XXXIII, fig. 5)

Distr. Japan, Java, Sumatra, Bali, U.S.A.

var. **Kriegeri** GRÖNBLAD in Krypt. Fl. XIII, Abt. 1, 545, 1937; HIRANO Jap. Journ. Bot. 14, 226, 1954.

Var. leviter longioribus, lobis polaribus leviter dilatatis, marginibus lateralibus inferioribus minus rotundis; a latere visae ovatae. Long. 25 μ , Lat. 17.4 μ , Lat. isth. 7 μ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu; Nogiwano-kwannon-ike in Iwa-shiro; Kashima-cho in Iwaki; Shinohara-ike, Fuse-ike in Oomi. (Pl. XXXIII, fig. 6)

Distr. Japan, Finland, Sumatra.

Our form of var. *Kriegeri* has more rounded apical angles and inflated lateral margins.

Sect. **Ornata** HIRANO, sect. nov.

Cellulae parvae; semicellulae 3–5 lobatae, lobo polari cum spinis apicalibus et apice retuso, marginibus lateralibus sinuatis et retusis; membrana cum granulis vel denticulis in centro et intra marginem.

1a. Apice recto vel leviter retuso.

2a. Cellulae latiores quam longiores, sinu lineari aperto..... **E. diplostauron**

2b. Cellulae longiores quam latiores, sinu angusto-lineari.

3a. Cellulae cum tumore glabro ordinatae, spinis apicalibus brevibus

..... **E. acanthophorum** var. **bigranulatum**

3b. Cellulae cum tumore granulato ordinatae, spinis apicalibus longis.... **E. exile**

1b. Apice valide excavato..... **E. excavatum**

Euastrum diplostauron SKUJA in Nov. Act. Reg. Soc. Ups. IV, 14:5, 112, 1949.

—*Euastrum australiense* HIRANO in Act. Phytotax. Geobot. 14, 69, 1951; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 226, 1953.—*Euastrum* sp. in BORGE Bih. K. Sv. Vet. Akad. Handl. 22, III, no. 9, 14, 1896.

Cellulae parvae, circiter tam longae quam latae vel leviter latiores quam longiores sine spinis, profunde constrictae, sinu aperto et late lineari in extremo rotundo, isthmo elongato; semicellulae depresso-subhexagonales cum apice elevato, 3-lobatae, incisuris inter lobos polares et laterales latis et subrectangularibus, lobis polaribus brevibus, oblongo-rectangularibus cum

apice truncate convexo et leviter retuso, angulis apicalibus obtusis et spina breve ordinatis, angulis basalibus obtusis denticulis ordinatis; semicellulae cum denticulis tribus intra marginem loborum lateralem et denticulis duobus juxta infra apicem, in centro cum tumore granulato, 5 granulis in seriebus annulibus ordinatis; a latere visae subcirculares, apice subtruncato et lateribus cum tumore prominenti et emarginato prope basim utrobique; a vertice visae oblongae, lateribus cum tumore emarginato ad medium utrobique, polis truncatis denticulis duobus ad marginem et 2 alia denticula infra apices ad marginem ordinatis. Long. $21.6\ \mu$, Lat. $22.4\ \mu$, Lat. isth. $5.6\ \mu$.

Hab. **Hondo**: Ishigaki-ike in Ise. (Pl. XXXIII, fig. 20)

Distr. Japan, Burma, Australia.

Euastrum acanthophorum TURNER var. **bigranulatum** HIRANO, var. nov.

Var. apicibus semicellularum rectis integris non retusis vel sine incisuris apicalibus, marginibus lateralibus inferioribus denticulis tribus ordinatis; semicellulae cum duobus granulis incurvatis supra isthmum et denticulis infra angulos apicales utrobique. Long. $23.8\ \mu$, Lat. $21\ \mu$, Lat. isth. $5.6\ \mu$.

Hab. **Hondo**: Shiro-ike in Shinano. (Pl. XXXIII, fig. 9)

Euastrum exile JOSHUA in Journ. Linn. Soc. Bot. **21**, 640, 1886; KRIEGER Arch. Hydrobiol. suppl. **11**, 212, 1932; Krypt. Fl. XIII, Abt. **1**, 578, 1937; HIRANO Act. Phytotax. Geobot. **14**, 50, 1950; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 221, 1953.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae subquadratae vel subtrapeziformes, in parte inferiori subrectangulares, 5-lobatae, incisuris lateralibus nonnihil rectangulari-rotundis, lobis polaribus transverse rectangularibus, lateribus convexis, apice leviter convexo in medio retuso, angulis apicalibus rotundis cum spinis divergentibus, lobis lateralibus in margine retusis cum angulis basalibus rectangularibus; semicellulae cum prominentia verruca in medio prope basim lobi polaris et granulis singulis intra angulos apicales utrobique; a latere visae obverse ovatae, lateribus utrobique cum prominentia; a vertice visae ellipticae. Long. $26.7\ \mu$, Lat. $17.2\ \mu$, Lat. isth. $5.2\ \mu$.

Hab. **Hondo**: Ishigaki-ike in Ise; Shinohara-ike in Oomi. (Pl. XXXII, fig. 7)

Distr. Japan, Burma, Bali.

Euastrum excavatum HIRANO in Act. Phytotax. Geobot. **14**, 1, 1949; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 229, 1953.

Cellulae minutae, leviter longiores quam latiores, profunde constrictae, sinu acute aperto; semicellulae subtrapeziformes, 3-lobatae, incisuris laterali-

bus et cum apice late excavato, angulis apicalibus acutis et cum spina minuta ordinatis, marginibus lateralibus inferioribus rotundis, lobis polaribus et lateralibus cum granulis minutis ad angulos intra marginem; semicellulae in centrum cum tumore glabro ordinatae; in latere visae circulares cum apice producto; in vertice visae angusto-rectangulares, lateribus cum tumoribus prominentibus circularibus ad medium et granulis minutis prope tumorem utrobique ordinatis, polis rotundis. Long. $14\ \mu$, Lat. $13.5\ \mu$, Lat. isth. $3.6\ \mu$.

Hab. **Hondo**: Ukishima-ônuma in Uzen. (Pl. XXXVI, fig. 18)

Distr. Japan.

Sect. **Glabra** HIRANO, sect. nov.

Cellulae modicae; semicellulae generaliter 3-lobatae, lobo polari sine spinis vel denticulis et apice retuso; membrana generaliter glabra cum tumore mediano in centro semicellularum.

1a. Apice cellularum sine annulis granulorum.

2a. Lobo laterali rotundo..... **E. glaberrimum**

2b. Lobo laterali profunde retuso..... **E. pectinatum**

1b. Apice cellularum cum annulis granulorum ordinato..... **E. attenuatum**

Euastrum glaberrimum HIRANO in Act. Phytotax. Geobot. 14, 1, 1949.

Cellulae submediocres, circiter $1\frac{1}{4}$ - $1\frac{1}{3}$ plo longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter dilatato sed extrorsum acuto et rapide aperto; semicellulae 3-lobatae, incisuris lateralibus concavis, lobis polaribus cuneatis vel interdum leviter anguilliformis, apicibus truncatis et leviter retusis interdum leviter convexis, angulis apicalibus rotundis, partibus basalibus semicellularum transverse oblongo-ellipticis, marginibus lateralibus inferioribus bene rotundis; a latere visae subpyramidatae lateribus in parte basali cum tumore lato glabro utrobique, eo partibus basalibus semicellularum paene circularibus, partibus superioribus semicellularum leviter rectangularibus, angulis rotundis; a vertice visae ellipticae, lateribus cum tumore duobus ad medium utrobique, polis rotundis; membrana punctata, pyrenoidibus singulis in unaquaque semicellula. Long. 53 - $56\ \mu$, Lat. 34 - $42\ \mu$, Lat. isth. $12.6\ \mu$.

Hab. **Hokkaido**: Nakano near Sapporo, Horomui in Ishikari. **Hondo**: Chûkawa-ike in Uzen; Ô-numa in Kii. (Pl. XXXIV, fig. 3, 4)

Distr. Japan.

Euastrum pectinatum BRÉB. in LUNDELL Nov. Act. Regn. Soc. Ups. III, 8, 17, 1871 (forma); ALLORGE Rev. Alg. 5, 351, 1930; KRIEGER Krypt. Fl. XIII, Abt. 1, 536, 1937.

Cellulae mediocres, circiter $1\frac{1}{3}$ longiores quam latiores, profunde constrictae.

tae, sinu angusto-lineari et extremo leviter dilatato; semicellulae 3-lobatae, incisuris inter lobos rectangulari-rotundatis et leviter excavatis, lobis polaribus late subrectangularibus vel anguilliformis et ad apicem dilatatis, angulis apicalibus rotundatis, apicibus truncatis leniter retusis, lobis lateralibus subquadratis, marginibus lateralibus profunde retusis, angulis basalibus et lobis lateralibus rotundatis; semicellulae cum protuberantiis tribus horizontaliter in parte basali (altero supra isthmum altero intra angulum basalem utriusque), duabus parvis protuberantiis intra angulos polares utrobique ordinatae; membrana punctata; a vertice visae elliptico-oblongae, lateribus cum tribus conicis et rotundo-protuberantiis utrobique, polis bimamillatis, lobis polaribus elliptico-oblongis, polis bimamillatis et lateribus cum duabus protuberantiis hemisphericis. Long. 58-59 μ , Lat. 44-45 μ , Lat. isth. 8.5 μ .

Hab. **Hokkaido**: Yûfutsu, Tomakomai in Iburi. (New to Japan) (Pl. XXXIII, fig. 21)

Distr. Whole Europe, Greenland, N. America, New Caledonia, N. Africa.

Euastrum attenuatum WOLLE in Desm. U.S. 103, 1884; WEST Trans. Linn. Soc. Bot. 5, 243, 1896; KRIEGER Krypt. Fl. XIII, Abt. 1, 541, 1937; HIRANO Act. Phytotax. Geobot. 12, 31, 1943.

Cellulae submediocres, $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu aperto; semicellulae trilobatae, lobis polaribus rotundo-quadratis cum angulis rotundis vel subrectangularibus, apicibus truncatis vel leviter convexis verrucis in serie transversa intra apicem ordinatis, lobis lateralibus truncato-rotundis, marginibus lateralibus leviter retusis, angulis basalibus paene rectangulari-rotundis, in parte inferiore semicellularum protuberantiis tribus in serie transverse ordinatis (uno supra isthmum altero intra lobum lateralem); a vertice visae ellipticae, polis semicircularibus, lateribus cum tri-protuberantiis utrobique, lobo polari circulari. Long. 59-63 μ , Lat. 34-36.4 μ , Lat. isth. 8.4-13 μ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi. **Hondo**: Nogiwanokwannon-ike in Iwashiro; Ozenuma in Kôzuke; Inago of Kitamaki-mura in Shinano. (Pl. XXXIII, fig. 10)

Distr. Japan, Burma, U.S.A., Colombia, Patagonia.

Sect. **Retusa** OKADA emend. HIRANO

Euastrum sect. *Retusa* OKADA in Mem. Fac. Fish. Kagoshima Univ. 3, 225, 1953.

Cellulae modicae vel magnae, generaliter 3-5 lobatae, lobo polari cum apicibus retusis et sine incisuris medianis, membrana granulis, verrucis vel denticulis ordinata, tumoribus prominentibus cum granulis vel denticulis

radialiter ordinatis.

- 1a. Semicellulae 3-lobatae.
 - 2a. Cellulae modicae, 40–80 μ in longitudinem.
 - 3a. Lobo lateralis horizontaliter disposito, sinu angusto-lineari... **E. ceylanicum**
 - 3b. Lobo lateralis leviter divergente disposito, sinu acute aperto... **E. platycerum**
 - 2b. Cellulae magnae, 90–140 μ in longitudinem..... **E. turgidum**
- 1b. Semicellulae 5-lobatae.
 - 2a. Cellulae modicae, 45–75 μ in longitudinem.
 - 3a. Semicellulae cum tumore granulato ordinatae.
 - 4a. Tumore granulato-elliptico, granulis intra marginem loborum in seriebus radialibus ordinatis **E. germanicum**
 - 4b. Tumore granulato-circulari, granulis irregulariter ordinatis... **E. spinulosum**
 - 5a. Lobo polari non dilatato; incisuris inter lobos polarium et lateralium late apertis et non profundioris **f. typica**
 - 5b. Lobo polari dilatato; incisuris inter lobos polarium et lateralium anguste aperto et profundo **var. inermius**
 - 3b. Semicellulae cum 3 tumoribus granulatis ordinatae..... **E. gemmatum**
 - 2b. Cellulae magnae, 75–140 μ in longitudinem..... **E. verrucosum**

Euastrum ceylanicum (W. & G. S. WEST) KRIEGER in Krypt. Fl. XIII, Abt. 1, 627, 1937; HIRANO Act. Phytotax. Geobot. 12, 33, 1937; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 233, 1953.—*Euastrum spicatum* TURNER var. *ceylanicum* (W. & G. S. WEST) KRIEGER in Arch. Hydrobiol. suppl. 11, 215, 1932.—*formae* W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 150, 1902; OKADA Bot. Mag. 50, 258, 1936.

Cellulae mediocres, $1\frac{1}{5}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato, parte exteriori mediocriter aperto; semicellulae trilobatae, incisuris lateralibus latis et apertis, lobis polaribus late rectangularibus cum angulis apicalibus late rotundis, spinis brevibus validis nonnullis ad angulos et intra angulos praeditis, apice convexo in medio late retuso, lobis lateralibus late rotundis vel subquadratis in margine retusis et leviter convergentibus, angulis superioribus basalibusque rotundis et in spinam brevem validam in ambitu et intra marginem ordinatis, in centro semicellularum granulato tumore magno et prope in medio lobi lateralis uniuscujusque granulato tumore parvo, annulo centrali granulorum (10 et 5) circa granulum centalem majus, annulo utrobique granulorum 5 in formam concentrica circa granulum centalem majorem; a latere visae subpyramidatae, apice anguste acute rotundis, sinu late aperto; a vertice visae paene rectangulares, lateribus leviter retusis cum granulato-tumoribus tribus utrobique, tumore mediano magno, prope polos tumore parvo, polis latissime rotundis spinis brevibus ad polos et tribus intra polos utrobique praeditis, lobo polari late rectangulari cum angulis dentatis; membrana punctata. Long. 56–76 μ , Lat. 45–62 μ , Lat. isth. 11–16 μ .

Hab. Hokkaido: Shimoyûbetsu in Kitami; Nakano near Sapporo, Horomui in Ishikari. **Hondo:** Hizume in Rikuchû; Ôishita, Chûkawa-ike in Uzen; Kashima-cho in Iwaki; Ozegahara in Kôzuke; Shakuhachi-ike in Yamashiro. **Kiushiu:** Ahira in Ôsumi. (Pl. XXXIII, fig. 17)

Distr, Japan, Sumatra, Ceylon.

Euastrum platycerum REINSCH in Contr. Alg. Fung. 85, 1875; FUJISAWA Journ. Jap. Bot. 10, 442, 1934; KRIEGER Krypt. Fl. XIII, Abt. 1, 630, 1937; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 234, 1953.

Cellulae submediocres, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae 3-lobatae, incisuris lateralibus latis et rectangulari-rotundis, lobis polaribus subrectangularibus cum angulis apicalibus rotundis et spinis ad angulos, apice retuso, lobis lateralibus latissime rectangularibus leviter subdivergentibus, marginibus lateralibus rotundato-divergentibus spinis 4 brevibus in ambitu et granulis acutis nonnullis irregulariter intra marginem, granulis acutis nonnullis irregulariter infra apicem loborum polorum praeditis, semicellulae tumore mediano granulis in annulum ornato, annulo granulorum 8-9 et intra annulum in medio ornatum; a latere visae subpyramidatae, lateribus cum tumoribus prominentibus utrobique, apice acuto; a vertice visae ellipticae, lobis polaribus cum angulis bini divis. Long. 47-56 μ , Lat. 41-47.6 μ , Lat. isth. 10-13 μ .

Hab. Hokkaido: Shimoyûbetsu in Kitami; Nakano near Sapporo, Horomui in Ishikari; Tôasa-numa, Yûfutsu in Iburi. **Hondo:** Hizume in Rikuchû; Kawajiri, Aka-numa in Ugo; Kotsutsumi in Mutsu; Chûkawa-ike, Ôishita, Hakuryu-ko in Uzen; Akaiyachi in Iwashiro; Inago of Kitamaki-mura in Shinano; Suhara-ike in Mikawa; Biwa-ike in Owari; Ishigaki-ike, Tamaru in Ise; Shinohara-ike in Oomi. **Kiushiu:** Nakahama of Lake Ikeda in Satsuma. (Pl. XXXI, fig. 9, Pl. XXXIV, fig. 11)

Distr. Japan, Europe.

Euastrum turgidum WALL. in KRIEGER Krypt. Fl. XIII, Abt. 1, 624, 1937. — *typicum* TURNER in K. Sv. Vet. Akad. Handl. 25, 74, 1893. — var. *Grunowii* TURNER in l. c. 75, 1893; OKADA Bot. Mag. 50, 316, 1936.

Cellulae magnae, circiter $1\frac{1}{2}$ plo longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae trapeziformes, 3-lobae, incisuris lateralibus mediocriter profundis et semicircularibus, lobis polaribus late cuneatis, apicibus late truncatis et rectis vel nonnihil leviter concavis, lobis lateralibus transverse rectangularibus, bilobulatis, incisuris inter lobulos superiores et inferiores semicircularibus vel saepe leviter retusis,

lobulis lateralibus superioribus minores quam in inferioribus, angulis basalibus leviter rotundis, granulis magnis conicis 4-6 ad angulos apicales et laterales superiores inferioresque et granulis 4-6 irregulariter dispositis intra marginem ornatis; semicellulae tumore mediano granulato supra isthmum, granulis in annulum ornatis, annulo granulorum 11-13 et 7-8 intra annulum in medio situs; membrana punctata; a vertice visae oblongo-ellipticae. Long. 124-140 μ , Lat. 98-112 μ , Lat. isth. 35-42 μ .

Hab. **Hondo**: Futatsuyagata near Akita in Ugo; Hakuryu-ko in Uzen; Ojiroi in Iwaki; Kotsutsumi-nishi-ike in Mikawa; Biwa-ike in Owari; Oku-ike of Higashikusano-mura, Fuse-ike, Shinohara-ike in Oomi; Ariga-ike, Shaku-hachi-ike in Yamashiro. **Kiushiu**: Ahira in Ōsumi. (Pl. XXXIII, fig. 24)

Distr. Japan, India, Burma, Java, Sumatra, Banka, Australia.

Euastrum germanicum (SCHMIDLE) KRIEGER in Krypt. Fl. XIII, Abt. 1, 638, 1937; HIRANO Act. Phytotax. Geobot. 12, 40, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 237, 1953.—*Euastrum monocylum* (NORDST.) RACIB. var. *germanicum* SCHMIDLE in MIGULA Krypt. Fl. 2, 488, 1907; DICK Krypt. Forsch. 1, 447, 1926; HOMFELD Pflanzenf. 12, 31, 1929; OKADA Bot. Mag. 50, 85, 1936.

Cellulae mediocres, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrietae, sinu angusto-lineari in capite ampliato; semicellulae semicirculares, 5-lobatae, incisuris lateralibus profundis et obtusis, lobis polaribus late rectangularibus in margine paene parallelis, apice leviter convexo vel paene recto mediana retuso, angulis apicalibus rectangulari-rotundis granulis acutis tribus ornatis, marginibus lateralibus bilobulatis, lobulis lateralibus angulari-rotundis vel paene semicircularibus cum granulis acutis tribus ornatis, lobulis lateralibus superioribus in oblique exteriori directis; in centro semicellularum tumore granulato mediano supra isthmum, angulo granulorum 10 et granulis 3 intra annulum in forma trianguli ornatis, granulis interioribus magnis et inflatis, intra angulum unumquemque lorum lateralem et polarem granulis seriebus tribus nonnullis radialiter ornatis; a latere visae ovatae, apice anguste rotundo; a vertice visae ellipticae cum tumore mediano utrobique et lobo polari rectangulari-rotundo vel subcirculari. Long. 50-75 μ , Lat. 42-64 μ , Lat. isth. 11-17 μ .

Hab. **Hokkaido**: Tayokoro in Takachi; Tomakomai in Iburi. **Hondo**: Kotomo-numa, Aka-numa, Kawashiri in Ugo; Hizume in Rikuchû; Izu-numa in Rikuzen; Kôriyama, Hôzawa-ike in Iwashiro; Oze-numa in Kôzuke; Kita-ura in Hitachi; Onjaga-ike in Kamifusa; Daizahôshi-ike in Shinano; Kana-shôzu, Ôkaguchi in Ise; Matsubara-naiko in Oomi; Mizoroga-ike, Shaku-hachi-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Dôgo near Matsuyama in Iyo. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma; Ahira in

Ôsumi. (Pl. XXXIII, fig. 15)

Distr. Japan, Manchuria, Germany, Aral sea.

Euastrum germanicum does quite coincide with the European description and is widely distributed on the marshes and ponds in our country. A large form was found on the marsh near Tomakomai, Hokkaido.

Euastrum spinulosum DELP. in ALLORGE Rev. Alg. **1**, 465, 1924; KRIEGER Krypt. Fl. XIII, Abt. **1**, 633, 1937; PRESCOTT & SCOTT Amer. Midl. Nat. **34**, 245, 1945.—subsp. *africanum* NORDST. in Lund Univ. Årsskr. **16**, 9, 1880; ROY & BISSET Journ. Bot. **24**, 194, 1886; FUJISAWA Journ. Jap. Bot. **10**, 442, 1934; WEST Trans. Linn. Soc. Bot. **6**, 149, 1902.—var. *africanum* (NORDST.) OKADA in Mem. Fac. Fish. Kagoshima Univ. **3**, 239, 1953.

Cellulae mediocres, circiter longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae semicirculares vel truncato-pyramidatae, 5-lobatae, incisuris lateralibus profunde et lineatis, lobis polaribus late cuneatis vel transverse rectangularibus, lateribus convexis cum angulis apicalibus rotundis, apice retuso, lobis lateralibus superioribus semicircularibus vel subrectangularibus oblique directis cum apice numquam convexo, raro truncato, lobis lateralibus inferioribus maiores quam superioribus, horizontaliter directis cum lateribus late rotundis, incisuris inter lobos lateralem superiorem et inferiorem mediocriter profundis et late apertis, granulis 4-5 ad marginem loborum lateralium polarumque et granulis 4-5 in seriebus 2-3 intra marginem, granulis in serie exterius radialiter et in serie interius irregularibus ordinatis; in centro semicellularum tumore granulato, annulo granulorum 10 et 4-5 intra annulum in medio situs; a vertice visae oblongae, lateribus cum tumore distincte mediano utrobique. Long. 64.5-75.3 μ , Lat. 56-64.5 μ , Lat. isth. 14-17 μ .

Hab. **Hondo**: Bagyû-numa in Iwaki; Yokohama (Roy & Biss.) in Sagami; Kotsutsumi-nishi-ike in Mikawa, Ogurano-ike in Yamashiro. **Shikoku**: Yamauchi-mura in Sanuki. (Pl. XXXIII, fig. 9)

Distr. Japan, China, Burma, India, Ceylon, Java, Sumatra, Afghanistan, whole Europe, Africa.

var. ***inermius*** NORDST. in Lund Univ. Årsskr. **16**, 9, 1880; WEST Trans. Linn. Soc. Bot. **6**, 149, 1902; KRIEGER Arch. Hydrobiol. suppl. **11**, 215, 1932; PRESCOTT Pap. Mich. Acad. Sci. **21**, 143, 1936; KRIEGER Krypt. Fl. XIII, Abt. **1**, 635, 1937; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 240, 1953.—subsp. *inermius* NORDST. in ROY & BISSET Journ. Bot. **24**, 194, 1886.

Var. incisuris lateralibus profundioribus et angustioribus, ad incisuris inter lobos laterales superiores et inferiores inflatis, granulis acutis nonnullis in ambitu et intra marginem loborum lateralium polarumque; semicellulis cum granulato-tumoribus tribus (uno magno mediano supra isthmum, altero parvo intra marginem loborum lateralem inferiorem). Long. 53-70 μ ,

Lat. 47.6–59 μ , Lat. isth. 11–17 μ .

Hab. **Hokkaido**: Nakano near Sapporo, Horomui in Ishikari. **Hondo**: Kyutai in Mutsu; Futatsuyagata in Ugo; Hizume in Rikuchû; Ôishita, Chûkawa-ike, Ô-numa in Uzen; Izu-numa in Rikuzen; Kagami-ishi-mura, Akaiyachi in Iwashiro; Kashima-cho in Iwaki; Biwa-ike in Owari; Ishigaki-ike, Jôdo-ike in Ise; Shinohara-ike in Oomi; Shakuhachi-ike in Yamashiro. (Pl. XXXIII, fig. 16)

Distr. Japan, China, Burma, India, Ceylon, Java, Australia, Germany, S. Africa.

Euastrum gemmatum BRÉB. in RALFS Brit. Desm. 87, 1848; WEST Monogr. Brit. Desm. 2, 63, 1905; MIGULA Krypt. Fl. 2, 489, 1907; SMITH Wisc. Bull. 57, 26, 1924; SKUJA Act. Horti Bot. Univ. Latv. 3, 144, 1928; OKADA Journ. Imp. Fish. Inst. 30, 154, 1930; KRIEGER Krypt. Fl. XIII, Abt. 1, 639, 1937; HIRANO Act. Phytotax. Geobot. 12, 39, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 236, 1953.

Cellulae raro parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profundissime constrictae, sinu acuto et aperto in vertice angusto-lineari; semicellulae subpyramidatae, trilobatae, incisuris lateralibus profundissime apertis obtusisque, lobo polari cuneato cum angulo apicali angulari-rotundo, apice late retuso in medio, lobo laterali latissime rectangulari in margine laterali bilobulato cum angulo angulari-rotundo, tumoribus granulatis tribus in serie transversa in partem inferiorem semicellularum (uno in medio, altero intra lobum lateralem utrobique), tumoribus medianis cum granulis in serie concentrici (annulo extra granulos 10 et annulo intra granulos quinque) ornatis, tumoribus lateralibus minoribus quam in medianis cum granulis 5–6 in seriebus concentricis ornatis; a latere inferiore visae tumoribus late inflatis et attenuatis a latere superiori, lobis polaribus cuneiformibus cum angulis rotundis, apice concavo; a vertice visae ellipticae, lateribus leviter undulatis cum tumoribus tribus magnis utrobique, polis rotundis, lobis polaribus subquadratis cum lateribus profunde retusis et angulis rotundis. Long. 52–56 μ , Lat. 37–39 μ , Lat. isth. 9.7–11 μ .

Hab. **Hokkaido**: Nikuru-numa in Kitami; Toyokoro in Tokachi; Yûfutsu, Tôasa-numa, Benten-numa in Iburi; Shizukari in Oshima. **Hondo**: Kotsutsumi in Mutsu; Ogata, Kawashiri in Ugo; Akaiyachi in Iwashiro; Oze-numa, Jiuemon-ike in Kôzuke. (Pl. XXXIII, fig. 18)

Distr. Japan, Kuriles, Manchuria, China, Burma, India, whole Europe, Greenland, N. & S. America.

Euastrum gemmatum in our country has an acutely open sinus. KOSSINSKAYA has recorded a form of this species from Cola peninsula which has

a slightly open sinus. Our form more open, while in European forms the sinus is narrowly linear.

Euastrum verrucosum EHRENB. in RALFS Brit. Desm. 79, 1848: ROY & BISSET Journ. Bot. 24, 193, 1886; WEST Monogr. Brit. Desm. 2, 64, 1905; MIGULA Krypt. Fl. 2, 489, 1907; HUBER-PESTALOZZI Arch. Hydrobiol. 22, 419, 1931; FUJISAWA Journ. Jap. Bot. 10, 442, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 209, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 643, 1937; PRESCOTT & SCOTT Amer. Midl. Nat. 34, 247, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 242, 1953.

Cellulae magnae, subhexagonales, circiter $1\frac{1}{5}$ longiores quam latiores, profunde constrictae, sinu aperto in parte exteriori sed angusto-lineari in parte media et in fundo; semicellulae subtriangulares 3-lobatae, incisuris lateralibus profundioribus et leviter angustioribus quam incisuris inter lobulos lateralium superiorum et inferiorum, lobis polaribus late et rectangularibus in margine leviter convexis et dilatatis versus apicem, angulis apicalibus rotundatis et cum granulis acutis 4-6 ad angulos, apice late retuso, lobis lateralibus superioribus mamillatis et parvioribus quam in inferioribus, lobis lateralibus inferioribus leviter divergentibus, angulis lateralibus superioribus et inferioribus rotundis cum granulis 4-5 ad angulos; semicellulae cum granulato-tumoribus tribus in serie transversa trans basim (uno mediano magno supra isthmum, et altero parvo utrobique intra angulos basales), granulis in serie concentricis ornatis, membrana granulata in omni facies semicellulae; a latere visae subovatae, lateribus in parte superiori leviter retusis cum tumoribus ad basim utrobique, apice truncato et retuso; a vertice visae oblongo-ellipticae, polo acuto et rotundo, lateribus cum tumoribus tribus utrobique, lobo polari rectangulare. Long. 73-95 μ , Lat. 65-77 μ , Lat. isth. 14-21 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Nikuru-numa in Kitami; Moseushi, Horomui in Ishikari; Tôasa-numa in Iburi. **Hondo**: Kotsutsumi in Mutsu; Hosonuma in Ugo; Hakuryu-ko, Ôishita, Chûkawa-ike in Uzen; Keshonuma, Kobuchi-numa in Rikuzen; Nanko in Iwaki; Akaiyachi in Iwashi; Mohara in Kamifusa; Gôno-ike in Hitachi; Takashihara, Ônuma in Mikawa; Biwa-ike in Owari; Tamaru in Ise. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi. (Pl. XXXIII, fig. 26)

Distr. Japan, Siberia, whole Europe, Greenland, N. America, central Africa.

Subgen. **Entomum** (PRINTZ) HIRANO, comb. nov.

Euastrum sect. *Entomum* PRINTZ in Pflanzenfam. 3, 358, 1927.

Cellulae parvae vel modicae, 3-5 lobatae, lobo polari cum apicibus incisuris medianis variabiliter profundis et apertis vel angusto-lineari ordinatae.

- 1a. Cellulae modicae, sine spinis apicalibus, marginibus integris glabris; membrana glabra cum seriebus centralibus tumorum Sect. **Incisa**
- 1b. Cellulae parvae, cum spinis apicalibus, marginibus cum spinis vel denticulis ordinatis; membrana seriebus centralibus prominentibus granulorum ordinata Sect. **Excisa**

Sect. **Incisa** OKADA

Euastrum sect. *Incisa* OKADA in Mem. Fac. Fish. Kagoshima Univ. 3, 196, 1953.

Cellulae modicae, lobo polari generaliter incisura mediana profunda ornato, angulis loborum polorum et lateralium glabris sine spinis vel granulis, in centrum semicellularum tumore ordinatis.

- 1a. Semicellulae sine lobis lateralibus superioribus.
 - 2a. Margine laterali semicellularum leviter concavo vel paene recto interdum sinuato.
 - 3a. Margine laterali concavo..... **E. ansatum**
 - 3b. Margine laterali recto vel sinuato.
 - 4a. Punctula in parte superiori semicellularum distincta in series verticales.
 - 5a. Cellulae cum foraminibus medianis singulis ordinatae interdum nullis.
 - 6a. Cellulae 57-90 μ in longitudinem var. **pyxidatum**
 - 6b. Cellulae 80-115 μ in longitudinem var. **dideltiforme**
 - 5b. Cellulae cum foraminibus duobus medianis verticaliter ordinatae var. **javanicum**
 - 4b. Punctula in parte superiori semicellularum non ordinatae in seriebus verticalibus..... **E. cuneatum**
 - 2c. Margine laterali distincte concavo inter lobos polarium et lateralium.
 - 4a. Lobo polari breve, attenuato ad apicem.
 - 5a. Lobo laterali glabro, semicellulae sine foraminibus medianis.... **E. inerme**
 - 5b. Lobo laterali crenulato, semicellulae cum foraminibus medianis excentriter ordinatae..... **E. pingue**
 - 4b. Lobo polari elongato et capitato, dilatato versus sursum **E. indicum** var. **capitatum**
- 1b. Semicellulae cum lobis lateralibus superioribus.
 - 2a. Semicellulae cum levis lobis lateralibus superioribus ordinatae.
 - 3a. Lobo polari dilatato versus sursum **E. ampullaceum**
 - 3b. Lobo polari attenuato versus sursum.
 - 4a. Cellulae magnae, 100-140 μ in longitudinem **E. didelta**
 - 5a. Lobo laterali inferiori rotundo, lobis polaribus non elongatis..... f. **typica**
 - 5b. Lobo laterali inferiori parallelo et retuso, lobis polaribus elongatis var. **japonicum**
 - 4b. Cellulae modicae, 45-80 μ in longitudinem.
 - 5a. Semicellulae cum 3 distincte tumoribus..... **E. gnathophorum**
 - 5b. Semicellulae cum 5 tumoribus..... **E. sinuosum**
 - 6a. Lobo polari elongato.
 - 7a. Semicellulae distincte triangulares, angulis basalibus truncatis et divergentibus..... var. **dideltoides**

- 7b. Semicellulae non triangulares, angulis basalibus rotundis.
 - 8a. Semicellulae cum 11 tumoribus et 11 foraminibus... var. **subjenneri**
 - 8b. Semicellulae cum 5 tumoribus et 4 foraminibus.. var. **germanicum**
- 6b. Lobo polari non elongato.
 - 7a. Margine laterali inferiori parallelo var. **parallelum**
 - 7b. Margine laterali inferiori non parallelo.
 - 8a. Lobo laterali cum foraminibus ordinato..... var. **perforatum**
 - 8b. Lobo laterali sine foraminibus.
 - 9a. Incisura inter lobos laterales superiores et inferiores et inter lobos polarium et lateralium superiorum vadosos; semicellulae gradatim attenuatae ad apices var. **gangense**
 - 9b. Incisura mediocriter profunda; semicellulae non gradatim attenuatae ad apices.
 - 10a. Semicellulae cum lobis polaribus dilatatis ordinatae var. **scrobiculatum**
 - 10b. Semicellulae cum lobis polaribus angustis ordinatae.
 - 11a. Semicellulae cum 11 foraminibus..... var. **aböense**
 - 11b. Semicellulae cum 5 foraminibus var. **reductum**
- 2b. Semicellulae cum distinctis lobis lateralibus superioribus ordinatae.
 - 3a. Cellulae elongatae, circiter $2\frac{1}{2}$ longiores quam latiores; lobis polaribus elongatis **E. Ozense**
 - 3b. Cellulae non elongatae, minusve duplo longiores quam latiores; lobis polaribus non elongatis.
 - 4a. Incisura inter lobos polares et laterales superiores angusta et acuta **E. crassum**
 - 5a. Margine laterali inferiori retuso f. **typica**
 - 5b. Margine laterali inferiori convexo..... var. **tumidum**
 - 4b. Incisura inter lobos polares et laterales superiores lata et rotunda.
 - 5a. Lobo laterali superiori horizontaliter ordinato..... **E. pinnatum**
 - 5b. Lobo laterali superiori divergente ordinato.
 - 6a. Lobo laterali superiori retuso..... **E. oblongum**
 - 6b. Lobo laterali superiori mamillato et rotundo.
 - 7a. Lobo laterali superiori ad medium semicellularum ordinato.. **E. affine**
 - 7b. Lobo laterali superiori a parte superiori quam ad medium semicellularum ordinato..... **E. humerosum**

Euastrum ansatum EHRENB. in RALFS Brit. Desm. 85, 1848; MIGULA Krypt. Fl. 2, 492, 1907; KRIEGER Hedw. 70, 144, 1930; OKADA Journ. Imp. Fish. Inst. 30, 152, 1934; KRIEGER Krypt. Fl. XIII, Abt. 1, 484, 1937; HIRANO Act. Phytotax. Geobot. 12, 29, 1943; OKADA Men. Fac. Fish. Kagoshima Univ. 3, 198, pl. 1, f. 4, (non fig. 5) 1953.

Cellulae mediocres, duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari; semicellulae elongato-pyramidatae, marginibus lateralibus leviter concavis, angulis basalibus rotundis, apice truncato incisura mediana profunda et angusto-lineari cum angulis superioribus rotundis; membrana dense punctata, punctae in seriebus nonnullis verticaliter dispositis

in partem superiorem semicellularum, protuberantibus tribus in serie transverse trans basim semicellularum, in medio duabus protuberantiis transverse dispositis; a latere visae ellipticae, duabus protuberantiis in latere utrobique dispositis et apicibus late rotundis; a vertice visae ellipticae. Long. 87-95 μ , Lat. 39-42 μ , Lat. isth. 11-14 μ .

Hab. **Hokkaido**: Chôboshi-numa in Nemuro; Kiritappu in Kushiro; Toyokoro in Tokachi; Horomui in Ishikari; Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Kurobo-numa in Mutsu; Kotomo-numa, Moritake-ôtsutsumi, Megata, Nishi-numa in Ugo; Hijiori-naga-numa, Ôishita, Chûkawa-ike in Uzen; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Kashima-cho in Iwaki; Oze-numa, Ômine-numa in Kôzuke; Kôridono-ike in Echigo; Okemi-ike, Kizaki in Shinano; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike, Jôdo-ike, Kanashôzu in Ise; Shinohara-ike, Fuse-ike in Oomi; Takaraga-ike, Mizoroga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Imuta-ike in Satsuma; Ahira in Ôsumi. (Pl. XXXI, fig. 3)

Distr. Japan, Kuriles, Siberia, whole Europe, N. & S. America, Australia, Africa.

var. **javanicum** (GUTW.) KRIEGER in Krypt. Fl. XIII, Abt. 1, 488, 1937.

Var. semicellulis similibus in var. dideltiforme, in medio semicellularum scrobiculis binis verticalibus dispositis. Long. 106 μ , Lat. 52 μ , Lat. isth. 14 μ .

Hab. **Hondo**: Fuse-ike in Oomi. (New to Japan) (Pl. XXXI, fig. 13)

Distr. Java, Sumatra.

var. **dideltiforme** DUCELLIER in WEST Monogr. Brit. Desm. 2, 27, 1905; KRIEGER Krypt. Fl. XIII, Abt. 1, 488, 1937; HIRANO Journ. Jap. Bot. 20, 37, 1944.

Var. cellulis paulum maioribus quam in var. pyxidati, lobo polari producto-elongato, gradatim attenuato ad apicem non dilatato prope apicem, marginibus lateralibus subparallelis, membrana densiore granulata quam in var. pyxidata. Long. 81-109 μ , Lat. 42-53 μ , Lat. isth. 11-15 μ .

Hab. **Hokkaido**: Okineppe, Chôboshi-numa in Nemuro; Kiritappu in Kushiro; Nikuru-numa, Sarufutsu in Kitami; Toyokoro in Tokachi; Yûfutsu in Iburi. **Hondo**: Mt. Hakkoda in Mutsu; Hirumo-numa in Ugo; Ô-numa, Ôishitano-junsai-tsutsumi in Uzen; Akaiyachi in Iwashiro; Ojiroi, Kashima-cho in Iwaki. **Kiushiu**: Bôgatsuru of Mt. Kujû in Bungo; Imuta-ike in Satsuma. (Pl. XXXI fig. 8)

Distr. Japan, Europe, N. America.

var. **pyxidatum** DELP. in WEST Monogr. Brit. Desm. 2, 29, 1905; SCHULZ Bot. Arch. 2, 126, 149, 1922; DICK l.c. 3, 222, 1923; KRIEGER Krypt. Fl. XIII, Abt. 1, 489, 1937; OKADA

Journ. Imp. Fish. Inst. **33**, 112, 1939; HIRANO Act. Phytotax. Geobot. **12**, 29, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 199, 1953.

Var. *lobis lateralibus superioribus leviter acutis*, lobo polari quadrato, marginibus lateralibus paene parallelis in partem superiorem semicellularum, membrana punctata, punctae non densior ornatae, in medio semicellularum cum scrobiculo magno, protuberantiis non distinctis. Long. 53-84 μ , Lat. 28-39 μ , Lat. isth. 8-12.6 μ .

Hab. **Hokkaido**: Tôro in Kushiro; Toyokoro in Tokachi; Sarufutsu, Shimo-yûbetsu in Kitami; Horomui, Nakano near Sapporo in Ishikari; Tôasa-numa, Benze-numa in Iburi; Shizukari in Oshima. **Hondo**: Kurobo-numa, Mt. Hachimantai in Mutsu; Bora-numa, Hoso-numa, Nishi-numa, Hirumo-numa, Moritake-ôtsutsumi, Aka-numa, Kotomo-numa, Megata, Kariwano in Ugo; Hizume in Rikuchû; Eboshi-numa, Hakuryu-ko, Kaibai-ike, Ôishita, Chûkawa-ike, Mazawano-naga-numa, Hijiori-naga-numa, Sugigamine of Mt. Zawo in Uzen; Izu-numa, Naga-numa, Kesho-numa, Kirifushi-numa in Rikuzen; Ôuchi-numa, Nogiwano-kwannon-ike, Numano-taira of Mt. Bandai, Akaiyachi in Iwashiro; Bagyu-numa, Nanko, Kashimacho, Hibushi-numa in Iwaki; Kanazuka-mura in Echigo; Ômine-numa Oze-numa, Jiuemon-ike in Kôzuke; Shigakôgen, Midoriga-ike of Mt. Yatsugadake, Inago of Kitamaki-mura, Kurobishi of Happo-ridge, Kamikôchi, Kizaki, Lake Nakatsuna, Ashinota-ike, Okemi-ike in Shinano; Tanuki-numa in Suruga; Hichimenzan-ôike in Kai; Takashihara, Kotsutsumi-nishi-ike, Ô-numa in Mikawa; Biwa-ike in Owari; Ishigaki-ike, Kanashôzu, Jôdo-ike, Tamaru in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike, Takaraga-ike, Shakuhachi-ike, Ariga-ike in Yamashiro. **Shikoku**: Matsuyama in Iyo; Yamada in Tosa. **Kiushiu**: Kôgamuta of Aso in Higo; Imuta-ike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi. (Pl. XXXI, fig. 1)

Distr. Japan, Kuriles, central China, India, Sumatra, Europe, E. Africa.

Euastrum cuneatum JENNER in RALFS Brit. Desm. 90, 1848; RACIBORSKI Wydz. Akad. Um. Krakow **10**, 30, 1889; WEST Monogr. Brit. Desm. **2**, 25, 1905; MIGULA Krypt. Fl. **2**, 493, 1907; OKADA Journ. Imp. Fish. Inst. **30**, 153, 1934; HIRANO Act. Phytotax. Geobot. **12**, 36, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 200, 1953.

Cellulae mediocres, duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae angusto-pyramidatae, marginibus lateralibus paene rectis etiam levius sinuatis, angulis basalibus et apicalibus leviter rotundis, apice truncato incisura mediana profunda et angusto-lineari; membrana punctata vel minute scrobiculata, non tumore semicellularum; a latere visae ovatae-pyramidatae, apicibus truncato-rotundis; a vertice visae late ellipticae, lateribus convexis vel leviter triundulatis.

Long. 90–101 μ , Lat. 48–50 μ , Lat. isth. 14–17 μ .

Hab. **Hokkaido**: Toyokoro in Tokachi; Numano-taira of Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari; Tôasa-numa in Iburî; Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai, Mt. Kurikoma in Rikuchû; Mt. Gassan, Mt. Azuma in Uzen; Oze-gahara in Kôzuke; Mt. Naeba, Kurosawano-ike, Kôyano-ike of Mt. Myoko in Echigo; Mt. Tateyama, Tarobei-daira, Kurobe-goro-daira, Mt. Kaminotake, Kumonotaira, Sennin-ike in Etchû; Shigakôgen, Daimon-pass, Mt. Kazafuki, Tenguno-hara, Happo-ridge, Shirouma-ôike, Mt. Sanpôgamine in Shinano; Kanashôzu in Ise. (Pl. XXXI, fig. 12, Pl. XXXII, fig. 13)

Distr. Japan, Kuriles, Europe, Greenland, N. America, Australia, New Zealand.

Euastrum inerme (RALFS) LUND. in Nov. Act. Regn. Soc. Ups. ser. 3, VIII, 20, 1871; WEST Monogr. Brit. Desm. 2, 24, 1905; ALLORGE Rev. Alg. 5, 350, 1930; KRIEGER Krypt. Fl. XIII, Abt. 1, 506, 1937; PRESCOTT Amer. Midl. Nat. 34, 240, 1945. — *Euastrum elegans* (BRÉB.) KUTZ. var. *inerme* RALFS in Brit. Desm. 89, 1848.

Cellulae parvae, circiter $1\frac{1}{2}$ – $1\frac{3}{8}$ longiores quam latiores, nonnihil anguste ellipticae, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae subpyramidatae, angulis basalibus oblique truncatis, 5-lobatae, lobis polaribus subrectangularibus in margine leviter convergentibus, angulis apicalibus bene rotundis, apicibus truncatis et convexis incisura mediana profunda et angusto-linea, marginibus lateralibus late retusis, lobis lateralibus superioribus leviter acutis, semicellulae cum tumoribus tribus (uno juxta et supra isthmum, altero in medio semicellularum) et prominenti scrobiculis singulis inter tumores; a latere visae pyramidatae cum parte basis quadrata, marginibus lateralibus superioribus leviter retusis, a vertice visae ellipticae, lateribus cum tumoribus binis utrobique, polis rotundis. Long. 39 μ , Lat. 23 μ , Lat. isth. 8.4 μ .

Hab. **Hondo**: Fuse-ike in Oomi. (New to Asia) (Pl. XXXI, fig. 6)

Distr. Europe, N. America, Colombia.

I am not certain whether the form from Fuse-ike corresponds to the European species or not, since the lateral margin of lateral lobe is very faintly retuse and is often convex. The size of our form is distinctly smaller than the European dimension.

Euastrum pingue ELFV. in WOLLE Desm. U. S. 105, 1884; WEST Monogr. Brit. Desm. 2, 30, 1905; TAYLOR Pap. Mich. Acad. Sci. 20, 207, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 497, 1937.

Cellulae submediocres, circiter $1\frac{1}{2}$ longiores quam latiores, profunde con-

strictae, sinu angusto-lineari sed leviter aperto ad extrorsum; semicellulae rotundo-subpyramidatae, 3-lobatae, lobis polaribus angustis et transverse subrectangularibus cum apicibus truncatis leviter convexis, incisura mediana modice profunda ordinata, angulis apicalibus obtuse rotundatis et minute verrucosis, incisuris inter lobos polares et laterales late retusis, marginibus lateralibus convexis, angulis basalibus late rotundatis; membrana scrobiculata, scrobiculis leviter magnis in medio semicellularum et prope angulos apicem et basalem haec habitus adventus verrucosus ad angulos apicalem visum; a latere visae ovatae, apicibus rotundatis, lateribus leviter retusis juxta infra apicem; a vertice visae ellipticae cum paullo inflatione and medium utrobique et polis rotundatis. Long. 52–56 μ , Lat. 38.7–40 μ , Lat. isth. 10.8–13 μ .

Hab. **Hokkaido**: Numanotaira, Kumoigahara of Mt. Daisetsu in Ishikari. (New to Asia) (Pl. XXXIV, fig. 2)

Distr. Europe, N. America.

Euastrum indicum KRIEGER var. **capitatum** KRIEGER in Krypt. Fl. XIII, Abt. 1, 534, 1937; HIRANO Act. Phytotax. Geobot. 14, 50, 1950; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 203, 1953.

Var. lobis polaribus elongatioribus et capitatis, apice convexo, sinu angusto-linea parte exteriori non aperta. Long. 62–75.6 μ , Lat. 31–33.6 μ , Lat. isth. 8.4–11 μ .

Hab. **Hondo**: Koke-numa in Ugo; Ôishitano-junsaitsutsumi in Uzen; Kashima-cho in Iwaki; Kôyano-ike of Mt. Myoko in Echigo; Ishigaki-ike, Kanashôzu in Ise; Fuse-ike in Oomi (Pl. XXXI, fig. 15)

Distr. Java, Japan.

Euastrum ampullaceum RALFS in Brit. Desm. 83, 1848; WEST Monogr. Brit. Desm. 2, 19, 1905; MIGULA Krypt. Fl. 2, 494, 1907; KAWAMURA Freshw. Biol. 1, 99, 1918; KRIEGER Hedw. 70, 144, 1930; TAYLOR Pap. Mich. Acad. Sci. 20, 200, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 515, 1937; OKADA ASAHINA's Inkwa. 141, 1939; HIRANO Act. Phytotax. Geobot. 12, 28, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 208, 1953.

Cellulae modicae, $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato, isthmo angusto; semicellulae trilobatae, lobis polaribus late cuneatis cum angulis rotundis apicibus convexis cum incisura mediana profunda et angusta, marginibus lateralibus bilobulatis, incisuris lateralibus fere rectangularibus, lobulis superioribus et inferioribus uterque rotundis, mamillato-projectionibus nonnumquamque elevationibus intra marginem lateralem lobolum utrobique ornatis; semicellulae tumore prominenti 3 (altero supra isthmum altero intra angulum basalem utriusque), in centro tumoribus 5 et prominente scrobiculis 3 triangulis ornatis; a latere visae

elongato-pyramidatae, angulis basalibus rectangularibus, lateribus basalibus retusis, lateribus superioribus rectis vel leviter concavis, apice rotundo; a vertice visae ellipticae, polis acute projectis, lobis polaribus rectangularibus lateribus retusis et angulis subacutis; membrana minute scrobiculata. Long. 81–84 μ , Lat. 44.8–47.6 μ , Lat. isth. 11–12.6 μ .

Hab. **Hokkaido**: Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari. **Hondo**: Mt. Hachimantai in Mutsu; Koke-numa in Ugo; Sugigamine of Mt. Zawo, Mt. Gassan in Uzen; Oze in Kôzuke; Mt. Kirigamine in Shinano. (Pl. XXXII, fig 8)

Distr. Japan, whole Europe, Faeroes, N. America, Azores.

Euastrum didelta RALFS in Brit. Desm. 84, 1848; WEST Journ. Linn. Soc. Bot. 34, 382, 1899; Monogr. Brit. Desm. 2, 15, 1935; MIGULA Krypt. Fl. 2, 492, 1907; SMITH Wisc. Bull. 57, 22, 1924; OKADA Journ. Imp. Fish. Inst. 30, 153, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 202, 1934; KRIEGER Krypt. Fl. XIII, Abt. 1, 517, 1937; HIRANO Act. Phytotax. Geobot. 12, 38, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 201, 1953.

Cellulae mediocriter magnae, duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae anguste truncato-pyramidatae, 5-lobatae, incisuris lateralibus latis apertisque, lobis polaribus quadratis leviter dilatatis ad apicem cum angulis apicalibus rotundis, apicibus subtruncatis, in parte mediana incisura profunda angusto-lineari, lobis lateralibus bilobulatis vel valide biundulatis, incisuris lobulatis lateralibus leviter profundis, angulis lateralibus et basalibus late rotundis, lateralibus inferioribus leviter retusis, tumoribus tribus in serie transversa trans basim semicellularum (uno juxta et supra isthmum, altero intra lobum lateralem), tumoribus binis transversaliter in centro semicellularum et scrobiculis in centro semicellularum; a latere visae elongato-pyramidatae, angulis basalibus rectangularibus, apicibus truncatis cum angulis apicalibus rotundis; a vertice visae ellipticae, tumoribus tribus utrobique. Long. 115–150 μ , Lat. 53–70 μ , Lat. isth. 18–26 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Numano-taira of Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai, Mt. Komagatake, Mt. Kurikoma in Rikuchu; Sugigamine of Mt. Zawo, Hijiori-nagnuma in Uzen; Mt. Bandai in Iwashiro; Oze in Kôzuke; Mt. Kaminotake, Ôniu-ike on Mt. Norikura in Etchû; Daimon-pass, Shigakôgen, Midoriga-ike, Amaga-ike of Mt. Yatsugatake, Mt. Kazafuki, Shirouma-ôike, Happo-ridge, Mt. Kirigamine, Kamikôchi in Shinano; Mt. Hira in Oomi. (Pl. XXXI, fig. 17)

Distr. Japan, Kuriles, Siberia, Burma, India, Ceylon, whole Europe, Faeroes, Greenland, N. America, Paraguay, N. Africa.

var. **japonicum** HIRANO in Act. Phytotax. Geobot. **14**, 69, 1951.

Var. *semicellulae latiores*, lobis polaribus elongatioribus ut in var. *bengalica*, sed marginibus lateralibus inferioribus loborum lateralium parallelis et leviter retusis, scrobiculis medianis nullis. Long. 114-116 μ , Lat. 61-62 μ , Lat. isth. 14-15 μ .

Hab. **Hokkaido**: Tomakomai in Iburi. (Pl. XXXI, fig. 4, 5)

Distr. Japan.

Euastrum gnathophorum W. & G. S. WEST in Journ. Linn. Soc. Bot. **33**, 160, 1897; KRIEGER Arch. Hydrobiol. suppl. **11**, 213, 1932; Krypt. Fl. XIII, Abt. **1**, 508, 1937; HIRANO Act. Phytotax. Geobot. **12**, 41, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 202, 1953.

Cellulae mediocres, duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari; *semicellulae* pyramidatae, trilobatae, lobo polari angulari-subquadrato leviter attenuato cum angulis late rotundis, apice truncato incisura mediana profunda angusto-linearique, lobo laterali bilobulato, lateribus in medio profunde retusis, lobulo laterali rotundo; tumoribus tribus prominentibus in serie transversa trans basim *semicellularum* (uno juxta et supra isthmum, altero supra sinum); membrana punctata; a latere visae perpendiculari elongato-rectangulares cum apice late rotundo, lateribus cum tumoribus binis verticaliter utrobique; a vertice visae rectangulari-rotundae cum polo rotundo. Long. 47-73 μ , Lat. 34-36 μ , Lat. isth. 11-14 μ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu, Horomui in Ishikari. **Hondo**: Mt. Hakkoda, Benze-numa in Mutsu; Koke-numa, Hirumo-numa, Moritake-ôtsutsumi, Megata in Ugo; Hakuryu-ko, Mt. Gassan, Chûkawa-ike, Hijiori-naga-numa, Ôishita, Sugigamine of Mt. Zawo in Uzen; Ojroi, Hibu-shi-numa, Bagyu-numa in Iwaki; Oze, Ômine-numa, Mt. Akagi in Kôzuke; Mt. Naeba in Echigo; Shigakôgen, Daimon-pass, Mt. Kirigamine, Happo-ridge, Tengunohara, Mt. Sanbôgamine in Shinano; Mt. Tateyama in Etchû; Takashihara in Mikawa; Ishigaki-ike, Kanashôzu, Tamaru in Ise; Mt. Hira, Fuse-ike in Oomi; Takaraga-ike, Sawano-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Imuta in Satsuma; Koshiki-ike of Mt. Kirishima in Hiuga. (Pl. XXXI, fig. 14).

Distr. Japan, Borneo, Sumatra, Ceylon, Malay.

Euastrum sinuosum LENORM. var. **dideltoides** KRIEGER in Arch. Hydrobiol. suppl. **11**, 214, 1932; Krypt. Fl. XIII, Abt. **1**, 501, 1937; HIRANO Journ. Jap. Bot. **20**, 39, 1944; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 205, 1953.

Var. *lobis polaribus leviter elongatis et dilatatis ad apicem*, lobis lateralibus superioribus paulo productis et mamillatis, in parte basis *semicellula*

oblique truncata; semicellulae leviter triangulares. Long. 56-90 μ , Lat. 31-50 μ , Lat. isth. 7-14 μ .

Hab. **Hokkaido**: Nopporo, Horomui in Ishikari; Shizukari in Oshima. **Hondo**: Megata, Nishi-numa in Ugo; Chûkawa-ike in Uzen; Bagyu-numa in Iwaki; Tamaru in Ise; Shinohara, Fuse-ike in Oomi. **Kiushiu**: Imuta-ike in Satsuma. (Pl. XXXII, fig. 10)

Distr. Japan, Sumatra.

var. **subjenneri** W. & G. S. WEST in Trans. Linn. Soc. Bot. 6, 148, 1902; KRIEGER Krypt. Fl. XIII, Abt. 1, 505, 1937; HIRANO Act. Phytotax. Geobot. 12, 45, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 207, 1953.

Var. semicellulis parvioribus et longioribus, lobis polaribus relative elongatioribus, tumoribus uniformibus 11 ut in var. aböense, tumoribus parvis binis intra marginem loborum polarum. Long. 45-62 μ , Lat. 27-34 μ , Lat. isth. 7-11 μ .

Hab. **Hondo**: Koke-numa in Ugo; Numano-taira of Mt. Bandai in Iwashi-ro; Ozegahara in Kôzuke; Kôyano-ike of Mt. Myoko in Echigo; Gakinotanbo in Etchû; Togakushi in Shinano; Mizoroga-ike, Takaraga-ike, Sawano-ike in Yamashiro. **Kiushiu**: Hirabaru of Yabakei in Bunzen; Bôgatsuru of Mt. Kujû in Bungo. (Pl. XXXII, fig. 6)

Distr. Java, Ceylon.

var. **germanicum** (RACIB.) LÜTKEM. in KRIEGER Krypt. Fl. XIII, Abt. 1, 502, 1937. —var. *Jenneri* (ARCH.) RACIB. forma *germanica* RACIB. in Pamietn. Wydz. Akad. Um. Krak. 17, 31, 1889. (reprint) — *E. sinuosum* forma *elongata* GRÖNBLAD in Act. Soc. Faun. Flor. Fenn. 47, 32, 1920.

Cellulae cum polis polaribus leviter elongatis et dilatatis, semicellulae cum tumoribus 5. et foraminibus medianis 1-4 ornatis. Long. 59-78 μ , Lat. 36.5-47.6 μ , Lat. isth. 7-12.5 μ .

Hab. **Hondo**: Happo-ridge in Shinano. (New to Japan) (Pl. XXXII, fig. 4, Pl. XXXIII, fig. 27)

Distr. Caroline, Europe.

var. **parallelum** KRIEGER in Krypt. Fl. XIII, Abt. 1, 502, 1937; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 9, 1942.

Var. marginibus lateralibus inferioribus parallelis et retusis. Long. 57-62 μ , Lat. 30-31 μ , Lat. isth. 8.4-10 μ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Hijiori-naga-numa, Ôshitan-junsai-tsutsumi in Uzen; Ômine-numa in Kôzuke; Kizaki in Shinano. (New to Asia) (Pl. XXXI, fig. 2)

Distr. U. S. A.

var. **perforatum** KRIEGER in Krypt. Fl. XIII, Abt. 1, 503, 1937; HIRANO Act. Phytotax. Geobot. 12, 44, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 206, 1953.

Differt a forma typica lobis lateralibus distincte intrantibus per scrobiculis. Long. 56–76 μ , Lat. 34–51 μ , Lat. isth. 8.5–14 μ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Mazawano-naga-numa in Uzen; Ozegahara in Kôzuke; Tsuga-daira in Shinano; Fuse-ike in Oomi; Ko-ike in Yamashiro. (Pl. XXXI, fig. 7, Pl. XXXII, fig. 5)

Distr. Japan, Europe.

var. **gangense** (TURNER) KRIEGER in Krypt. Fl. XIII, Abt. 1, 502, 1937; HIRANO Act. Phytotax. Geobot. 13, 148, 1943; PRESCOTT & SCOTT Amer. Midl. Nat. 34, 244, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 205, 1953. — *Euastrum gangense* TURNER in K. Sv. Vet. Akad. Handl. 25, 87, 1893. — *E. didelta* RALFS var. *inermiforme* DUCELLIER in KRIEGER Arch. Hydrobiol. suppl. 11, 212, 1932.

Var. *semicellulis elongato-pyramidatis*, *incisuris inter lobos aequaliter latis* et *apertis cum prominentibus scrobiculis in medio*. Long. 46–59 μ , Lat. 18–30 μ , Lat. isth. 6–11 μ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Yatsumanako of Mt. Iwate, Mt. Kurikoma in Rikuchû; Mt. Gassan in Uzen; Mt. Akagi in Kôzuke; Kôyano-ike, Kurosawano-ike of Mt. Myoko in Echigo; Mt. Tateyama, Kurobe-gorodaira in Etchû; Shiro-uma-ôike, Tenguno-hara, Mt. Kazafuki, Happo-ridge in Shinano. Sawano-ike in Yamashiro. (Pl. XXXII, fig. 2)

Distr. Japan, India, Sumatra, U. S. A.

Euastrum sinuosum var. *gangense* is principally found on the *sphagnum*-bogs of the subalpine region in the central and northern part of Japan. The side view of semicell of this variety is somewhat different from the typical form figured by KRIEGER in its bi-inflated lateral side and in its lack of median scrobiculation in front view.

var. **scrobiculatum** NORDST. in Arch. Hydrobiol. suppl. 11, 215, 1932 (as forma); Krypt. Fl. XIII, Abt. 1, 503, 1937; HIRANO Journ. Jap. Bot. 20, 37, 1944; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 207, 1953.

Var. *angulis lateralibus et polaribus unoquoque rotundis*; *semicellulae cum tumore quinque, inter tumorem scrobiculis 1–5 ornatis*. Long. 62–73 μ , Lat. 34–45 μ , Lat. isth. 10–14 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Shiraoi-poroto-numa, Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Benze-numa, Kotsutsumi in Mutsu; Mt. Komagatake, Moritake-ôtsutsumi, Megata in Ugo; Izu-numa, Kesho-numa in Rikuzen; Ojiroi in Iwaki; Mt. Akagi in Kôzuke;

Okemi-ike in Shinano; Takashihara in Mikawa; Ishigaki-ike in Ise; Shino-hara-ike, Mt. Hira in Oomi; Takaraga-ike in Yamashiro. **Shikoku**: Yamada in Tosa. **Kiushiu**: Byakushi-ike, Koshiki-ike, Ôhatayama of Mt. Kirishima in Hiuga. (Pl. XXXIII, fig. 28)

Distr. Japan, Sumatra, Europe.

var. **aböense** (ELFV.) CEDERGR. in Krypt. Fl. XIII, Abt. 1, 500, 1937; HIRANO Act. Phytotax. Geobot. 12, 43, 1943.—*Euastrum aböense* ELFV. in WEST Monogr. Brit. Desm. 2, 23, 1905; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 17, 1921; ALLORGE Rev. Alg. 5, 348, 1930; OKADA Journ. Imp. Fish. Inst. 30, 151, 1934; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 41, 1935; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 197, 1953.

Var. *cellulis similibus tamquam in forma typica sed levissime sinuatis*, $1\frac{1}{2}$ plo longius quam latis; *semicellulae tumore 5 (tribus supra basim, binis trans centrum) tumore unumquamque cum scrobiculis singulis in medio tumoris, inter tumorem superiorem et inferiorem scrobiculis tribus in formam trianguli ornatis, atque scrobiculis tribus in serie horizontaliter supra tumorem superiorem (uno infra mediam incisuram, altero intra lobum lateralem superiorem utrobique) itaque scrobiculis 11 visis in unaquaque semicellula; a latere visae elliptico-pyramidatae, lateribus tumore bini utrobique. Long. 60–73 μ , Lat. 39–45 μ , Lat. isth. 12.6–14 μ .*

Hab. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Komagatake in Ugo; Mt. Azuma in Uzen; Oze in Kôzuke; Shigakôgen in Shinano. (Pl. XXXII, fig. 1)

Distr. Japan, Kuriles, Europe.

var. **reductum** W. & G. S. WEST in Journ. Bot. 35, 83, 1897; Journ. Linn. Soc. Bot. 33, 160, 1897; Monogr. Brit. Desm. 2, 22, 1905; STRÖM Nyt. Mag. Naturv. 57, 25, 1919; Skrift. Det. Norske Vidensk.-Akad. Oslo, Math.-Nat. Kl. 6, 203, 1926; ALLORGE Rev. Alg. 5, 351, 1930; OKADA Journ. Imp. Fish. Inst. 30, 156, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 208, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 503, 1937; HIRANO Act. Phytotax. Geobot. 12, 44, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 206, 1953.

Cellulae minores quam in forma typica, lobis polaribus rotundatioribus, non dilatatis ad apicem, lobis lateralibus superioribus paulo acutis; a vertice visae tumore utrobique multe reducto. Long. 48–68 μ , Lat. 28–40 μ , Lat. isth. 8.4–13 μ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu; Koke-numa in Ugo; Mt. Azuma, Mt. Gassan in Uzen; Akaiyachi in Iwashiro; Bagyu-numa, Hibushi-numa in Iwaki; Oze in Kôzuke; Mt. Naeba in Echigo; Mt. Tateyama in Etchû; Tsuga-daira, Mt. Kirigamine in Shinano; Tanuki-numa in Suruga; Mt. Hira in Oomi. (Pl. XXXII, fig. 3)

Distr. Japan, Kuriles, Siberia, Thailand, Malay, Borneo, Ceylon, Europe, N. America, Colombia, W. Africa.

Euastrum ozense HIRANO in Mem. Coll. Sci. Univ. Kyoto, B. 19, 65, 1948.

Cellulae mediocres, circiter $2\frac{1}{2}$ plus longae quam latae, profunde constrictae, sinu angusto-lineari extremo ampliato; semicellulae elongato-subpyramidatae vel subtriangulares, trilobae, angulis inter lobos rectangularibus et rotundatis, lobis polaribus elongato-cuneatis, lateralibus levissime divergentibus, apicibus convexis cum angulis rotundatis et incisura mediana profunda et angusto-linea extrema subampliata, lobis lateralibus bilobulatis, lobulis superioribus mamillatis et leviter subdivergentibus, lobulis inferioribus cum angulis basalibus rotundatis, lateribus in medio late retusis vel concavis; cum tumore parvo intra lobulos laterales et in centro semicellularum cum prominente scrobiculo magno singulo; a latere visae angusto-subovatae, lobis polaribus truncato-subpyramidatis, parte basis semicellulae rectangulari cum marginibus retusis; a vertice visae ellipticae, lobis polaribus subrectangularibus. Long. 125-137 μ , Lat. 48-50 μ , Lat. isth. 19-20 μ .

Hab. **Hondo**: Ko-numa, Ozegahara in Kôzuke. (Pl. XXXII, fig. 11)

Distr. Japan.

Euastrum crassum (BRÉB.) KÜTZ. in RALFS Brit. Desm. 81, 1848; LUNDELL Nov. Act. Regn. Soc. Ups. ser. 3, VIII, 17, 1871; WEST Monogr. Brit. Desm. 2, 5, 1905; MIGULA Krypt. Fl. 2, 494, 1907; SCHULZ Bot. Arch. 2, 126, 1922; SMITH Wisc. Bull. 57, 22, 1924; ALLORGE Rev. Alg. 5, 349, 1930; OKADA Journ. Imp. Fish. Inst. 30, 153, 1934; HIRANO Act. Phytotax. Geobot. 12, 35, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 209, 1953.

Cellulae magnae, circiter duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae subrectangulares, trilobae, incisuris lateralibus angustis profundisque, lobo polari late cuneato cum angulis late rotundis, apice convexo incisura mediana profunda lineari, lobo laterali subquadrato in margine late retuso et subparallelo leviter convergenti, angulis lateralibus et basalibus late rotundis; protuberantiis hemisphericis tribus similibus in serie transversa trans basim semicellularum (altera juxta medianam et supra isthmum, altera lateraliter utrobique in medio et supra sinum); membrana punctata; a latere visae angusto-pyramidatae, angulis basalibus subrectangularibus, apice truncato-rotundo; a vertice visae ellipticae, protuberantiis medianis utrobique. Long. 158-162 μ , Lat. 81-84 μ , Lat. isth. 25-26 μ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu in Ishikari; Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai, Mt. Kurikoma in Rikuchu; Mt. Komagatake, Koke-numa in Ugo; Mt. Azuma, Mt. Gassan in Uzen; Oze in Kôzuke; Mt. Naeba in Echigo; Ôniuike on Mt. Norikura in Etchû; Shigakôgen, Daimon-pass, Mt. Kazafuki,

Tengunohara, Happo-ridge, Mt. Kirigamine in Shinano. (Pl. XXXII, fig. 14)
Distr. Japan, Kuriles, Siberia, India, whole Europe, N. America.

var. **tumidum** OKADA in Mem. Fac. Fish. Kagoshima Univ. 3, 210, 1953.

Cellulis latioribus, marginibus lateralibus tumidis et convexis. (non retusis)
Long. 150–155 μ , Lat. 87–90 μ , Lat. isth. 28 μ .

Hab. **Hondo**: Misumi-daira of Mt. Hakkoda in Mutsu; Koshiki-ike in Shinano. (Pl. XXXIV, fig. 1)

Distr. Japan.

Euastrum pinnatum RALFS in WEST Monogr. Brit. Desm. 2, 10, 1905; OKADA Journ. Imp. Fish. Inst. 33, 114, 1939; KRIEGER Krypt. Fl. XIII, Abt. 1, 522, 1937; PRESCOTT Amer. Midl. Nat. 34, 243, 1945; HIRANO Act. Phytotax. Geobot. 14, 170, 1952; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 213, 1953.

Cellulae rarius magnae, circiter duplo longiores quam latiores, profunde constrictae, sinu lineari et leviter aperto; semicellulae anguste pyramidatae vel subsemiellipticae, 5-lobatae, incisuris lateralibus profundis et apertis, lobis polaribus projectione anguilli-formibus, rapide dilatatis versus apicem, apicibus truncato-convexis in medio incisuris profundis et linearibus, angulis apicalibus rotundis et minute denticulatis, lobis lateralibus superioribus parvis quam inferioribus et horizontaliter directis, lobis lateralibus inferioribus quadrato-oblongis cum marginibus profunde retusis, angulis lateralibus rotundis et minute denticulatis; semicellulae cum tumoribus magnis intra lobum lateralem inferiorem utrobique, tumoribus tribus parvis in centro semicellularum (uno singulo juxta et supra isthmum, altero duobus horizontaliter supra tumorem medianum); a latere visae subquadratae in parte inferiori et elongato-subpyramidatae in parte superiori, lateribus inferioribus convexis et in medio retusis, lateribus superioribus rectis, angulis apicalibus plene rotundis, apicibus rectis et leviter concavis, lobis lateralibus superioribus late emarginatis, lobis lateralibus inferioribus subquadratis; a vertice visae ellipticae cum tumore utrobique, lobis polaribus oblongo-rectangularibus. Long. 106–132 μ , Lat. 59–64 μ , Lat. isth. 16–17 μ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari; Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai in Rikuchu; Mt. Kurikoma in Ugo; Mt. Gassan in Uzen. (Pl. XXXII, fig. 15)

Distr. Japan, Siberia, whole Europe, N. & S. America, Faeroes, N. Africa.

Euastrum oblongum (GREV.) RALFS in Brit. Desm. 80, 1848; ROY & BISSET Journ. Bot. 24, 194, 1886; WEST Monogr. Brit. Desm. 2, 12, 1905; MIGULA Krypt. Fl. 2, 495, 1907; HUSTEDT Arch. Hydrobiol. 6, 331, 1911; SMITH Wisc. Bull. 57, 23, 1924; OKADA Journ. Imp.

Fish. Inst. **30**, 155, 1934; TAYLOR Pap. Mich. Acad. Sci. **20**, 205, 1935; HIRANO Act. Phytotax. Geobot. **12**, 157, 1943; PRESCOTT Amer. Midl. Nat. **34**, 242, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 211, 1953.

Cellulae magnae, oblongo-ellipticae, duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter dilatato; semicellulae oblongo-semiellipticae, 5-lobatae, incisuris lateralibus profundissime sublinearibus et apertis in vertice obtusis, lobis polaribus late cuneatis cum angulis apicalibus rotundis, apicibus convexis et in medio incisuris profundis et angusto-linearibus, lobis lateralibus superioribus et inferioribus utriusque late subquadratis cum angulis rotundis et margine retusis, lobis lateralibus superioribus parviores quam lobis inferioribus et divergente productis, incisuris inter lobum lateralem superiorem et inferiorem semicirculari-obtusis; semicellulae cum tumore mediano supra isthmum et tumore singulo in lobo unoquoque laterali, scrobiculis singulis in medio semicellularum; membrana aspere punctata; a latere visae ovatae vel elongato-subpyramidatae, apice truncato-rotundo lateribus superioribus paene rectis vel leviter convexis vel concavis, lateribus inferioribus cum mamillatis undulationibus binis, sinu acutis apertisque; a vertice visae ellipticae, polis anguste rotundis, lateribus cum tumore 5 utrobique. Long. 115-162 μ , Lat. 60-78 μ , Lat. isth. 18-25 μ .

Hab. **Hokkaido**: Chôboshi-numa in Nemuro; Kiritappu in Kushiro; Nikuru-numa in Kitami; Toyokoro-konuma in Tokachi; Nakano near Sapporo in Ishikari; Shiraoi-poroto-numa in Iburi; Shizukari in Oshima. **Hondo**: Benze-numa in Mutsu; Kotomo-numa, Megata in Ugo; Hakuryu-ko, Ôishita, Chûkawa-ike in Uzen; Kesho-numa in Rikuzen; Akaiyachi, Nogiwanokwannon-ike in Iwashiro; Bagyu-numa in Iwaki; Ômine-numa in Kôzuke; Daimon-pass, Inago of Kitamaki-mura, Togakushi, Okemi-ike, Kizaki, Ashinotaike, Kamikôchi in Shinano; Mt. Hichimenzan-ôike in Kai; Tanuki-numa in Suruga; Takashihara in Mikawa; Kanashôzu in Ise; Mt. Hira in Oomi; Shakuhachi-ike in Yamashiro. **Shikoku**; Yamada in Tosa. (Pl. XXXI, fig. 11)

Distr. Japan, Kuriles, China, Siberia, whole Europe, Greenland, N. & S. America, Africa.

Euastrum affine RALFS in WEST Monogr. Brit. Desm. **2**, 17, 1905; KRIEGER Krypt. Fl. XIII, Abt. **1**, 520, 1937; HIRANO Jap. Journ. Bot. **14**, 225, 1954.

Cellulae submagnae, leviter duplo longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter ampliato; semicellulae 5-lobatae, lobis polaribus anguilli-formis, angulis superioribus bene rotundis, apicibus leviter convexis cum incisura mediana profunda et linea, lobis lateralibus bilobulatis, lobulis superioribus minores quam inferioribus, mamil-

lato-formis vel semicircularis, leviter subdivergentibus, lobulis inferioribus subquadratis cum marginibus retusis et angulis basalibus rectangularibus, incisuris inter lobos profundis et concavis; semicellulae cum protuberantiis magnis intra lobulos laterales inferiores et duabus parvis supra isthmum, in centro cellularum cum aliis duabus magnis protuberantiis; a latere visae subquadratae in parte inferiori, subpyramidatae in parte superiori sed dilatatae ad apicem, marginibus lateralibus inferioribus distincte retusis, superioribus rectis et convergentibus, angulis apicalibus bene rotundis, apicibus truncatis, lobis lateralibus superioribus emarginatis, inferioribus rhomboidis cum angulis rotundis; a vertice visae ellipticae cum 4 protuberantiis lateralibus, lobis polaribus quadrato-oblongis. Long. 123 μ , Lat. 67 μ , Lat. isth. 20 μ .

Hab. **Hondo**: Mt. Hakkoda in Mutsu. (Pl. XXXI, fig. 18)

Distr. Japan, India, whole Europe, N. America.

Euastrum humerosum RALFS in Brit. Desm. 82, 1848; WEST Monogr. Brit. Desm. 2, 8, 1905; MIGULA Krypt. Fl. 2, 496, 1907; HIRANO Act. Phytotax. Geobot. 12, 41, 1943; PRESCOTT Amer. Midl. Nat. 34, 239, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 210, 1953.

Cellulae modicae, $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae subtriangulares, 5-lobatae, incisuris lateralibus late apertis, lobis polaribus anguilli-formibus cum angulis rotundis, apicibus convexis vel rectis incisuris medianis profundis et angusto-linearibus, lobis lateralibus superioribus mamillatis et angulari-rotundis, lobis lateralibus inferioribus paene quadratis margine retuso et cum angulo rotundo, incisuris inter lobos laterales superiores et inferiores latissime et profunde retusis vel concavis, protuberantiis tribus in serie transversa trans basim semicellularum, protuberantiis binis parvis transversaliter in centro semicellularum etiam scrobiculis prominentibus in centro semicellularum ornatis; membrana subtiliter scrobiculata, scrobiculis praecipue validis in lobum polarem et protuberantium; a latere visae elongato-subpyramidatae cum protuberantiis binis utrobique in parte inferiori, lateribus superioribus convergentibus et dilatatis ad apicem, angulis apicalibus rotundis, apice retuso; a vertice visae ellipticae cum protuberantiis tribus prominenti utrobique. Long. 95-132 μ , Lat. 56-70 μ , Lat. isth. 15.4-22 μ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Benze-numa in Mutsu; Koke-numa in Ugo; Mt. Kurikoma, Yatsumanako, Onaeshiro-ko of Mt. Iwate in Rikuchu; Sugigamine of Mt. Zawo, Mt. Azuma in Uzen; Hibushi-numa in Iwaki; Oze, Ômine-numa, Mt. Akagi in Kôzuke; Senjôgahara, Shimizu-daira of Mt. Nasu in Shimotsuke; Kurosawano-ike of Mt. Myoko, Mt. Naeba in Echigo; Mt. Tateyama, Mt. Eboshi, Kurobegoro-daira, Tarobei-daira, Sennin-ike, Gakino-tanbo in Etchû;

Shigakôgen, Daimon-pass, Mt. Kazafuki, Tenguno-hara, Tsuga-daira, Happo-ridge, Mt. Kirigamine, Mt. Sanpôgamine in Shinano. (Pl. XXXI, fig. 16, Pl. XXXII, fig. 12)

Distr. Japan, Siberia. India, whole Europe, U. S. A.

Sect. **Excisa** OKADA

Euastrum sect. *Excisa* OKADA in Mem. Fac. Fish. Kagoshima Univ. 3, 215, 1953.

Cellulae submediocres vel parvae, 3-5 lobatae, angulis loborum polorum et lateralium denticulis vel granulis ordinatis, in centro semicellularum granulo magno et intra lobos granulo vel denticulo ordinatis.

- 1a. Semicellulae sine lobis lateralibus superioribus.
 - 2a. Semicellulae semiellipticae, lobis polaribus rotundis.
 - 3a. Membrana glabra cum tumore glabro, marginibus lateralibus sine spina **E. bilobum**
 - 3b. Membrana cum tumore granulato, marginibus lateralibus cum spina ordinatis **E. elegans**
 - 4a. Margine laterali inferiori cum denticulis ordinata f. **typica**
 - 4b. Margine laterali inferiori glabro, late rotundo var. **pseudelegans**
 - 2b. Semicellulae subtrapeziformes, lobis polaribus rectangularibus.
 - 3a. Incisura apicalis profunda et late aperta; marginibus cum spina longa ordinatis **E. flammeum**
 - 3b. Incisura apicalis non profunda et acute aperta; marginibus cum denticulis ordinatis.
 - 4a. Parte basali semicellularum hexagona **E. simplicius**
 - 4b. Parte basali semicellularum rectangulari.
 - 5a. Lobo laterali cum tribus denticulis marginibus ordinato; tumore mediano cum 5 granulis ordinato **E. denticulatum**
 - 6a. Apice lato f. **typica**
 - 6b. Apice angusto var. **angusticeps**
 - 5b. Lobo laterali cum duobus denticulis marginibus ordinato; tumore mediano cum 2 granulis ordinato **E. subalpinum**
- 1b. Semicellulae cum lobis lateralibus superioribus.
 - 2a. Lobo laterali superiori rotundo sine spina **E. dubium**
 - 3a. Membrana cum granulis, lobis polaribus rectangularibus f. **typica**
 - 3b. Membrana glabra sine granulis, lobis polaribus rotundis var. **tritum**
 - 2b. Lobo laterali superiori cum spina ordinato.
 - 3a. Cellulae cum tumore mediano glabro ordinatae.
 - 4a. Cellulae parvae, 22-25 μ in longitudinem; membrana sine foramine mediano **E. subamoenum**
 - 4b. Cellulae magnae, 60-75 μ in longitudinem; membrana cum duobus foraminibus mediane transversaliter ordinata **E. Crameri**
 - 3b. Cellulae cum tumore mediano granulato.
 - 4a. Lobo polari elongato; cellulae mediocriter longae, $1\frac{1}{2}$ longiores quam latiores **E. praemorsum**
 - 4b. Lobo polari non elongato; cellulae $1\frac{1}{2}$ - $1\frac{1}{2}$ longiores quam latiores.

- 5a. Lobo laterali superiori cum denticulis, lobis lateralibus inferioribus cum distincta spina ordinatis **E. divaricatum**
- 5b. Lobo laterali superiori cum duobus denticulis ordinato, lobis lateralibus inferioribus sine spina.
- 6a. Apice distincte convexo, incisura inter lobos polarium et lateralium profunda et rotunda **E. bidentatum**
- 6b. Apice truncato, incisura inter lobos polarium et lateralium rectangularis **E. Turneri**

Euastrum bilobum LÜTKEM. in MIGULA Krypt. Fl. 2, 493, 1907; DICK Krypt. Forsch. 1, 248, 1919; DONAT Pflanzenareal. 2, 19, 21, Karte 23, 1928; HIRANO Act. Phytotax. Geobot. 12, 32, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 199, 1953.

Cellulae raro parvae, anguste ellipticae, circiter $1\frac{2}{3}$ -plo longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo ampliato; marginibus lateralibus concavis et leviter minute fluentis, gradatim attenuato ad apices, angulis basalibus rotundis, lobo polari rotundo et apice incisura mediana profundissime angusto-lineari in vertice aequae dilatato; a latere visae lanceolatae, parte basali circulares, parte superiori transverse subrectangulares; a vertice visae ellipticae. Long. 47-48 μ , Lat. 28 μ , Lat. isth. 9.8 μ .

Hab. **Hondo**: Ozegahara, Nushiri-daira in Kôzuke. (Pl. XXXIII, fig. 22)

Distr. Japan, Europe.

Euastrum elegans (BRÉB.) KÜTZ. in RALFS Brit. Desm. 89, 1848; ROY & BISSET Journ. Bot. 24, 194, 1886; WEST Monogr. Brit. Desm. 2, 48, 1905; DICK Krypt. Forsch. 1, 249, 1919; Bot. Arch. 3, 224, 1923; SMITH Wisc. Bull. 57, 25, 1924; KRIEGER Krypt. Fl. XIII, Abt. 1, 591, 1937; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 220, 1953.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae ovato-pyramidatae, subtrilobae, angulis basalibus subrectangularibus, marginibus lateralibus in parte basis divergentibus et truncatis, in parte medio retuso-emarginatis, angulis lateralibus cum granulis minutis acutis, angulis apicalibus obtusis cum spinis brevibus, apicibus valde convexis in parte exteriori leviter retusis, in medio incisura profundissima et lineari aperta; semicellulae tumore mediano supra isthmum granulis triangularibus ornato; a vertice visae ellipticae cum polis acutis, lateribus in medio utrobique tumore emarginato; a latere visae ovatae, tumore emarginato ad basim utrobique, apice leviter rotundo. Long. 30-31 μ , Lat. 19-20 μ , Lat. isth. 6 μ .

Hab. **Hondo**: Ina (FUJISAWA) in Shinano; Fuse-ike in Oomi. (Pl. XXXI, fig. 10)

Distr. Japan, Siberia, whole Europe, Faeroes, Spitzbergen, Greenland, N. & S. America. Africa, Azores.

var. **pseudelegans** (TURN.) W. & G. S. WEST. in Monogr. Brit. Desm. 2, 49, 1905; OKADA Journ. Imp. Fish. Inst. 30, 154, 1934; KRIEGER Krypt. Fl. XIII, Abt. 1, 595, 1937; PRESCOTT Amer. Midl. Nat. 34, 238, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 221, 1953,

Var. *angulis basalibus late rotundis*; in centro semicellularum prominenti granulo supra isthmum. Long. 30-39 μ , Lat. 22.4-25.8 μ , Lat. isth. 5-7 μ .

Hab. **Hokkaido**: Horomui in Ishikari. **Hondo**: Aka-numa in Ugo; Izu-numa in Rikuzen; Kashima-cho in Iwaki; Ô-numa in Mikawa; Shinohara-ike in Oomi; Ariga-ike in Yamashiro. **Kiushiu**: Ahira in Ôsumi; Nakahama of Lake Ikeda, Nakahara-ike of Fukiagenohama in Satsuma. (New to Japan) (Pl. XXXIII, fig. 7)

Distr. India, British Isles, N. America, Australia.

Euastrum flammeum JOSHUA in Journ. Linn. Soc. Bot. 21, 638, 1886; OKADA Bot. Mag. 50, 431, 1936; KRIEGER Krypt. Fl. XIII, Abt. 1, 608, 1937; HIRANO Act. Phytotax. Geobot. 14, 50, 1950; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 222, 1953.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu acute aperto; semicellulae subquadratae, 3-lobatae, incisuris lateralibus latis et rectangularibus, lobis polaribus late rectangularibus, lateribus leviter divergentibus cum spinis majoribus intra marginem et spinis 3-4 brevibus intra loborum polarum irregulariter dispositis, apice truncato-convexi incisura mediana profundissime et acute aperta, angulis apicalibus in spinam validam majorem divergenter productis, lobis lateralibus transverse ellipticis, lateribus convexis cum spinis tribus acutis in ambitu et spinis tribus brevibus intra marginem; in medio semicellula cum spinis 2-4 supra isthmum; a latere visae in parte basis ellipticae et in parte superiore quadratae, utrobique lateralem loborum polorum spinis binis; a vertice visae ellipticae cum granulis binis utrobique. Long. 40-41 μ , Lat. 25-26 μ , Lat. isth. 6-7 μ .

Hab. **Hondo**: Akaiyachi in Iwashiro; Shinohara-ike in Oomi. (Pl. XXXIII, fig. 25)

Distr. Japan, Burma.

Euastrum simplicius TURNER in K. Sv. Vet. Akad. Handl. 25, 81, 1893.

Cellulae parvae, circiter $1\frac{1}{4}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae subtrapeziformes, 3-lobatae, lobis polaribus subrectangularibus et leviter dilatatis versus sursum, marginibus lateralibus rectis leviter divergentibus, apice convexo cum incisura mediana profunda et acute aperta ordinato, angulis apicalibus spina breve et divergente ordinatis, incisuris inter lobos polares et laterales latis et rectangularibus, lobis lateralibus triangularibus, margini-

bus lateralibus superioribus convergentibus et leviter convexis vel paene rectis, marginibus lateralibus inferioribus divergentibus rectis, angulis basalibus obtusis, angulis lateralibus subacutis spina breve ordinatis; semicellulae cum granulato tumore in centrum, granulis 7, circiter in seriebus annularibus (uni in centro et 6 in parte exteriori) ordinatae, lobis polaribus et lateralibus cum granulis 2-3 intra marginem ordinatis. Long. 42μ , Lat. 33.6μ , Lat. isth. 8.4μ .

Hab. **Hondo**: Ozegahara in Kôzuke. (New to Japan) (Pl. XXXIII, fig. 8)
Distr. India.

Euastrum denticulatum (KIRCHN.) GAY in WEST Trans. Linn. Soc. Bot. 5, 53, 1895; Monogr. Brit. Desm. 2, 56, 1905; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 12, 1921; TAYLOR Pap. Mich. Acad. Sci. 20, 774, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 583, 1937; PRESCOTT & SCOTT Trans. Amer. Micr. Soc. 61, 8, 1942; HIRANO Act. Phytotax. Geobot. 12, 36, 1943; PRESCOTT Amer. Midl. Nat. 34, 236, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 217, 1953.

Cellulae parvae, sed forma variabilis, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite ampliato; semicellulae subquadratae vel subpyramidatae, trilobatae, incisuris lateralibus subrectangulari-obtusis, lobis polaribus multo late rectangularibus, apice truncato incisura mediana subprofunda et aperta, angulis apicalibus acuto-rotundis vel rectangularibus cum spinis validis brevibus productis, lobis lateralibus latissime rectangularibus margine convexis vel truncatis prope parallelis et trigranulatis, angulis basalibus et superioribus lateralibus rotundis vel subrectangularibus; in centro semicellularum supra isthmum tumore mediano granulato, annulo granulorum quinque ornato, intra lobum polarem et lateralem granulo 3-4 ornato; a latere visae ovatae, lateribus cum tumore emarginato et granulato utrobique, apice acuto; a vertice visae ellipticae, polis acutis lateribus cum tumore granulato mediano utrobique. Long. 24- 31μ , Lat. 14- 19.6μ , Lat. isth. 4- 5.6μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro in Tokachi; Nakano near Sapporo, Horomui in Ishikari; Tomakomai, Tôasa-numa, Yûfutsu in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Benze-numa in Mutsu; Hizume in Rikuchu; Koke-numa, Nishi-numa, Hirumo-numa, Mt. Kurikoma, Moritake-ôtsutsumi, Aka-numa, Megata in Ugo; Izu-numa, Kesho-numa in Rikuzen; Hakuryu-ko, Chûkawa-ike, Ôishita in Uzen; Hibushi-numa, Ojiroi in Iwaki; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Oze in Kôzuke; Kôridonono-ike, Kôyano-ike of Mt. Myoko in Echigo; Shigakôgen, Mt. Kirigamine, Mt. Kazafuki, Kizaki in Shinano; Mt. Hichimenzan-ike in Kai; Takashihara in Mikawa; Ishigaki-ike, Jôdo-ike, Kanashôzu in Ise; Mt. Hira,

Fuse-ike in Oomi. **Kiushiu**: Ahira in Ôsumi. (Pl. XXXV, fig. 3)

Distr. Japan, Siberia, China, Malay, Ceylon, Java, whole Europe, Iceland, Greenland, N. America, Africa, Azores.

var. **angusticeps** GRÖNBL. in Act. Soc. Faun. Flor. Fenn. **49**, 13, 1921; KRIEGER Krypt. Fl. XIII, Abt. **1**, 584, 1937.

Semicellulae leviter minores, apicibus semicellularum angustioribus, marginibus lateralibus lobum lateralem granulis tribus distinctibus instructis. Long. 25μ , Lat. 21μ . Lat. isth. 5.6μ .

Hab. **Hondo**: Nanko in Iwaki. (New to Asia) (Pl. XXXVI, fig. 14)

Distr. Switzerland, Finland, Sweden, New Foundland.

Euastrum subalpinum MESSIK. in KRIEGER Krypt. Fl. XIII, Abt. **1**, 569, 1937.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae trilobatae, lobis polaribus late cuneatis vel transverse rectangularibus cum angulis in spinam minute productis, apicibus paene rectis vel leviter convexis in medio incisuris profunde et acute apertis, lobis lateralibus bilobulatis vel in margine retusis cum angulis basalibus rectangulari-rotundis, granulis 2-3 intra marginem loborum lateralium polorumque ordinatis; in centro semicellularum cum granulatumore, granulis binis elongatis et incurvis; a latere visae ovatae, utrobique cum distincta inflatione in parte basis semicellulae; a vertice visae oblongae cum inflatione utrobique. Long. 21μ , Lat. 15.4μ , Lat. isth. 5.6μ .

Hab. **Hondo**: Mt. Kirigamine in Shinano; Ikejiri-ike in Tanba. (New to Asia) (Pl. XXXIV, fig. 14)

Distr. Germany, Switzerland.

Euastrum dubium NÄG. in WEST Monogr. Brit. Desm. **2**, 43, 1905; DICK Mitt. Pfalz Ver. Nat. Pollichia **3**, 123, 1930; KRIEGER Krypt. Fl. XIII, Abt. **1**, 571, 1937; PRESCOTT Amer. Midl. Nat. **34**, 237, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 219, 1953.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae elongate truncato-pyramidatae, 5-lobatae, lobis polaribus breve et transverse rectangularibus, apice truncato incisura mediana profunda et aperta, angulis apicalibus rectangulari-rotundis et in spinam brevem ornatis, lobis lateralibus superioribus rotundis et leviter parvioribus quam lobis lateralibus inferioribus, lobis lateralibus inferioribus late rotundis vel convexo-truncatis vel nonnumquam oblique truncatis, granulis paucis binis intra marginem loborum polorum et granulis binis intra angulos basales; semicellulae cum tumore mediano

glabro; a latere visae ovato-oblongae, apice acute rotundo; a vertice visae elliptico-oblongae. Long. $26.6-33.6\mu$, Lat. $19.6-21\mu$, Lat. isth. $4.2-7.5\mu$.

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Horomui in Ishikari. **Hondo**: Bora-numa in Mutsu; Hosonuma in Ugo; Nanko in Iwaki; Mt. Akagi in Kôzuke; Inago of Kitamaki-mura, Myojin-ike of Kamikôchi, Kizaki, Ashinota-ike in Shinano; Ishigaki-ike, Kanashôzu in Ise; Fuse-ike in Oomi. **Kiushiu**: Kôga-muta of Aso in Higo; Ahira in Ôsumi. (New to Japan) (Pl. XXXV, fig. 6, 7)

Distr. Manchuria, China, Siberia, whole Europe, Spitzbergen, Greenland, N. America, N. Africa.

var. **tritum** W. & G. S. WEST in Ann. R. Bot. Gard. Calcutta **6**, 198, 1907; KRIEGER Krypt. Fl. XIII, Abt. **1**, 573, 1937.

Cellulae minores quam in forma typica, lobo polari cum angulis apicalibus rotundis et apice convexo, lobo laterali superiori leviter acutis; membrana glabra. Long. $22.4-28\mu$, Lat. $15.4-19.6\mu$, Lat. isth. $5.6-7\mu$.

Hab. **Hondo**: Ôishita in Uzen; Jôdo-ike in Ise; Nukigawa of Lake Biwa, Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. (New to Japan) (Pl. XXXVI, fig. 10)

Distr. Burma.

Euastrum subamoenum SCHMIDLE in Ber. Dtsch. Bot. Ges. **11**, 552, 1893; MIGULA Krypt. Fl. **2**, 491, 1907.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice subampliato; semicellulae subtrapeziformes, trilobatae, incisuris lateralibus profunde apertis et semicircularibus, lobis polaribus late rectangularibus vel multe depressis hexagonalibus, apicibus truncatis et rectis incisuris medianis profunde nonnumquam non profunde apertis, angulis apicalibus subrectangularibus cum spinis acutis singulis nonnumquam cum mucrone, lobis lateralibus bilobulatis, incisuris inter lobulos retusis vel concavis, lobulis unumquemque truncato-rotundis et nonnumquam granulis minus praeditis; membrana glabra; a latere et vertice visae non observata. Long. $22.4-28\mu$, Lat. $18.3-25\mu$, Lat. isth. $4.5-7\mu$.

Hab. **Hondo**: Izu-numa in Rikuzen; Shaku-hachi-ike, Ko-ike in Yamashiro. (New to Asia) (Pl. XXXIII, fig. 19)

Distr. Germany.

Euastrum Crameri RACIB. in Pam. Wydz. Mat.-Przyr. Akad. Um. Krak. **17**, 32, 1889 (reprint); GEISSBÜHLER Mitt. Thurg. Naturf. Ges. **28**, 171, 1930; KRIEGER Krypt. Fl. XIII, Abt. **1**, 620, 1937; HIRANO Act. Phytototax. Geobot. **12**, 34, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **3**, 216, 1953.

Cellulae submediocres, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in vertice ampliato; semicellulae pyramidatae, 5-lobatae, incisuris lateralibus latis et rectangulari-obtusis, lobis polaribus late rectangularibus, lateralibus subparallelis spinis magnis in medio infra marginem, apicibus truncato-convexis paulo 6-undulatis incisura mediana alta et angusta, angulis apicalibus rectangularibus in spinam validam productis, lobis lateralibus bilobulatis, lobulis superioribus minores quam inferioribus, angulis superioribus rectangulari-rotundis spinis brevibus validis singulis et spinis singulis infra marginem ordinatis, angulis lateralibus inferioribus cum spinis singulis infra marginem, angulis basalibus rectangularibus spinis brevibus validis in medio sinus; in medio semicellularum scrobiculis binis magnis horizontaliter ordinatis; membrana punctata; a latere visae subpyramidatae, apice anguste acute rotundis, sinu late aperto; a vertice visae paene rectangulares cum tumore mediano utrobique. Long. 62-64.4 μ , Lat. 42-44.8 μ , Lat. isth. 11-14 μ .

Hab. **Hokkaido**: Toyokoro in Tokachi. **Hondo**: Oze-numa in Kôzuke; Chûkawa-ike in Uzen. (Pl. XXXIII, fig. 23)

Distr. Japan, Europe.

Euastrum praemorsum (NORDST.) SCHMIDLE in ENGLER's Bot. Jahrb. 26, 45, 1898; KRIEGER Krypt. Fl. XIII, Abt. 1, 621, 1937. — *Euastrum rostratum* RALFS var. *praemorsum* NORDST. in K. Sv. Vet. Akad. Handl. 22, 34, 1888; KRIEGER Arch. Hydrobiol. Suppl. 11, 214, 1932.

Cellulae submediocres, circiter $1\frac{1}{5}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite ampliato; semicellulae anguste subquadratae, 5-lobatae, incisuris lateralibus latis et apertis, lobis polaribus obverse trapeziformibus, marginibus lateralibus leviter concavis, apicibus leviter truncato-convexis incisura mediana profunda et aperta, angulis apicalibus rectangularibus et cum spinis brevibus acutis, in parte inferiori semicellulis late rectangularibus, lobis lateralibus superioribus et inferioribus paene aequalibus et late truncatis vel leviter retuso-emarginatis in margine 2-3 granulatis, lobis lateralibus superioribus leviter divergentibus productis, angulis basalibus rectangularibus; semicellulae cum tumore mediano juxta et supra isthmum, granulis paucis 2-3 intra marginem lorum lateralem superiorem et inferiorem, utrobique infra basim incisura apicalis cum uno granulo magno conico; a latere visae subtriangulares, lateribus rectis vel leviter concavis tumore prominenti prope basim et tumore parvo prope apicem utrobique. Long. 53-62 μ , Lat. 32-38 μ , Lat. isth. 7-11 μ .

Hab. **Hokkaido**: Horomui in Ishikari; Shizukari in Oshima. **Hondo**: Nanko in Iwaki; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Kanori-ike in

Shinano; Mizoroga-ike in Yamashiro. (Pl. XXXIII, fig. 14)
Distr. Sumatra, Australia, New Zealand, E. Africa.

Euastrum divaricatum LUND. in Nov. Act. Regn. Soc. Ups. ser. 3, VIII, 21, 1871; TURNER K. Sv. Vet. Acad. Handl. 25, 84, 1893; WEST Monogr. Brit. Desm. 2, 42, 1905; MIGULA Krypt. Fl. 2, 499, 1907; SMITH Wisc. Bull. 57, 26, 1924; CEDERGREN Ark. Bot. 25, 37, 1933, MESSIKOMMER Viertelj. Naturf. Ges. Zurich 80, 31, 1935; OKADA Bot. Mag. 50, 315, 1936; KRIEGER Krypt. Fl. XIII, Abt. 1, 598, 1937; HIRANO Act. Phytotax. Geobot. 12, 38, 1943; PRESCOTT Amer. Midl. Nat. 34, 237, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 218, 1953.

Cellulae parvae, $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo ampliato; semicellulae subtriangulares vel truncato-pyramidatae, distincte 3-lobatae, incisuris lateralibus rectangularibus et obtusis, lobis polaribus latissime rectangularibus, apicibus convexo-truncatis incisuris medianis profundis et acutis apertisque, angulis apicalibus in spinam brevem divergentem productis vel granulo acuto ornatis, lobis lateralibus bilobulatis, lobulis superioribus triangularibus et cum angulis rotundis, lobulis inferioribus cum angulis truncato-rotundis et denticulo singulo in exteriori sinu, cum spinis singulis distinctis horizontaliter vel leviter divergentibus in angulum loborum lateralem; in centro semicellularum tumore granulato mediano supra isthmum, annulo granulorum 6 circa granulum centralem, granulis tribus intra marginem loborum polarem et granulis 2-3 intra marginem lobulorum lateralem uniuscuiusque; a latere visae ovatae, tumore emarginato ad basim utrobique apice spina parva ornato; a vertice visae ellipticae, utrobique polo spina, medio utrobique tumore granulato ornatae. Long. 40-42 μ , Lat. 35-36 μ , Lat. isth. 7-8 μ .

Hab. **Hokkaido**: Numano-taira of Mt. Daisetsu, Kamikoshi-ukishimahara in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Komagatake in Ugo; Mt. Gassan in Uzen; Mt. Nishi-azuma in Iwashiro; Ozegahara in Kôzuke. (Pl. XXXIII, fig. 3)

Distr. Japan, Siberia, whole Europe, U. S. A., W. Indies.

Euastrum bidentatum NÄG. in Gatt. einz. Alg. 122, 1849; WEST Monogr. Brit. Desm. 2, 39, 1905; SCHULZ Bot. Arch. 2, 126, 150, 1922; DICK l. c. 3, 222, 1923; OKADA Journ. Imp. Fish. Inst. 30, 152, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 200, 1935; KRIEGER Krypt. Fl. XIII, Abt. 1, 601, 1937; HIRANO Act. Phytotax. Geobot. 12, 31, 1943; PRESCOTT Amer. Midl. Nat. 34, 234, 1945; OKADA Mem. Fac. Fish. Kagoshima Univ. 3, 215, 1953.

Cellulae parvae, circiter longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite dilatato; semicellulae subpyramidatae, 5-lobatae, incisuris latere apertis obtusisque, lobis lateralibus bilobulatis, lobulis lateralibus late rotundis vel truncato-rotundis cum granulis duobus vel

tribus acutis, intra angulos superiores granulis tribus et intra angulos inferiores granulorum seriebus duobus horizontaliter praeditis, angulis basalibus subrectangularibus, lobis polaribus latissime rectangularibus leviter dilatatis cum angulis in spinam brevem productis, apice convexo-undulato incisura mediana profunda et aperta, granulis tribus intra marginem lateralem utrobique et granulis parvis duobus vel tribus infra basim incisurae apicalis utrobique (nonnumquam absentis) praeditis; in medio semicellularum granulatum supra isthmum, annulo granulorum 5- vel 6 circa granulum centalem; membrana conferte punctata; a latere visae ovatae, basi lateribus utrobique cum trigranulato-tumore; a vertice visae ellipticae, tumore utrobique trigranulato, polis acutis granulatis. Long. 43-56 μ , Lat. 26.6-39 μ , Lat. isth. 7-12.5 μ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Kiritappu in Kushiro; Shikaribetsu-wopputo in Tokachi; Shizukari in Oshima. **Hondo**: Naga-numa of Mt. Hachimantai in Rikuchu; Jiuemon-ike in Kôzuke; Daimon-pass, Kizaki, Myojin-ike of Kamikôchi in Shinano; Ishigaki-ike in Ise. (Pl. XXXIII, fig. 1, 12)

Distr. Japan, Kuriles, Manchuria, Siberia, China, India, Pamir, whole Europe, Iceland, Greenland, N. & S. America, E. Africa, Azores.

Euastrum Turneri W. WEST in Journ. Linn. Soc. Bot. 29, 141, 1893; WEST Monogr. Brit. Desm. 2, 37, 1905; SKVORTZOW Journ. Bot. 64, 125, 1926; KRIEGER Krypt. Fl. XIII, Abt. 1, 589, 1937.

Cellulae parvae, circiter 1 $\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari in capite leviter ampliato; semicellulae trapeziformes, 3-lobatae, incisuris inter lobos polares et laterales profundis et apertis, extremis leviter rotundis, lobis polaribus late rectangularibus, apicibus convexis et retusis in medio vel elevatis in medio cum incisura mediana profunda linea et aperta, angulis apicalibus rectangularibus et in spinam brevem acutam validam productis, lobis lateralibus bilobulatis, lobulis truncatis et angulis granulis singulis parvis ornatis, saepe autem non ornatis, incisuris inter lobulos latis et retusis, lobis unoquoque granulis acutis 3-4 intra marginem ornatis, cum granulato-protuberantibus singulis medianis supra isthmum, granulis elongatis et quinque aliquantum in forma circulari ornatis; a latere visae ovato-triangulares, apicibus aliquantum acutis, lateribus convexis cum granulato-protuberantiis prope basim utrobique; a vertice visae ellipticae. Long. 36-43 μ , Lat. 27-28 μ , Lat. isth. 8-9 μ .

Hab. **Hokkaido**: Shimoyûbetsu in Kitami; Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Tôasa-numa in Iburi. **Hondo**: Hizume in Riku-

chû; Hirumo-numa in Ugo; Ôishita in Uzen; Nogiwano-kwannon-ike, Akai-yachi, Numano-taira of Mt. Bandai in Iwashiro; Kobuchi-numa in Rikuzen; Hibushi-numa, Bagyu-numa in Iwaki, Goda-numa in Shimofusa; Gakino-tanbo in Etchû; Kotsutsumi-nishi-ike in Mikawa; Inago of Kitamaki-mura in Shinano; Mt. Hichimenzan in Kai; Biwa-ike in Owari; Ishigaki-ike, Tamaru in Ise; Shinohara-ike, Fuse-ike in Oomi. **Shikoku**: Matsuyama, Misakapass in Iyo; Yamada in Tosa, **Kiushiu**: Nakahama of Lake Ikeda in Satsuma. (New to Japan) (Pl. XXXIII, fig. 2, 11)

Distr. Manchuria, Europe, Arctic Canada.

Gen. *Micrasterias* AG.

in RALFS Brit. Desm. 68, 1848; RABENHORST Flor. Europ. Alg. 3, 187, 1868; HANSGIRG Prod. Alg. Böhm. 207, 1888; WEST Monogr. Brit. Desm. 2, 76, 1905; SMITH Wisc. Bull. 57, 40, 1924; WEST & FRITSCH Treat. Brit. Alg. 276, 1927; PRINTZ in ENGL. Pflanzenf. 3, 359, 1927; SMITH Freshw. Alg. U. S. 581, 1933; KRIEGER Krypt. Fl. XIII, Abt. 2, 1, 1939.

Cellulae variables, generalis magnae, leviter longae quam latae, profundissime constrictae ad medium, sinu generalis lineari vel sublineari aliquando aperto exterius; semicellulae subsemicirculares, generalis 5-lobatae, sed in paucis speciebus trilobae, lobis polaribus late cuneatis, apicibus emarginatis vel late incisuris; lobis lateralibus bilobulatis, lobulis omnibus generaliter ulterius paulo bilobatis, incisuris polaribus inter lobos polares et laterales superiores profundis, incisuris lateralibus (inter lobos laterales superiores et inferiores) non profundis quam incisuris polaribus, in centro basis semicellulam sine tumoribus; membrana generalis glabra vel punctata, aliquando serie denticulis in margine sinus et incisurae regulariter ordinatis; a vertice visae angusto elliptico lanceolatae; zygosporae globosae cum spinis validis simplicis vel furcatis in capite.

- 1a. Semicellulae sine processibus apicalibus vel lateralibus...Subgen. **Eumicrasterias**
- 1b. Semicellulae cum processibus apicalibus vel lateralibus..... Subgen. **Atomocystis**

Subgen. *Eumicrasterias* (HANS.) HIRANO, stat. nov.

Micrasterias sect. *Eumicrasterias* HANS. in Prodr. Algenfl. Böhm. 1, 208, 1888; PRINTZ Pflanzenfam. 3, 360, 1927.

Semicellulae tri- vel 5-lobatae, lobis polaribus integris cum incisuris apicalibus medianis, lobis lateralibus horizontaliter vel radialiter dispositis.

- 1a. lobis polaribus integris; lobis lateralibus semicellularum duabus, horizontaliter dispositis Sect. **Tetrachastrum**
- 1b. Lobis polaribus cum incisura mediana variabiliter profundis ordinatis, lobis lateralibus semicellularum quaternis, radialiter dispositis..... Sect. **Actinocystis**

Sect. **Tetrachastrum** (DIXON) HANSG.

Micrasterias sect. *Tetrachastrum* (DIXON) HANSG. in Prodr. Algenfl. Böhm. **1**, 207, 1888; PRINTZ Pflanzenfam. **3**, 360, 1927. — *Holocystis* HASS. in Hist. Brit. Freshw. Alg. **1**, 386, 1845. — *Micrasterias* sect. *Holocystis* (HASS.) W. & G. S. WEST in Monogr. Brit. Desm. **2**, 77, 1905. — subgen. *Holocystis* (HASS.) TURNER in K. Sv. Vet. Akad. Handl. **25**, 98, 1893 (pro parte) — sect. *Integerrimae* OKADA in Mem. Fac. Fish. Kagoshima Univ. **2**, 98, 1951.

Semicellulae trilobatae, lobis polaribus integris, lobis lateralibus horizontalibus.

- 1a. Lobo laterali non diviso, in parte inferiori loborum polorum elongato
..... **M. pinnatifida**
- 1b. Lobo laterali diviso, in parte inferiori loborum polorum non elongato
..... **M. decemdentata**

Micrasterias pinnatifida (KÜTZ.) RALFS in Brit. Desm. 77, 1848; ROY & BISSET Journ. Bot. **24**, 193, 1886; WEST Trans. Linn. Soc. Bot. **5**, 238, 1896; Monogr. Brit. Desm. **2**, 80, 1905; MIGULA Krypt. Fl. **2**, 502, 1907; KAWAMURA Freshw. Biol. **1**, 99, 1918; SMITH Wisc. Bull. **57**, 41, 1924; KRIEGER Arch. Hydrobiol. Suppl. **11**, 218, 1932; OKADA Journ. Imp. Fish. Inst. **30**, 161, 1934; TAYLOR Pap. Mich. Acad. Sci. **20**, 214, 1935; KRIEGER Krypt. Fl. XIII, Abt. **2**, 16, 1939; PRESCOTT & SCOTT Pap. Mich. Acad. Sci. **25**, 96, 1940; **28**, 76, 1942; HIRANO Act. Phytotax. Geobot. **12**, 74, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 99, 1952.

Cellulae parvae, circiter tam longae quam latae, profundissime constrictae, sinu angusto-lineari exterius aperto; semicellulae trilobae, incisuris inter lobos profundis et late apertis, lobo polari in parte inferiore cylindrico, prope apicem subito dilatato, apice late recto vel leviter convexo cum angulis apicalibus emarginato-dentatis, lobis lateralibus semifusiformibus et horizontalibus, angulis lateralibus emarginato-dentatis, membrana glabra; a latere visae ovato-pyramidatae cum apice rotundo; a vertice visae angusto-ellipticae, polis acutis. Long. 58–68 μ , Lat. 58–69 μ , Lat. isth. 11–15 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Sarufutsu, Shimoyûbetsu, Komukai-ponto, Notoro-ponto in Kitami; Toyokoro-konuma in Tokachi; Nakano near Sapporo, Horomui in Ishikari; Tôasa-numa, Tomakomai, Yûfutsu, Numanohata in Iburi; Shizukari, Junsai-akanuma, Ko-numa in Oshima. **Hondo**: Koke-numa, Hirumo-numa, Megata in Ugo; Hakuryu-ko, Ôishita, Chûkawa-ike in Uzen; Izu-numa in Rikuzen; Hôzawano-ike, Kôriyama, Nogiwanokwannon-ike, Akaiyachi in Iwashiro; Bagyu-numa in Iwaki; Ozegahara in Kôzuke; Goda-numa in Shimofusa; Kanori-ike, Inago of Kitamaki-mura, Kizaki in Shinano; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise; Nukigawa, Fuse-ike, Shinohara-ike, Matsubara-naiko in Oomi; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Imutaike, Nakahama of Lake Ikeda in Satsuma; Ahira in Ôsumi. (Pl. XXXIV,

fig. 9, Pl. XXXV, fig. 2)

Distr. Japan, Kuriles, Manchuria, Siberia, China, India, Ceylon, Sumatra, Asia Minor, whole Europe, N. & S. America.

Micrasterias decemdentata NÄG. in ROY & BISSET Journ. Bot. **24**, 193, 1886; MIGULA Krypt. Fl. **2**, 501, 1907; BERGE Ark. Bot. **15**, 66, 1918; DONAT Pflanzenf. **5**, 12, 1926; GISTL Krypt. Forsch. **1**, 466, 1926; HOMFELD Pflanzenf. **12**, 34, 1929; SKVORTZOW Philip. Journ. Sci. **49**, 149, 1932; OKADA Inkwa. **147**, 1939; KRIEGER Krypt. Fl. XIII. Abt. **2**, 34, 1939; HIRANO Journ. Jap. Bot. **20**, 37, 1944; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 104, 1952.

Cellulae parvae, late ellipticae, paullo longiores quam latae, profundissime constrictae, sinu leviter aperto et acutangulo; semicellulae semicirculares, 3-lobae, incisuris inter lobos polares et superiorem lateralem profundis et angusto-apertis, lobo polari late cuneato, apice late convexo cum angulis inferioribus acutis et in spinam brevem instructis, lobis lateralibus bilobulatis, incisuris inter lobulos modice profundis et acute apertis, lobulis truncatis et emarginatis cum angulis in spinam brevem acutam productis nonnumquam sine spina; a vertice visae fusiformes cum polis acutis; membrana glabra vel punctata. Long. 63-84 μ , Lat. 56-76 μ , Lat. isth. 14-20 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Komukai-ponto in Kitami; Horomui, Nakano near Sapporo in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Naga-numa of Mt. Hachimantai in Rikuchû; Nishi-numa, Kawajiri in Ugo; Hakuryu-ko, Chûkawa-ike, Ôishita in Uzen; Izu-numa, Kesho-numa, in Rikuzen; Kôriyama, Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Oji-roi, Nanko in Iwaki; Kôridonono-ike, Matsunoyama in Echigo; Lake Kizaki in Shinano; Biwa-ike in Owari; Kanashôzu, Jôdo-ike in Ise; Nukigawa, Fuse-ike in Oomi; Ikejiri-ike in Tanba. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Kôga-muta of Azo in Higo; Miyazaki in Hiuga; Imuta-ike, Nakahama of Lake Ikeda in Satsuma. (Pl. XXXIV, fig. 17, Pl. XXXV, fig. 5)

Distr. Japan, China, Europe, Australia.

Sect. *Actinocystis* (TURNER) W. & G. S. WEST

Micrasterias sect. *Actinocystis* (TURNER) W. & G. S. WEST in Monogr. Brit. Desm. **2**, 77, 1905. — subgen. *Actinocystis* TURNER in K. Sv. Vet. Akad. Handl. **25**, 98, 1893. — sect. *Cuneatae* OKADA in Mem. Fac. Fish. Kagoshima Univ. **2**, 105, 1952. — sect. *Uncinatae* OKADA in l. c. **2**, 131, 1952.

Semicellulae 5-lobae, lobis polaribus incisura mediana variabiliter profunde ordinatis, lobis lateralibus inferioribus horizontalibus et superioribus divergentibus.

- 1a. Lobo laterali paulo diviso, incisuris inter lobulos late apertis.
 - 2a. Lobo polari elongato et evidenter producto versus sursum ex lobo laterali, lobulis relative brevibus et robustis..... **M. Crux-melitensis**
 - 3a. Lobo laterali cum 4 lobuletis..... f. **typica**
 - 3b. Lobo laterali cum 8 lobuletis..... var. **superflua**
 - 2b. Lobo polari breve non producto ex lobo laterali, lobulis elongatis et angustis **M. radiata**
- 1b. Lobo laterali multo diviso, incisuris inter lobulos angusto-linearibus.
 - 2a. Apice semicellularum integro sine incisura apicali **M. truncata**
 - 2b. Apice semicellularum retuso vel cum incisura apicali.
 - 3a. Lobo laterali aequaliter diviso.
 - 4a. Cellulae sine projectionibus prope basim.
 - 5a. Apice loborum polorum retuso-emarginato, incisuris apicalibus acuminatis.
 - 6a. Sinu angusto-lineari.
 - 7a. Lobo polari cum marginibus rectis parallelis ordinato, subito dilatato prope apicem **M. lux**
 - 7b. Lobo polari sine marginibus parallelis, gradatim dilatato versus apicem..... **M. papilliferum**
 - 8a. Membrana sine serie denticulorum var. **glabra**
 - 8b. Membrana cum serie denticulorum..... f. **typica**
 - 6b. Sinu acute aperto, incisuris apertis ex basi **M. Murrayi**
 - 5b. Apice loborum polorum generaliter cum incisuris apicalibus profundis et acute apertis aliquando vadosis ordinato.... **M. denticulata**
 - 6a. Incisura inter lobos profunda, incisuris apicalibus profundis.
 - 7a. Apice lobulorum emarginato, angulis loborum apicalium rotundis, incisuris apicalibus sine denticulis.
 - 8a. Semicellulae rotundo-semicirculares, lobis lateralibus cum incisuris quaternis interlobularibus ordinatis..... f. **typica**
 - 8b. Semicellulae angulari-semicirculares, lobis lateralibus cum incisuris tribus interlobularibus ordinatis..... var. **angulosa**
 - 7b. Apice lobulorum emarginato-dentato, angulis loborum apicalium emarginatis, incisuris apicalibus cum denticulis ad marginem utrobique ordinatis..... var. **notata**
 - 6b. Incisura inter lobos non profunda, incisuris apicalibus retusisvar. **angusto-sinuata**
- 4b. Cellulae cum projectionibus prope basim semicellularum ordinatae **M. Thomasiana**
- 5a. Semicellulae cum projectionibus tribus trans basim ordinatae, lobis polaribus sine projectionibus f. **typica**
- 5b. Semicellulae cum projectionibus duabus elongatis supra sinum ordinatae, lobis polaribus cum projectionibus brevibus singulis ad marginem incisuram utrobique ordinatis..... var. **javanicum**
- 3b. Lobo laterali inaequaliter diviso.
 - 4a. Apice loborum polorum retuso-emarginato; cellulae solitariae.
 - 5a. Membrana glabra vel cum serie denticulorum ordinata.
 - 6a. Lobo polari cum angulis productis ordinato, sine denticulis parvis singulis intra marginem prope angulos **M. rotata**

- 6b. Lobo polari sine angulis productis, cum denticulis parvis
singulis intra marginem prope angulos **M. Sol**
- 7a. Membrana glabra..... f. **typica**
- 7b. Membrana cum serie denticulorum prope sinum et incisa
intra marginem..... var. **ornata**
- 5b. Membrana denticulata in toto semicellulae **M. apiculata**
- 4b. Apice loborum polorum profunde et late excavato; cellulae in
colonias formantae..... **M. foliacea**

Micrasterias Crux-melitensis (EHRENB.) HASS. in RALFS Brit. Desm. 73, 1848; ROY & BISSET Journ. Bot. 24, 193, 1886; WEST Monogr. Brit. Desm. 2, 116, 1905; KAWAMURA Freshw. Biol. 1, 99, 1918; HOMFELD Pflanzenf. 12, 34, 1929; FUJISAWA Journ. Jap. Bot. 10, 443, 1934; OKADA Journ. Imp. Fish. Inst. 30, 158, 1934; FUJISAWA Hakubutsu 34, 15, 1936; KRIEGER Krypt. Fl. XIII, Abt. 2, 62, 1939; PRESCOTT & SCOTT Pap. Mich. Acad. Sci. 23, 72, 1942; HIRANO Act. Phytotax. Geobot. 12, 73, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 2, 106, 1952.

Cellulae mediocres, paulo longiores quam latiores, profundissime constrictae, sinu aperto acutangulo; semicellulae quinquelobatae, incisuris inter lobos profundis et late apertis, incisuris inter lobos polares et superiores laterales profundioribus, lobo polari in parte inferiori quadrato cum lateribus paene parallelis, prope apicem dilatato, apice late retuso vel concavo, angulis apicalibus in processus breves sursum divergentes productis, apicibus bifurcatis, lobis lateralibus verticalibus aequalibus nonnumquam subaequalibus vel inaequalibus, in lobulis duobus divisis, incisura mediana multo profundiore, lobulis divergentibus et emarginato-bidentatis; membrana glabra; a vertice visae rhomboideo-ellipticae. Long. 102–129 μ , Lat. 84–124 μ , Lat. isth. 14–20 μ .

Hab. **Hokkaido**: Tokotan, Kiritappu in Kushiro; Notoro-ponto, Komukai-ponto, Shimoyûbetsu in Kitami; Toyokoro in Tokachi; Horomui, Nakano near Sapporo, Minenobu, Nopporo, Moseushi in Ishikari; Yûfutsu, Numano-hata, Tôasa-numa, Tomakomai, Shiraoi-poroto-numa in Iburi; Junsai-akanuma, Konuma, Shizukari in Oshima. **Hondo**: Aka-numa, Ogata, Kariwano in Ugo; Ôishita, Chûkawa-ike in Uzen; Izu-numa, Naga-numa in Rikuzen; Ojiroi in Iwaki; Kôriyama, Akaiyachi in Iwashiro; Oze-numa in Kôzuke; Goda-numa in Shinofusa; Inago of Kitamaki-mura, Kanori-ike in Shinano; Tanuki-numa in Suruga; Matsubara-naiko, Shinohara-ike, Nukigawa, Lake Biwa in Oomi; Mizoroga-ike in Yamashiro; Ikejiri-ike in Tanba. **Kiushiu**: Nakahara-ike of Fukiagenohama; Ahira in Ôsumi. (Pl. XXXIV, fig. 15)

Distr. Japan, Kuriles, Manchuria, Siberia, China, Burma, India, Ceylon, Celebes, Asia Minor, whole Europe, N. America, Brazil, central Africa.

var. **superflua** TURNER in WEST Monogr. Brit. Desm. 2, 117, 1905; HOMFELD Pflanzenf. 12, 34, 1929; KRIEGER Krypt. Fl. XIII, Abt. 2, 67, 1939; HIRANO Act. Phytotax. Geobot. 15, 146, 1954.

Var. lobis lateralibus multo separatis, lobulis praeterea divisis, cum 8 lobuletis parvis ordinatis. Long. $116\ \mu$, Lat. $116\ \mu$, Lat. isth. $17\ \mu$.

Hab. **Hondo**: Lake Biwa in Oomi. (Pl. XXXVI, fig. 3)

Distr. Japan, British Isles, Germany.

Micrasterias radiata HASS. in WEST Monogr. Brit. Desm. **2**, 113, 1905; MIGULA Krypt. Fl. **2**, 503, 1907; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **49**, 23, 1921; KRIEGER Krypt. Fl. XIII, Abt. **2**, 68, 1939; PRESCOTT & SCOTT Pap. Mich. Acad. Sci. **25**, 96, 1940; l. c. **28**, 76, 1942; TAFT Ohio Journ. Sci. **45**, 191, 1945.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu aperto et extremo acutangulo; semicellulae semicirculares, 5-lobatae, incisuris inter lobos mediocris profundis et apertis, lobo polari subquadrato in parte inferiori et alte dilatato, angulis apicalibus productis in processus longos divergentes in apice furcatis, apicibus semicellularum concavis, lobo laterali aequae, in lobulis aequalibus diviso, lobulis longis divergentibus in apice furcatis, lobulis apicalibus et lateralibus similibus et radialiter dispositis; a latere visae ovato-lanceolatae, apice producto; a vertice visae anguste subrhomboides, polis acuminatis et productis; membrana glabra vel punctata. Long. $140\ \mu$, Lat. $140\ \mu$, Lat. isth. $22.4\ \mu$.

Hab. **Hokkaido**: Tomakomai in Iburi. (New to Japan) (Pl. XXXV, fig. 9)

Distr. China, India, Europe, N. & S. America, central Africa.

Micrasterias truncata (CORDA) BRÉB. in RALFS Brit. Desm. **75**, 1848; WEST Journ. Linn. Soc. Bot. **31**, 383, 1899; Monogr. Brit. Desm. **2**, 82, 1905; KAWAMURA Freshw. Biol. **1**, 99, 1918; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **49**, 20, 1921; SCHULZ Bot. Arch. **2**, 128, 148, 1922; l. c. **3**, 261, 1923; SMITH Wisc. Bull. **57**, 43, 1924; OKADA Journ. Imp. Fish. Inst. **30**, 162, 1934; TAYLOR Pap. Mich. Acad. Sci. **20**, 216, 1935; KRIEGER Krypt. Fl. XIII, Abt. **2**, 25, 1939; PRESCOTT & SCOTT Pap. Mich. Acad. Sci. **28**, 79, 1942; HIRANO Act. Phytotax. Geobot. **12**, 76, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 101, 1952.

Cellulae submediocres, circulares vel ellipticae, paullo longiores quam latiores, profundissime constrictae, sinu angusto-lineari in vertice subampliato et in parte exteriori subaperto; semicellulae 5-lobatae, incisuris infra lobos polares subampliatas et modice profundis, incisura lateralis sublinearis vel acutangula et non profundiore, lobo polari latissime cuneato cum lateribus divergentibus, apice leviter convexo vel paene recto, angulis apicalibus plerumque emarginato-bifidis, lobis lateralibus bilobulatis, lobulis emarginato-bifidis; membrana plerumque punctata; a latere visae late ovatae; a vertice visae fusiformes-ellipticae cum polis acutis. Long. $95-98\ \mu$, Lat. $97-98\ \mu$, Lat. isth. $22-23\ \mu$.

Hab. **Hokkaido**: Kiritappu, Tokotan in Kushiro; Kamikoshi-ukishimahara, Numano-taira of Mt. Daisetsu in Ishikari; Tomakomai in Iburi; Shizukari

in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Hachimantai, Mt. Kurikoma in Rikuchû; Koke-numa in Ugo; Nogiwano-kwannon-ike, Akaiyachi in Iwashi-ro; Oze, Ômine-numa in Kôzuke; Mt. Naeba in Echigo; Daimon-pass, Mt. Kirigamine, Shigakôgen, Shirouma-kamino-tanbo in Shinano; Kanashôzu in Ise; Mt. Hira in Oomi. **Kiushiu**: Hirabaru of Yabakei in Bunzen. (Pl. XXXVI, fig. 4, 5, 17)

Distr. Japan, Kuriles, China, India, whole Europe, N. & S. America.

Micrasterias lux JOSHUA in Journ. Linn. Soc. Bot. **21**, 636, 1886; TURNER K. Sv. Vet. Akad. Handl. **25**, 91, 1893; WRIEGER Krypt. Fl. XIII, Abt. **2**, 97, 1939; HIRANO Act. Phytotax. Geobot. **13**, 149, 1943.

Cellulae mediocres, subcirculares, circiter tam longae quam latae, profundissime constrictae, sinu angusto-lineari; semicellulae subsemicirculares vel subtriangulares, 5-lobatae, incisuris inter lobos profundis et leviter apertis, lobo polari elongato cum lateribus parallelis in parte inferiore, dilatatis versum apicem, apice retuso-emarginato in medio acuminato, angulis apicalibus in processus breves attenuatos cum apicibus profunde furcatis oblique productis, cum denticulo minuto ad angulos intra marginem apicalem utrobique, lobis lateralibus superioribus et inferioribus aequalibus, in lobis aequalibus 4 divis, incisuris inter lobulos profundis et apertis, lobulis similibus divergentibusque gradatim attenuatis et radialiter ornatis cum apice profundo et emarginato. Long. et Lat. 176 μ , Lat. isth. 20 μ .

Hab. **Hondo**: Mizoroga-ike in Yamashiro. (Pl. XXXVII, fig. 1)

Distr. Japan, Burma, India.

Micrasterias papillifera BRÉB. in RALFS Brit. Desm. **72**, 1848; WEST Monogr. Brit. Desm. **2**, 91, 1905; CUSHMAN Bull. Torrey Bot. Club. **32**, 225, 1905; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **47**, 36, 1920; DICK Krypt. Forsch. **1**, 448, 1926; HOMFELD Pflanzenf. **12**, 35, 1929; TAYLOR Pap. Mich. Acad. Sci. **20**, 214, 1935; OKADA Journ. Imp. Fish. Inst. **33**, 115, 1939; KRIEGER Krypt. Fl. XIII, Abt. **2**, 87, 1939; PRESCOTT Pap. Mich. Acad. Sci. **25**, 95, 1940; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 119, 1952.

Cellulae mediocres, subellipticae, leviter longiores quam latae, profunde constrictae, sinu angusto-lineari in vertice leviter ampliato; semicellulae subcirculares vel subellipticae, 5-lobatae, incisuris inter lobos profundis linearibus, lobo polari cuneato cum marginibus lateralibus concavis, apice concavo et in medio incisura profunde retusa ad verticem acutangulis apertis, angulis apicalibus leviter productis et furcato-emarginatis, cum denticulis minutis duobus intra marginem apicalem prope incisuris medianis utrobique, lobis lateralibus superioribus et inferioribus paene aequalibus et cuneatis, in lobulis aequalibus 4 divis, incisura primaria mediana profundiore et duplo longiore quam duas incisuras parvas, apicibus lobulorum emarginato-

dentatis, incisuris omnibus leviter apertis; membrana minute punctata cum serie denticulorum minutorum intra marginem incisurarum primariarum secundiarumque et sinus; a latere visae elliptico-oblongae, apicibus tricuspidatis; a vertice visae angusto-oblongae, polis acutis. Long. 120–126 μ , Lat. 106–108 μ , Lat. isth. 11–16 μ .

Hab. **Hokkaido**: Toyokoro-konuma in Tokachi. **Hondo**: Kashima-cho, Nanko in Iwaki. (Pl. XXXV, fig. 10, Pl. XXXVI, fig. 8, Pl. XXXVII, fig. 4)

Distr. Japan, Kuriles, Siberia, China, whole Europe, Greenland, N.America, Brazil, New Zealand.

var. **glabra** NORDST. in WEST Monogr. Brit. Desm. 2, 93, 1905; STRÖM Naturw. Unters. Sarek-Geb. schwed.-Lapp. 3, 472, 1923; KRIEGER Krypt. Fl. XIII, Abt. 2, 89, 1939; IRÉNÉE-MARIE Nat. Canad. 76, 24, 1949.

Cellulae serie denticulorum nullae. Long. 123 μ , Lat. 98 μ , Lat. isth. 16.8 μ .

Hab. **Hondo**: Kanashôzu in Ise. (New to Asia) (Pl. XXXV, fig. 11)

Distr. British Isles, N. Russia, N. America, Brazil.

Micrasterias Murrayi W. & G. S. WEST in Journ. Linn. Soc. Bot. 35, 538, 1903; Monogr. Brit. Desm. 2, 93, 1905; GRÖNBLAD Act. Soc. Faun. Flor. Fenn. 49, 23, 1921; DICK Bot. Arch. 3, 224, 1923.

Cellulae mediocres, circulares, circiter tam longae quam latae, profundissime constrictae, sinu mediocriter aperto in vertice acutangulo; semicellulae late semicirculares, profunde 5-lobatae, incisuris inter lobos mediocriter apertis interdum subradialibus, lobo polari in parte inferiore elongato-cuneato cum lateribus subparallelis, in parte superiori dilatato, apice retuso-emarginato cum angulis apicalibus emarginato-dentatis, utrobique denticulo minuto ad angulis apicalibus intra marginem apicalem lobi polaris, lobis lateralibus aequalibus, in lobulis aequalibus 4 divis. lobulis emarginato-dentatis, incisuris inter lobulos acute apertis, incisura mediana duplo-longiore quam incisura secunda; membrana cum serie denticulorum minutorum intra margines incisurarum et sinus. Long. et Lat. 120 μ , Lat. isth. 15 μ .

Hab. **Hondo**: Akaiyachi in Iwashiro. (New to Asia) (Pl. XXXVI, fig. 13)

Distr. British Isles, Germany, Finland.

Micrasterias denticulata BRÉB. in RALFS Brit. Desm. 70, 1848; WEST Monogr. Brit. Desm. 2, 105, 1905; MIGULA Krypt. Fl. 2, 505, 1907; BERGE Ark. Bot. 15, 67, 1918; SMITH Wisc. Bull. 57, 45, 1924; FUJISAWA Journ. Jap. Bot. 10, 443, 1934; OKADA Journ. Imp. Fish. Inst. 30, 159, 1934; KRIEGER Krypt. Fl. XIII, Abt. 939; OKADA Mem. Fac. Fish. Kago-shima Univ. 2, 111, 1952.

Cellulae magnae, late ellipticae, paullo longiores quam latiores, profundissime constrictae, sinu angusto-lineari; semicellulae semicirculares vel

semiellipticae, 5-lobatae, incisuris profundis et angusto-linearibus in vertice subampliatis, lobo polari anguste cuneato cum marginibus inferioribus subparallelis et marginibus superioribus leviter divergentibus, apice truncato et retuso in medio, incisura profunde et late aperta ad extremum acutanguli, angulis apicalibus rotundis, lobis lateralibus aequalibus et cuneatis, in lobulis aequalibus 4 divisus, incisura primaria mediana multo profundior et duplo longior quam in incisuras duas parvas, lobulis exterius retusis vel emarginatis nonnumquam cum minutis incisuris; membrana punctata; a latere visae angusto-pyramidatae cum apice rectangulari, lateribus cum acutis protuberantiis ad basim utrobique; a vertice visae angusto-ellipticae, polis acutis, conicis, lateribus cum protuberantiis tribus parvis in medio utrobique. Long. $240\ \mu$, Lat. $200\ \mu$, Lat. isth. $29\ \mu$.

Hab. **Hokkaido**: Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Ônuma of Mt. Hachimantai in Rikuchû; Chûkawa-ike in Uzen; Myojin-ike of Kamikôchi, Ina (FUJISAWA), Mt. Kirigamine (FUJISAWA, USHIYAMA) in Shinano; Tamaru in Ise. **Shikoku**: Yodo-mura in Iyo. (Pl. XXXIV, fig. 6)

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

var. **angulosa** (HANTZSCH) W. & G. S. WEST in Trans. Roy. Irish Acad. **32**, 30, 1902; Monogr. Brit. Desm. **2**, 107, 1905; OKADA Journ. Imp. Fish. Inst. **30**, 159, 1934; l. c. **33**, 115, 1939; KRIEGER Krypt. Fl. XIII, Abt. **2**, 107, 1939; HIRANO Act. Phytotax. Geobot. **12**, 73, 1943. — *Micrasterias angulosa* HANTZSCH in OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 114, 1952.

Semicellulae late subovatae, partibus latissimis ad basim, marginibus inferioribus leviter divergentibus, lobis lateralibus aequalibus, in lobulis aequalibus 4 divisus, apicibus in lobulos truncatis et leviter emarginatis (non incisus). Long. $218-258\ \mu$, Lat. $173-210\ \mu$, Lat. isth. $28-34\ \mu$.

Hab. **Hondo**: Hakuryu-ko in Uzen; Ozegahara in Kôzuke; Daimon-pass, Mt. Kirigamine, Happo-ridge in Shinano; Kanashôzu in Ise: Mt. Hira in Oomi; Takaraga-ike, Koike in Yamashiro. **Kiushiu**: Bôgatsuru of Mt. Kuju in Bungo. (Pl. XXXIV, fig. 7)

Distr. Japan, Kuriles, whole Europe, Greenland, N. America, New Zealand, S. Africa.

var. **angusto-sinuata** GAY in WEST Monogr. Brit. Desm. **2**, 108, 1905; OKADA Journ. Imp. Fish. Inst. **30**, 159, 1934; HIRANO Act. Phytotax. Geobot. **12**, 74, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 113, 1952.

Var. incisuris inter lobos non profundioribus, apice lobi polaris profunde retuso ad medium (non inciso). Long. $232-288\ \mu$, Lat. $208-230\ \mu$, Lat. isth. $31-38\ \mu$.

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Ônuma of Mt. Hachimantai

in Rikuchû; Koke-numa in Ugo; Nogiwano-kwannon-ike in Iwashiro; Oze, Mt. Akagi in Kôzuke; Kôridonono-ike in Echigo; Mizoroga-ike in Yamashiro. **Kiushiu**: Mt. Ôhatayama of Mt. Kirishima in Hiuga. (Pl. XXXIV, fig. 8)

Distr. Japan, Kuriles, British Isles, France.

var. **notata** NORDST. in K. Sv. Vet. Akad. Handl. **22**, 29, 1888; WEST Monogr. Brit. Desm. **2**, 108, 1905; KAISER Krypt. Forsch. **1**, 435, 1926; KRIEGER Arch. Hydrobiol. suppl. **11**, 217, 1932; OKADA Journ. Imp. Fish. Inst. **30**, 160, 1934; FUJISAWA Hakubutu **34**, 15, 1936.

Var. *incisuris apicalibus lobi polaris nonnihil variabilis, caviformibus cum mucro vel denticulo minuto in parte superiori et prope apicem incisurae apicalis utrobique, marginibus lobulis irregulariter emarginatis et divisis*. Long. 185-288 μ , Lat. 174-256 μ , Lat. isth. 22-31 μ .

Hab. **Hokkaido**; Nikuru-numa in Kitami; Horomui in Ishikari. **Hondo**: Mt. Komagatake, Hirumo-numa in Ugo; Ôishita, Hakuryu-ko in Uzen; Ina (FUJISAWA) in Shinano; Jodo-ike in Ise; Fuse-ike in Oomi; Shakuhashi-ike in Yamashiro. **Kiushiu**: Hirabaru of Yabakei in Bunzen; Ahira in Ôsumi. (Pl. XXXIV, fig. 16)

Distr. Japan, Sumatra, Europe, New Zealand.

Micrasterias Thomasiana ARCH. in WEST Monogr. Brit. Desm. **2**, 110, 1905; ALLORGE Rev. Alg. **5**, 352, 1930; OKADA Journ. Imp. Fish. Inst. **33**, 115, 1939; KRIEGER in Krypt. Fl. XIII, Abt. **2**, 109, 1939; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 116, 1952.

Cellulae magnae, late ellipticae, paullo longiores quam latae, profundissime constrictae, sinu angusto-lineari in vertice ampliato; semicellulae 5-lobatae, incisuris inter lobos profundis et angusto-lineari in parte exteriori subaperto, lobo polari elongato-cuneato cum lateribus concavis, dilatato versus apicem, apice emarginato retuso cum incisura mediana profunda et aperta, angulis apicalibus emarginatis, angulis incisuris medianis subacutis, lobis lateralibus inaequalibus (superioribus majoribus), lobis lateralibus superioribus in lobulis aequalibus 4 divisis, lobis lateralibus inferioribus in lobulis subaequalibus 4 divisis, lobulis quoque in sublobulis aequalibus subdivisis, lobulis inferioribus interdum non subdivisis, incisuris inter sublobulos subapertis, apicibus in lobulis et sublobulis lobi lateralis emarginato-bidentatis; membrana cum projectionibus tribus in serie transversa trans basim semicellularum (projectionibus singulis parvis conicis medianis supra isthmum et projectionibus magnis prominentibus supra sinum interiorem utrobique et sursum in partem exteriorem semicellularum directis), cum dentibus magnis exterius directis intra basim lobuli lateralis uniuscujusque et processu brevi coniciforme in parte media loborum lateralium, processibus et dentibus omnibus

radialiter instructis; a vertice visae fusiformes cum polis acutis, lateribus in medio utrobique cum projectionibus tribus. Long. 206–256 μ , Lat. 168–210 μ , Lat. isth. 21.5–28 μ .

Hab. **Hokkaido**: Nikuru-numa, Shimoyûbetsu in Kitami; Kiritappu in Kushiro; Shizukari Ô-numa (OKADA) in Oshima. **Hondo**: Hakuryu-ko in Uzen; Ôniu-ike on Mt. Norikura in Etchû; Mt. Kirigamine (FUJISAWA) in Shinano; Kotsutsumi-nishi-ike in Mikawa. **Shikoku**: Yamada in Tosa. (Pl. XXXV, fig. 8)

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

var. **javanica** GUTW. in BERNARD Dep. agr. Indes Néerl. 138, 1908.

Var. *semicellulis* cum projectionibus bidentatis exterius curvatis intra basim lobuli lateralis uniuscujusque; cum processibus brevibus utrobique intra marginem incisionis apicalis lobi polaris; membrana glabra (non granulis vel dentibus). Long. 196–215 μ , Lat. 154–168 μ , Lat. isth. 22–26 μ .

Hab. **Hondo**: Ojiroi in Iwaki; Kotsutsumi-nishi-ike in Mikawa. (Pl. XXXV, fig. 4)

Distr. Java.

Micrasterias rotata (GREV.) RALFS in Brit. Desm. 71, 1848; ROY & BISSET Journ. Bot. 24, 193, 1883; WEST Monogr. Brit. Desm. 2, 102, 1905; MIGULA Krypt. Fl. 2, 507, 1907; KAWAMURA Freshw. Biol. 1, 99, 1918; SCHULZ Bot. Arch. 2, 128, 149, 1922; DICK l.c. 3, 224, 1923; OKADA Journ. Imp. Fish. Inst. 30, 161, 1934; KRIEGER Krypt. Fl. XIII, Abt. 2, 100, 1939; PRESCOTT & SCOTT Pap. Mich. Acad. Sci. 28, 78, 1942; HIRANO Act. Phytotax. Geobot. 12, 75, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. 2, 109, 1952.

Cellulae magnae, late ellipticae, paullo longiores quam latiores, profundissime constrictae, sinu in exteriore leviter aperto in medio et fundo angustolineari; semicellulae 5-lobatae, incisuris inter lobos profundis et sublinearibus; lobo polari in parte inferiore quadrato cum lateribus parallelis, partibus superioribus gradatim dilatatis versus apicem, apice retuso in medio acuminato, angulis apicalibus leviter productis et bidentatis; lobis lateralibus inaequalibus (superioribus majoribus), lobis lateralibus superioribus in lobulis aequalibus 4 divisis, incisura primaria mediana profundiore et incisuris parvis duobus, lobis lateralibus inferioribus in lobulis aequalibus 2 divisis, lobulis ulterius subbilobulis subdivisis, apicibus sublobulorum emarginatis et bidentatis; membrana delicate punctata; a vertice visae anguste elliptico-rhomboides. Long. 256–288 μ , Lat. 192–258 μ , Lat. isth. 31–40 μ .

Hab. **Hokkaido**: Chôbushi-numa in Nemuro; Kiritappu in Kushiro. **Hondo**: Mt. Hakkoda in Mutsu; Naga-numa of Mt. Hachimantai in Rikuchû, Kokenuma in Ugo; Oze-numa in Kôzuke; Inago of Kitamaki-mura in Shinano;

Kotsutsumi-nishi-ike in Mikawa. (Pl. XXXV, fig. 1)

Distr. Japan, Kuriles, Siberia, China, Thailand, Malay, whole Europe, U. S. A., Brazil.

Micrasterias Sol (EHRENB.) KÜTZ. in Spec. Alg. 171, 1849; WEST Monogr. Brit. Desm. 2, 95, 1905; KRIEGER Krypt. Fl. XIII, Abt. 2, 93, 1939; YAMAGUTI Rep. Limn. Surv. Kwant. Manch. 493, 1940; OKADA Mem. Fac. Fish. Kagoshima Univ. 2, 122, 1952.—*Micrasterias radiosa* RALFS in Brit. Desm. 72, 1848; WOLLE Desm. U. S. 109, 1884; SMITH Wisc. Bull. 57, 45, 1924.

Cellulae mediocres, paene circulares, profundissime constrictae, sinu angusto-lineari vel leviter aperto; semicellulae profunde 5-lobatae, incisuris inter lobos profundis et leviter apertis, lobo polari in parte inferiore angusto et elongato cum lateribus subparallelis, ad apicem dilatato, apice late emarginato in medio acuminato cum denticulo a margine apicale ad angulos apicales utrobique, angulis apicalibus bifido-dentatis, lobis lateralibus inaequalibus (superioribus majoribus), lobis lateralibus inferioribus in lobulis aequalibus 4 divisus, incisura mediana profundiore, lobis lateralibus superioribus bilobulatis, lobulis ulterius binis divisus (itaque 8 sublobulis aequalibus), lobulis et sublobulis bifurcatis; a latere visae lineari-oblongae, gradatim attenuatae versus apicem; a vertice visae lineari-fusiformes cum polis acutis; membrana subtiliter punctata. Long. 140–146 μ , Lat. 118–120 μ , Lat. isth. 14–15 μ .

Hab. **Hondo**: Shakuhachi-ike in Yamashiro. (New to Asia) (Pl. XXXVI, fig. 7)

Distr. Manchuria, whole Europe, N. America, Brazil.

var. **ornata** NORDST. in WEST Monogr. Brit. Desm. 2, 97, 1905; HIGASHI in OKAMURA's Nippon Sorui Meii 282, 1916; BERGE Ark. Bot. 19, 26, 1925; FUJISAWA Hakubutu 34, 14, 1936; KRIEGER Krypt. Fl. XIII, Abt 2, 96, 1939; HIRANO Act. Phytotax. Geobot. 12, 76, 1943, OKADA Mem. Fac. Fish. Kagoshima Univ. 2, 123, 1952.

Var. differt a forma typica cellulis cum serie denticulorum minorum intra margines incisurarum primariorum secundarumque et sinus. Long. 115–160 μ , Lat. 108–138 μ , Lat. isth. 14–21 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Shimoyûbetsu, Sarufutsu in Kitami; Shikaribetsu-wopputo in Tokachi; Tôasa-numa, Tomakomai in Iburi; Shizukari in Oshima. **Hondo**: Ogata in Ugo; Ôishita, Chûkawa-ike in Uzen; Nogiwanokwannon-ike in Iwashiro; Bagyu-numa in Iwaki; Oze in Kôzuke; Tanukinuma in Suruga; Kizaki in Shinano; Ishigaki-ike in Ise; Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. (Pl. XXXV, fig. 12)

Distr. Japan, British Isles, Germany, U. S. A., Panama, Brazil.

Micrasterias apiculata (EHRENB.) MENEGH. in RALFS Brit. Desm. 209, 1848; ROY & BISSET Journ. Bot. **24**, 193, 1886; WEST Monogr. Brit. Desm. **2**, 97, 1905, MIGULA Krypt. Fl. **2**, 506, 1907; HIGASHI in OKAMURA's Nippon Sorui Meii 283, 1916; SMITH Wisc. Bull. **57**, 47, 1924; HOMFELD Pflanzenf. **12**, 33, 1929; KRIEGER Krypt. Fl. XIII, Abt. **2**, 78, 1939; HIRANO Act. Phytotax. Geobot. **12**, 72, 1943; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 118, 1952.

Cellulae magnae, circiter $1\frac{1}{2}$ longiores quam latiores, profundissime constrictae, sinu angusto-lineari in parte exteriori leviter apertis; semicellulae quinquelobatae, incisuris inter lobos mediocriter profundis et apertis, lobo polari in parte inferiori cum lateribus subparallelis ad apicem gradatim divergentibus, apice retuso-emarginato cum spinis binis intra marginem ad medium utrobique, angulis apicalibus trispinatis, spina exteriori incurvata, lobis lateralibus bis divisis, itaque 4-lobulatis, incisuris inter lobulos profundis et apertis, incisura primariis profundiore, lobulis emarginatis cum apicibus profunde bifurcatis, angulis in spinam curvam productis; membrana cum multis dentibus irregularibus, spinis radialiter et exterius directis; a vertice visae rhomboido-ellipticae cum polis acutis. Long. 187–216 μ , Lat. 160–176 μ , Lat. isth. 34–42 μ .

Hab. **Hokkaido**: Toyokoro in Tokachi. **Hondo**: Aka-numa in Ugo; Akai in Iwashiro; Ozegahara in Kôzuke; Inago of Kitamaki-mura, Kizaki, Suwa (OKADA), Ina (FUJISAWA) in Shinano. (Pl. XXXVII, fig. 11, 13)

Distr. Japan, Formosa, Siberia, Burma, India, whole Europe.

Micrasterias foliacea BAIL. in BERNARD Dep. agr. Indes. Néerl. 133, 1908; SMITH Wisc. Bull. **57**, 54, 1924; TAYLOR Pap. Mich. Acad. Sci. **20**, 213, 1935; OKADA Bot. Mag. **50**, 81, 1936; FUJISAWA Hakubutu **34**, 14, 1936; OKADA Inkwa 151, 1939; KRIEGER Krypt. Fl. XIII, Abt. **2**, 76, 1939; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 131, 1952.

Cellulae parvae, paene rectangulares, circiter tam longae quam latae, profunde constrictae, sinu angusto-lineari in capite subampliato; semicellulae subrectangulares, lateribus paene parallelis, quinquelobatae, incisuris infra lobos polares profundis et linearibus in vertice mediocriter apertis, lobo polari subhexagono, apice in medio cum latissimis subrectangularibus excavationibus, angulis lateralibus lobi polaris acutis, angulis apicalibus lobi polaris acutis et cum spinis acute validis leviter incurvatis intra marginem apicalem utrobique, lobis lateralibus sublobulis divisis, incisuris inter lobulos mediocriter profundis, lobulis inaequalibus (superioribus majoribus), lobulis superioribus divergentibus, lobulis inferioribus horizontalibus, in lobulis ulterius inaequalibus bis divisis, apice lobuli lateralis emarginato et angulo acuto; a vertice visae angusto-fusiformes, polis acutis, lateribus in medio utrobique cum latis inflationibus; membrana glabra. Long. 73–78 μ , Lat. 67–70 μ , Lat. isth. 14 μ .

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Chûkawa-ike in Uzen; Ishigaki-ike in Ise; Shinohara-ike, Fuse-ike in Oomi; Mizoroga-ike in Yamashiro. **Kiûshiu**: Ahira in Ôsumi. (Pl. XXXVII, fig. 2)

Distr. Japan, China, Burma, Ceylon, N. America, Africa.

Subgen. **Atomocystis** (TURNER) HIRANO, stat. nov.

Micrasterias sect. *Atomocystis* TURNER in K. Sv. Vet. Akad. Handl. 25, 98, 1893.

Semicellulae tri- vel 5-lobatae, lobis polaribus et lateralibus cum processibus denticulatis cum apice spinato.

- 1a. Processibus glabris..... Sect. **Longicornes**
1b. Processibus serratis vel denticulatis..... Sect. **Serratae**

Sect. **Longicornes** OKADA

Micrasterias sect. *Longicornes* OKADA in Mem. Fac. Fish. Kagoshima Univ. 2, 124, 1952.

Semicellulae 3-lobatae, lobis polaribus et lateralibus in processus longos glabros productis, apicibus processuum spinatis.

Species unica..... **M. alata**

Micrasterias alata WALL. in LAGERHEIM Ofvers. K. Vet. Akad. Förh. 231, 1885; KRIEGER Arch. Hydrobiol. suppl. 11, 217, 1932; Krypt. Fl. XIII, Abt. 2, 61, 1939. — forma *depressa* TURNER in K. Sv. Vet. Akad. Handl. 25, 93, 1893; HIGASHI Journ. Jap. Bot. 8, 428, 1938; OKADA Inkwa. 157, 1939; Mem. Fac. Fish. Kagoshima Univ. 2, 125, 1952.

Cellulae modicae, ellipticae vel hexagonales, paulo longiores quam latiores, profundissime constrictae, sinu aperto acutangulo ad verticem angusto-lineari; semicellulae semiellipticae vel trapeziformes, profunde trilobatae, incisuris inter lobos verticales et profundissime subangusto-linearibus, lobo polari in parte inferiori elongato et cylindrico cum lateribus parallelis, partibus superioribus dilatatis, angulis apicalibus in processus longos angustos furcatos subdiver-genter productis, apice late retuso, lobis lateralibus trilobulatis, lobulis aequalibus et radialibus sursum angustatis cum apicibus profunde bifurcatis, inter lobulos profunde apertis, in parte basis lobulis superioribus versum primos directis, et in parte superiori divergentibus; a vertice visae subrhomboides cum polis productis; a latere visae ovato-lanceolatae, apice producto. Long. 168–179 μ , Lat. 154–156 μ , Lat. isth. 17–18 μ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike, Jôdo-ike in Ise; Shinohara-ike, Fuse-ike in Oomi, Ogurano-ike (OKADA, HIGASHI) in Yamashiro; Banryu-ko (HIGASHI) in Iwami. (Pl. XXXVII, fig. 3)

Distr. Japan, India, Java, Cuba.

Sect. **Serratae** OKADA

Micrasterias sect. *Serratae* OKADA in Mem. Fac. Fish. Kagoshima Univ. **2**, 125, 1952.—
sect. *Corniculatae* OKADA l. c. **2**, 127, 1952.

Semicellulae 3-lobatae, lobis polaribus in parte inferiore cylindricis, parte superiore expansis et in processos productis, cum processibus apicalibus suberectibus productis, lobis lateralibus horizontalibus symmetrice vel asymmetrice dispositis, marginibus denticulatis et seriebus denticulorum intra marginem lobi lateralis et polorum.

- 1a. Lobo polari sine processibus apicalibus..... **M. tropica** var. **polonica**
- 1b. Lobo polari cum processibus apicalibus ordinato..... **M. mahabuleshwarensis**
- 2a. Lobo laterali cum lobulis duobus ordinato.
 - 3a. Lobo polari cum processibus apicalibus duobus ordinato. f. **typica**
 - 3b. Lobo polari cum processibus apicalibus singulis ordinato..var. **asymmetricum**
- 2b. Lobo laterali cum lobulis tribus ordinato var. **Wallichii**

Micrasterias tropica NORDST. var. **polonica** RACIB. in GRÖNBLAD Act. Soc. Faun. Flor. Fenn. **55**, 7, 1924; OKADA Bot. Mag. **50**, 82, 1936; KRIEGER Krypt. Fl. XIII, Abt. **2**, 60, 1939; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 126, 1952.

Var. lobis lateralibus divergentibus, marginibus inferioribus cum denticulis validis 2-3 ad basim lobum lateralium; semicellulae cum denticulis tribus in medio supra sinum. Long. 118-120 μ , Lat. 99-101 μ , Lat. isth. 17-19.6 μ .

Hab. **Hondo**: Ô-numa in Mikawa: Fuse-ike in Oomi, Ogurano-ike (OKADA, HIGASHI) in Yamashiro. (Pl. XXXVI, fig. 6)

Micrasterias mahabuleshwarensis HOBSON in WEST Monogr. Brit. Desm. **2**, 121, 1905; MIGULA Krypt. Fl. **2**, 508, 1907; KRIEGER Krypt. Fl. XIII, Abt. **2**, 49, 1939; OKADA Mem. Fac. Fish. Kagoshima Univ. **2**, 127, 1952; HIRANO Act. Phytotax. Geobot. **15**, 144, 1954.

Cellulae magnae, circiter 1 $\frac{1}{2}$ longiores quam latae, profunde constrictae, sinu aperto acutangulo; semicellulae profunde 3-lobatae, lobo polari subquadrato in parte inferiori, alte dilatato, angulis apicalibus in processos longos attenuatos denticulatos divergente directos productis, apicibus processuum truncatis et acute trispinatis, processibus duobus brevibus margine denticulatis asymmetrice ad apicem projectis ornatis, uno in fronte et altero ad basim processuum apicalium, apicibus semicellularum paene rectis, aliquantum convexis vel concavis. generaliter granulis acutis nonnullis intra marginem ordinatis, lobis lateralibus profunde bilobulatis, lobulis aequalibus attenuatis versus apicem, in margine denticulatis, et apicibus acute trispinatis, lobulis superioribus divergentibus, lobulis inferioribus subhorizontalibus, incisuris inter lobos polares et laterales plus latioribus et apertioribus quam in

incisuris inter lobulos laterales; semicellulae cum denticulato-vel granulato-protuberantiis parvis supra isthmum ornata, serie denticulorum minutorum intra marginem lateralem lobum polarium et lateralium a protuberantia basis ad apicis extremitatem loborum ordinatae; a latere visae anguste ovato-oblongae, lateribus ad basim utrobique cum protuberantiis et apicibus cum processibus asymmetricis quaternis ornatis; a vertice visae rhomboido-fusiformes, polis attenuatis tridenticulatis, lateribus utrobique cum granulato-vel denticulato-protuberantiis parvis ornatis. Long. 132-163 μ , Lat. 118-142 μ , Lat. isth. 16.8-21.5 μ .

Hab. **Hondo**: Chûkawa-ike in Uzen; Ojiroi in Iwaki; Shinohara-ike, Lake Biwa in Oomi. (Pl. XXXVI, fig. 12)

Distr. Japan, Thailand, Burma, India, Ceylon, Java, Europe, U. S. A., Australia, British Guiana, Paraguay, E. Africa.

var. **asymmetrica** HIRANO in Act. Phytotax. Geobot. 14, 69, 1951.

Var. lobis polaribus cum processibus apicalibus singulis asymmetricice contra aliam semicellulam ordinatis. Long. 142-151 μ , Lat. 120-124 μ , Lat. isth. 21-22 μ .

Hab. **Hondo**: Kotsutsumi-nishi-ike in Mikawa. (Pl. XXXVI, fig. 1)

Distr. Japan.

var. **Wallichii** (GRUN.) W. & G. S. WEST in Monogr. Brit. Desm. 2, 122, 1905; MIGULA Krypt. Fl. 2, 508, 1907; HOMFELD Pflanzenf. 12, 35, 1929; KRIEGER Krypt. Fl. XIII, Abt. 2, 54, 1939; OKADA Mem. Fac. Fish. Kagoshima Univ. 2, 129, 1952; HIRANO Act. Phytotax. Geobot. 15, 144, 1954.

Var. lobulis lateralibus superioribus bilobulatis, incisuris inter lobulos profundis et apertis, semicellulae cum lobulis lateralibus tribus (inferioribus leviter majoribus). Long. 150-160 μ , Lat. 125-146 μ , Lat. isth. 17-23 μ .

Hab. **Hondo**: Ônuma in Mikawa; Lake Biwa in Oomi. **Shikoku**: Yamauchimura in Sanuki. (Pl. XXXVI, fig. 2)

Distr. Japan, India, Banka, Samoa, Europe.

Gen. **Staurostrum** MEYEN

in RALFS Brit. Desm. 119, 1848; RABENHORST Flor. Europ. Alg. III, 196, 1868; HANS GIRG Prodr. Alg. Böhm. 210, 1888; WEST Monogr. Brit. Desm. 4, 118, 1911; SMITH Wisc. Bull. 57, 62, 1924; WEST & FRITSCH Treat. Brit. Alg. 281, 1927; PRINTZ in ENGL. Pflanzenf. 3, 357, 1927; SMITH Freshw. Alg. U. S. 583, 1933.

Cellulae summe variabiles, generaliter longae quam latae sine spinis vel processibus, constrictione mediana generaliter profunda aliquando leva, sinu

aperto acutangulo aliquando angusto-lineari; semicellulae variabiles, subcirculares, subtriangulares, campanulatae, trapeziformes, hexagonales vel variae formes, angulis saepe in processus longos varios productis, apicibus processuum spinatis vel glabris, processibus generaliter in planis singulis sed aliquando in seriebus duobus planibus transversalibus ordinatis; a vertice visae communiter tri vel penta-angulares, raro biradiatae; membrana glabra, punctata, scrobiculata, granulata vel spinata aliquando emarginato-vel spiniverrucosa; chromatophoris generaliter axialibus simplicibus cum pyrenoidibus singulis vel nonnullis, in paucis speciebus parietalibus; zygosporae globosae, angulares vel cum verrucis obtusis, generaliter spinis simplicibus vel bifurcatis ad verticem, et omnes saepe ad elevationes mamillatas vel conicas dispositae.

- 1a. Cellulae ad angulos non productae in processus Subgen. **Prostaurationum**
- 1b. Cellulae ad angulos productae in processus Subgen. **Eustaurationum**

Subgen. **Prostaurationum** HIRANO subgen. nov.

Cellulae generaliter distincte et raro paulo constrictae, angulis non productis in processus; semicellulae semicirculares, ellipticae, fusiformes vel subtriangulares raro subcylindricae; membrana glabra, granulata vel spinata; chromatophoris axialibus vel parietalibus, pyrenoidibus singulis centralibus raro nonnullis in unaquaque semicellula.

- 1a. Cellulae subcylindricae, paulo constrictae, partibus superioribus semicellularum indistincte angulatis, parte inferiore cylindricis Sect. **Cylindriastrum**
- 1b. Cellulae profunde constrictae, non cylindricae, partibus superioribus semicellularum bene angulatis, in vertice visis 3-6-angulatae.
 - 2a. Cellulae glabrae vel punctatae vel granulatae sine spina vel verruca ad angulos.
 - 3a. Membrana glabra Sect. **Schaerichastrum**
 - 3b. Membrana granulata Sect. **Odontastrum**
 - 2b. Cellulae spina praeditae.
 - 3a. Spina solum ad angulos praedita.
 - 4a. Membrana glabra Sect. **Spinastrum**
 - 4b. Membrana granulata Sect. **Granuliformes**
 - 3b. Spina tota trans cellulam praedita Sect. **Raphidiastrum**
 - 2c. Cellulae verruca vel processa praeditae.
 - 3a. Cellulae verrucis ad angulos solum praeditae Sect. **aciculiformes**
 - 3b. Cellulae seriebus dorsalibus verrucarum praeditae Sect. **Rutidiastrum**
 - 3c. Cellulae seriebus dorsalibus processuum praeditae Sect. **stellatiformes**

Sect. **Cylindriastrum** TURNER emend. HIRANO.

Staurationum subgen. *Cylindriastrum* TURNER in K. Sv. Vet. Akad. Handl. **25**, 133, 1893.

Cellulae subcylindricae, paulo constrictae; membrana granulata vel verrucosa.

- 1a. Cellulae cum angulis apicalibus horizontaliter productis ordinatae... **St. capitulum**
 1b. Cellulae cum angulis apicalibus deflectentibus productis ordinatae... **St. pileolatum**

Staurationum capitulum BRÉB. in WEST Monogr. Brit. Desm. 4, 124, 1911.

Cellulae submediocres, circiter $1\frac{1}{2}$ – $1\frac{3}{8}$ longiores quam latae, modice constrictae, sinu acute aperto; semicellulae subcampanulatae, partibus basalibus inflatis, partibus superioribus dilatatis et divergentibus, angulis apicalibus rotundis et leviter productis, apicibus rectis vel leviter retusis, angulis basalibus rotundis; cum seriebus denticulorum concentricorum circa angulos apicales praeditis et cum seriebus duobus transversis denticulorum ad basim semicellularum; a vertice visae triangulares, lateribus paene rectis, angulis subacutis; a basi visae crenato-circulares, et crena unoquoque cum denticulis praedita. Long. $26.4\ \mu$, Lat. $22.4\ \mu$, Lat. isth. $14\ \mu$.

Hab. **Hondo**: Kanashôzu in Ise. (New to Asia) (Pl. XXXVII, fig. 25)

Distr. Europe, Greenland, Azores.

Staurationum pileolatum BRÉB. in WEST Monogr. Brit. Desm. 4, 127, 1911; HIRANO Jap. Journ. Bot. 14, 230, 1954.

Cellulae parvae, circiter $1\frac{1}{8}$ – $1\frac{4}{8}$ longiores quam latae, paullo constrictae, sinu aperto acutangolo; semicellulae subrectangulari-campanulatae, partibus basalibus latis cum seriebus annularibus verrucarum emarginatarum juxta et supra isthmum, in partibus superioribus dilatatis, marginibus lateralibus cum emarginato-verruca ad basim, retusis in medio, apicibus concavis, angulis apicalibus rotundato-conicis cum granulis minutis numerosis in seriebus concentricis ad angulos; a vertice visae parte basis semicellularum sunt circulares cum marginibus crenatis (circa 18–20) ornatis, a parte apicis triangulares, lateribus leviter concavis, angulis acute rotundis. Long. 33.6 – $38.7\ \mu$, Lat. 18.2 – $23.7\ \mu$, Lat. isth. 15.4 – $17\ \mu$.

Hab. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Mt. Kurikoma, Yatsumanako of Mt. Iwate in Rikuchu; Mt. Gassan, Sugigamine of Mt. Zawo in Uzen; Mt. Komagatake in Ugo; Mt. Azuma in Iwashiro; Senninike, Mt. Tateyama, Mt. Kaminotake, Tarobei-daira, Kurobegoro-daira in Etchû; Happo-ridge, Shirouma-ôike, Tengunohara, Kazafuki-ôike in Shinano. (Pl. XXXVII, fig. 5)

Distr. Japan, Europe, Brazil.

Sect. **Schaerichastrum** TURNER emend. HIRANO

Staurationum subgen. *schaerichastrum* TURNER in K. Sv. Vet. Akad. Handl. 25, 133, 1893.

Cellulae profunde constrictae, non subcylindricae, angulis non spina ordinatis sed raro cum mucro, membrana glabra vel punctata.

- 1a. Semicellulae ellipticae vel subellipticae, sinu acute aperto.
 - 2a. Angulis rotundis sine mucro.
 - 3a. Angulis non crassis.
 - 4a. Angulis bene rotundis.
 - 5a. Apice non elevato.
 - 6a. Apice convexo.
 - 7a. Semicellulae ellipticae..... **St. muticum**
 - 7b. Semicellulae subellipticae.
 - 8a. Marginibus ventralibus convexioribus quam marginibus dorsalibus **St. subgrande f. minor**
 - 8b. Marginibus dorsalibus convexioribus quam marginibus ventralibus **St. orbiculare. f. subangulata**
 - 6b. Apice recto **St. coarctatum**
 - 7a. Sinu acute aperto, semicellulae late longae, apice retuso f. **typica**
 - 7b. Sinu late aperto, semicellulae breves, apice recto vel paullo convexo..... var. **subcurtum**
 - 5b. Apice elevato **St. insigne**
 - 4b. Angulis subacutis **St. Bieneanum**
 - 3b. Angulis crassis **St. pachyrhynchum**
 - 4a. Apice concavo, angulis divergentibus f. **typica**
 - 4b. Apice convexo, angulis convergentibus..... var. **convergens**
 - 2b. Angulis rotundis cum mucro..... **St. brevispinum**
 - 3a. Cellulae 25-50 μ in longitudinem f. **typica**
 - 3b. Cellulae 22-23 μ in longitudinem..... var. **minima**
- 1b. Semicellulae semicirculares, subsemicirculares vel subtrapeziformes, sinu anguste lineari vel lineari-aperto.
 - 2a. Sinu angusto-lineari, angulis basalibus rotundis non productis, non crassatis.
 - 3a. Semicellulae semicirculares vel subsemicirculares vel trapeziformes, cellulae 16-65 μ in longitudinem.
 - 4a. Apice convexo aliquando recto **St. orbiculare**
 - 5a. Cellulae semper longae quam latae, 30-65 μ in longitudinem.
 - 6a. Semicellulae semicirculares f. **typica**
 - 6b. Semicellulae subtrapeziformes var. **hibernicum**
 - 6c. Semicellulae rotundo-subtriangulares..... var. **Ralfsii**
 - 5b. Cellulae tam longae quam latae, 22-27 μ in longitudinem; semicellulae depresso-semicirculares.
 - 6a. Semicellulae semicirculares, depressae..... var. **depressum**
 - 6b. Semicellulae subsemicirculares, perdepressae..... var. **Messikommeri**
 - 4b. Apice retuso, semicellulae trapeziformes **St. retusum** var. **boreale**
 - 3b. Semicellulae depresso-ovatae, cellulae 70-85 μ in longitudinem... **St. globosum**
 - 3c. Semicellulae semiellipticae, cellulae 90-120 μ in longitudinem **St. cosmarioides**
 - 2b. Sinu lineari-aperto, angulis basalibus subacutis et productis, leviter crassatis, cellulae 110-120 μ in longitudinem **St. Zahlbruckneri**
- 1c. Semicellulae subpyramidatae, sinu angusto-lineari..... **St. trihedrale**
- 1d. Semicellulae obverse triangulares vel subtriangulares, sinu late aperto.
 - 2a. Apice convexo..... **St. Clepsydra**

- 2b. Apice recto.
 - 3a. Marginibus lateralibus rectis.
 - 4a. Lateribus in vertice visis paene rectis..... var. **sibiricum**
 - 4b. Lateribus in vertice visis valide retusis..... **St. Bieneanum** var. **orientale**
 - 3b. Marginibus lateralibus leviter biundulatis, lateribus in vertice visis concavis..... **St. sibiricum** var. **occidentale**
- 1e. Semicellulae obtrapeziformes.
 - 2a. Angulis apicalibus non productis **St. tortum** var. **trigona**
 - 2b. Angulis apicalibus productis..... **St. subpygmaeum**

Staurostrum muticum BRÉB. in RALFS Brit. Desm. 125, 1848; MIGULA Krypt. Fl. 2, 526, 1907; WEST Monogr. Brit. Desm. 4, 133, 1911; SMITH Wisc. Bull. 57, 67, 1924; PRESCOTT Pap. Mich. Acad. Sci. 25, 93, 1940; HIRANO Jap. Journ. Bot. 14, 230, 1954.

Cellulae parvae, leviter tam longae quam latae, profunde constrictae, sinu aperto et acutangulo; semicellulae ellipticae, marginibus dorsalibus et ventralibus leviter convexis, apicibus nonnihil rectis in medio, angulis lateralibus bene rotundis; a vertice visae triangulares, lateribus concavis, angulis late rotundis; membrana glabra. Long. 26–34 μ , Lat. 23.7–31 μ , Lat. isth. 8.4–9.8 μ .

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro; Sarufutsu in Kitami; Horomui, Mt. Daisetsu in Ishikari; Yûfutsu, Tôasa-numa in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Kotsutsumi in Mutsu; Yatsumanako of Mt. Iwate in Rikuchu; Izu-numa, Kesho-numa, Kobuchi-numa in Rikuzen; Hakuryu-ko, Chûkawa-ike in Uzen; Akaiyachi, Numano-taira of Mt. Bandai, Nogiwano-kwannon-ike in Iwashiro; Bagyu-numa in Iwaki; Oze-numa in Kôzuke; Shimizu-daira of Mt. Nasu in Shimotsuke; Goda-numa in Shimofusa; Kagami-ike of Matsunoyama in Echigo; Inago of Kitamaki-mura, Happo-ridge, Tsuga-daira, Tashiro-ike of Kamikôchi, Okemi-ike, Kizaki in Shinano; Takashihara in Mikawa; Biwa-ike in Owari; Jôdo-ike in Ise; Nukigawa, Shinohara-ike, Fuse-ike, Lake Biwa in Oomi; Rokujizo in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Yabakei in Bunzen; Kôga-muta in Aso in Higo; Ahira in Ôsumi. (Pl. XXXVII, fig. 6)

Distr. Japan, Formosa, Siberia, Java, Europe, Spitzbergen, N. America, Australia, Hawaii.

Staurostrum subgrande BERGE var. **minor** SMITH in Wisc. Bull. 57, 67, 1924; OKADA Journ. Imp. Fish. Inst. 30, 189, 1934; ASAHINA's Inkwa. 183, 1939; HIRANO Jap. Journ. Bot. 14, 230, 1954.

Cellulae parvae et circiter dimidia pars formae typicae, cellulae leviter latiores. Long. 26.6–40 μ , Lat. 23–36 μ , Lat. isth. 8.4–11 μ .

Hab. **Hokkaido**: Chôboshi-numa in Nemuro; Kiritappu in Kushiro; Nikuru-numa in Kitami; Toyokoro in Tokachi; Nakano near Sapporo in Ishikari;

Konuma, Shizukari in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Akaiyachi in Iwashiro; Goda-numa in Shimofusa; Tanuki-numa in Suruga. (Pl. XXXVII, fig. 7, Pl. XXXVIII, fig. 9)

Distr. Japan, Kuriles, U. S. A.

Staurastrum coarctatum BRÉB. in West Monogr. Brit. Desm. 4, 139, 1911.

Cellulae parvae, leviter latiores quam longiores, profunde constrictae, sinu aperto acutangulo; semicellulae transverse oblongae vel subtriangulares, angulis lateralibus late rotundis et leviter divergentibus, marginibus lateralibus inferioribus convexis, apice leviter retuso in medio; a vertice visae triangulares, lateribus concavis, angulis bene rotundis. Long. 23.8–28 μ , Lat. 28–31 μ , Lat. isth. 6.5–8.6 μ .

Hab. **Hokkaido**: Toyokoro in Tokachi. **Hondo**: Ôishita in Uzen; Bagyu-numa in Iwaki; Okemi-ike in Shinano; Ishigaki-ike in Ise; Fuse-ike in Oomi. (New to Asia) (Pl. XXXVIII, fig. 19)

Distr. Europe.

var. **subcurtum** NORDST. in K. Sv. Vet. Akad. Handl. 22, 41, 1888; WEST Journ. Roy. Micr. Soc. 293, 1890; Monogr. Brit. Desm. 4, 139, 1911; KRIEGER Hedw. 70, 148, 1930.

Semicellulae subtriangulares, angulis lateralibus late rotundis et non divergentibus, sinu plus late aperto in vertice obtuso, isthmo leviter elongato. Long. 22.4–25.8 μ , Lat. 22.4–28.7 μ , Lat. isth. 5.5–8.6 μ .

Hab. **Hondo**: Moritake-ôtsutsumi in Ugo; Chûkawa-ike in Uzen; Izu-numa, Naga-numa, Kesho-numa in Rikuzen; Tanuki-numa in Suruga; Fuse-ike in Oomi. (New to Asia) (Pl. XXXVII, fig. 26)

Distr. Europe, New Zealand.

Staurastrum insigne LUND. in Nov. Act. Regn. Soc. Ups. ser. 3, VIII, 58, 1871; WEST Trans. Linn. Soc. Bot. 5, 261, 1896; MIGULA Krypt. Fl. 2, 524, 1907; STRÖM Naturw. Unters. Sarek.-Geb. 3, 492, 1923; CEDERGREN Ark. Bot. 25A, 75, 1933; CARTER Journ. Linn. Soc. Bot. 50, 170, 1935; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 3, 423, 1936.

Cellulae parvae, leviter longiores quam latae, modice constrictae, sinu late aperto paene rectangulari vel plus; semicellulae lobato-pyramidatae, in parte superiori semicirculares, in parte inferiori oblongae, marginibus lateralibus valide retusis in medio, trilobiformibus; a vertice visae pentagonae, lateribus concavis, angulis bene rotundis. Long. 19.6–30 μ , Lat. 16.8–22.4 μ , Lat. isth. 11–12.6 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Koke-numa in Ugo. (New to Japan) (Pl. XXXVII, fig. 20)

Distr. Siberia, Sweden, Canada.

Staurastrum Bieneanum RABENH. in ROY & BISSET Journ. Bot. **24**, 237, 1886; M'GULA Krypt. Fl. **2**, 525, 1907; WEST Monogr. Brit. Desm. **4**, 135, 1911; TAFT Ohio Journ. Sci. **45**, 202, 1945.

Cellulae submediocres, leviter latiores quam longiores, profunde constrictae, sinu aperto acutangulo; semicellulae subelliptico-rhomboides, marginis ventre convexiore quam dorso, apicibus convexis, angulis lateralibus subacutis; a vertice visae trigonae, lateribus leviter retusis in medio, angulis acute rotundis. Long. 30–31 μ , Lat. 36.4 μ , Lat. isth. 14 μ .

Hab. **Hondo**: Hakuryu-ko in Uzen; Daimon-pass in Shinano. (Pl. XXXVIII, fig. 5)

Distr. Japan, Siberia, Europe, Faeroes, Nova Zembla, N. America, New Zealand, Madagascar.

var. **orientale** W. & G. S. WEST in Bot. Tidskr. **24**, 178, 1901.

Cellulae minores quam in forma typica; semicellulae leviter obtriangulares, apice leviter convexo vel paene recto, sinu late aperto, non acuminato in verticem, marginibus lateralibus inferioribus leviter convexis vel paene rectis; in vertice visis lateribus valide retusis, angulis leviter productis et rotundis; membrana glabra. Long. 22.4 μ , Lat. 28 μ , Lat. isth. 6.5 μ .

Hab. **Hokkaido**: Shizukari in Oshima. (New to Japan) (Pl. XXXVIII, fig. 18)

Distr. Thailand.

Staurastrum pachyrhynchum NORDST. in Ofv. K. Vet. Akad. Forh. **32**, 1875; WEST Monogr. Brit. Desm. **4**, 151, 1911; KOSSINSKAYA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. **1**, 44, 1933; TAYLOR Pap. Mich. Acad. Sci. **20**, 195, 1935; PRESCOTT l. c. **25**, 93, 1940; WHEIDEN Nat. Mus. Canad. Bull. **97**, 108, 1947.

Cellulae parvae, paene tam longae quam latae vel leviter longiores, profunde constrictae, sinu aperto et subrectangulari vel acutangulo; semicellulae elliptico-subtriangulares, angulis lateralibus rotundis, marginibus dorsalibus truncatis et rectis vel leviter convexis, marginibus ventralibus leviter convexis; a vertice visae generaliter triangulares (aliquando 4–5-angulares), lateribus concavis, angulis rotundis; membrana glabra et valide incrassata ad angulos. Long. 25–31 μ , Lat. 28–34 μ , Lat. isth. 4.3–7 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Tomakomai, Yûfutsu, Tôasa-numa in Iburi; Shizukari in Oshima. **Hondo**: Hirumo-numa in Ugo; Ôishitano-junsai-tsutsumi in Uzen; Nogiwano-kwannon-ike, Akaiyachi in Iwashiro; Oze in Kôzuke; Kizaki in Shinano; Suhara-ike,

Kotsutsumi-nishi-ike in Mikawa; Jôdo-ike in Ise; Mizoroga-ike in Yamashiro. (Pl. XXXVII, fig. 21)

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

var. **convergens** RACIB. in Pamietn. Wydz. Akad. Um. Krakow 17, 26, 1889. (reprint)

Cellulae tam longae quam latae; semicellulae subellipticae, marginibus dorsalibus convexiores quam ventralibus, angulis lateralibus leviter curvatis deorsum; a vertice visae triangulares, lateribus leviter concavis, angulis leviter curvatis (ut in *St. cyrtocero*). Long. 29.4–30.8 μ , Lat. 28–30.8 μ , Lat. isth. 7.7–8.4 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. **Hondo**: Akai in Iwashiro; Mizoroga-ike in Yamashiro. (New to Asia) (Pl. XXXVII, fig. 22)

Distr. Europe.

Staurastrum brevispinum BRÉB. in RALFS Brit. Desm. 124, 1848; CUSHMAN Bull. Torrey Bot. Club 32, 226, 1905; MIGULA Krypt. Fl. 2, 534, 1907; WEST Monogr. Brit. Desm. 4, 145, 1911; KAISER Krypt. Forsch. 1, 227, 1919; SMITH Wisc. Bull. 57, 68, 1924; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 73, 207, 1928; ALLORGE Rev. Alg. 5, 364, 1930; KOSSINSKAJA Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 3, 433, 1936.

Cellulae parvae, circiter tam longae quam latae vel leviter latiores, profunde constrictae, sinu acute aperto; semicellulae oblongo-ellipticae, ventre convexiore quam dorso, angulis lateralibus rotundis cum uno mucro parvo et directis oblique et alte, apicibus generaliter convexis, raro leviter rectis; a vertice visae trigonae, lateribus concavis, angulis rotundis cum mucro parvo; membrana glabra. Long. 26–35 μ , Lat. 30–31 μ , Lat. isth. 10.8–11.5 μ .

Hab. **Hondo**: Nishi-numa in Ugo; Ashinota-ike in Shinano; Ô-numa in Mikawa. (New to Japan) (Pl. XXXVIII, fig. 7)

Distr. Siberia, India, whole Europe, Iceland, Greenland, Nova Zembla, N. & S. America, central Africa.

forma **minima** LÜTKEM. in MIGULA Krypt. Fl. 2, 534, 1907; WEST Monogr. Brit. Desm. 4, 147, 1911; DICK Mitt. Pfälz Ver. Pollichia 3, 137, 1930.

Cellulae minores quam in forma typica. Long. 22.4 μ , Lat. 23.8 μ , Lat. isth. 8.4 μ .

Hab. **Hondo**: Takashihara in Mikawa. (New to Asia) (Pl. XXXVIII, fig. 8)

Distr. Europe.

Staurastrum orbiculare RALFS in WEST Monogr. Brit. Desm. 4, 155, 1911; SCHULZ Bot. Arch. 2, 142, 1922; HOMFELD Pflanzenf. 12, 79, 1929; DICK Mitt. Pfälz Ver. Pollichia 3, 139, 1930.

Cellulae mediocres, leviter longiores quam latiores, profunde constrictae,

sinu angusto-lineari extremo leviter dilatato; semicellulae subsemicirculares, angulis basalibus rotundis; a vertice visae triangulares, lateribus leviter concavis, angulis late rotundis; membrana punctata. Long. 33.6-44.8 μ , Lat. 28-39 μ , Lat. isth. 7-11 μ .

Hab. **Hondo**: Ôishita, Chûkawa-ike in Uzen; Ojiroi in Iwaki. (New to Asia) (Pl. XXXVII, fig. 15)

Distr. Europe, N. America.

forma **subangulata** MESSIK. in Viertelj. Naturf. Ges. Zurich 72, 347, 1927.

Forma semicellulis conico-rotundatis, angulis basalibus subangulatis, sinu acute aperto. Long. 39 μ , Lat. 29.4 μ , Lat. isth. 12.6 μ .

Hab. **Hondo**: Jôdo-ike in Ise. (New to Asia) (Pl. XXXVII, fig. 16)

Distr. Switzerland.

var. **hibernicum** W. & G. S. WEST in Monogr. Brit. Desm. 4, 156, 1911; ALLORGE Rev. Alg. 5, 366, 1930; PRESCOTT Pap. Mich. Acad. Sci. 25, 93, 1940.

Cellulae maiores, apicibus semicellularum late truncatis, angulis basalibus subrotundatis. Long. 44.8 μ , Lat. 36.4 μ , Lat. isth. 11.2 μ .

Hab. **Hokkaido**: Kiritappu in Kushiro. (New to Asia) (Pl. XXXVIII, fig. 20)

Distr. Europe.

var. **Ralfsii** W. & G. S. WEST in Monogr. Brit. Desm. 4, 156, 1911; HYLANDER Conn. Bull. 42, 97, 1928.

Semicellulae triangulares, angulis basalibus bene rotundis, apice rotundato. Long. 32.3 μ , Lat. 28 μ , Lat. isth. 9.5 μ .

Hab. **Hondo**: Ushiku-numa in Hitachi. (New to Japan) (Pl. XXXVII, fig. 17)

Distr. India, Ceylon, whole Europe, Iceland, Spitzbergen, Greenland, Nova Zembla, Australia, U. S. A., S. America.

var. **depressum** ROY & BISSET in Journ. Bot. 24, 237, 1886; BERNARD Dep. agr. Indes. Néerl. 145, 1908; WEST Monogr. Brit. Desm. 4, 158, 1911, SCHULZ Bot. Arch. 2, 142, 1922; CARTER Journ. Linn. Soc. Bot. 46, 67, 1922; KRIEGER Hedw. 70, 145, 1930; ALLORGE Rev. Alg. 5, 365, 1930; PRESCOTT Pap. Mich. Acad. Sci. 25, 93, 1940.

Cellulae minores quam in forma typica, semicellulae depressae; membrana sparsim punctata. Long. 19.6-29.4 μ , Lat. 19.6-28 μ , Lat. isth. 7-8.4 μ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Kiritappu in Kushiro; Shimoyûbetsu in Kitami; Toyokoro-numa in Tokachi; Nakano near Sapporo, Horomui, Kamikoshi-ukishimahara, Hisago-numa of Mt. Daisetsu, Minenobu in Ishikari; Tôasa-numa, Tomakomai, Yûfutsu, Numanohata in Iburi; Shizukari in Oshima. **Hondo**: Mt. Hakkoda, Mt. Hachimantai, Komozuchi, Nagatai in Mutsu;

Koke-numa, Aka-numa, Kotomo-numa, Ogata, Nishi-numa, Mt. Kurikoma in Ugo; Hakuryu-ko, Mt. Azuma, Mt. Gassan, Ôishita, Chûkawa-ike, Hijiori-naga-numa in Uzen; Izu-numa, Kesho-numa in Rikuzen; Akai, Kagami-ishimura, Hôzawa-ike, Numano-taira of Mt. Bandai in Iwashiro; Bagyu-numa in Iwaki; Oze, Ômine-numa in Kôzuke; Goda-numa in Shimofusa; Mohara in Kamifusa; Mt. Naeba, Kurosawano-ike, Kôyano-ike of Mt. Myoko in Echigo; Shigakôgen, Happo-ridge, Tsuga-daira, Mt. Kazafuki in Shinano; Sennin-ike, Gakino-tanbo in Etchû; Takashihara, Ônuma in Mikawa; Tanuki-numa in Suruga; Biwa-ike in Owari; Toba in Ise; Nukigawa, Fuse-ike in Oomi; Shakuhashi-ike in Yamashiro; Ikejiri-ike in Tanba. **Shikoku**: Yamauchi-mura in Sanuki; Morimatsu in Iyo; Yamada in Tosa. **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda, Kagami-ike in Satsuma; Miyazaki in Hiuga. (Pl. XXXVII, fig. 18)

Distr. Japan, Formosa, Siberia, Manchuria, China, Thailand, Sumatra, U. S. A., Australia, New Zealand, New Caledonia, Madagascar.

var. **Messikommeri** HIRANO in Act. Phytotax. Geobot. **14**, 38, 1950. — *Staurastrum orbiculare* RALFS forma MESSIKOMMER in Viertelj. Naturf. Ges. Zurich **73**, 210, 1928.

Semicellulae perdepressae, subsemicirculares vel subfusiformes, sinu acuto paene lineari-aperto; in vertice visae valide retusae. Long. 21μ , Lat. 22μ , Lat. isth. 6.5μ .

Hab. **Hondo**: Ôishita in Uzen. (Pl. XXXVII, fig. 19)

Distr. Japan, Switzerland.

Staurastrum retusum TURNER var. **boreale** W. & G. S. WEST in Monogr. Brit. Desm. **4**, 160, 1911.

Cellulae parvae, semicellulae rotundiores, apicibus rectis vel leviter retusis, marginibus lateralibus convexis; membrana glabra. Long. $22-28\mu$, Lat. $22-28\mu$, Lat. isth. $7-8\mu$.

Hab. **Hokkaido**: Tomakomai in Iburi. **Hondo**: Mt. Komagatake in Ugo; Higusa-numa in Shimofusa; Matsubara-naiko in Oomi. (New to Asia) (Pl. XXXVII, fig. 27)

Distr. British Isles.

Staurastrum globosum ROY & BISSET in Journ. Bot. **24**, 237, 1886.

Cellulae mediocres, circiter $1\frac{1}{3}-1\frac{1}{2}$ plus longae quam latae, profunde constrictae, sinu angusto-lineari extrorsum valide aperto; semicellulae depressovatae, angulis basalibus bene rotundis, marginibus lateralibus convexis et convergentibus, angulis apicalibus late rotundis, apice convexo; a vertice visae trigonae, lateribus paene rectis, angulis late rotundis; membrana dense

punctata. Long. $70\ \mu$, Lat. $50.4\ \mu$, Lat. isth. $30.8\ \mu$.

Hab. **Hondo**: Inago of Kitamaki-mura in Shinano. (Pl. XXXVIII, fig. 24)
Distr. Japan.

Staurostrum cosmarioides NORDST. in WEST Monogr. Brit. Desm. 4, 161, 1911; BERGE Ark. Bot. 15, 44, 1918; TALYOR Pap. Mich. Acad. Sci. 20, 189, 1935.

Cellulae magnae, circiter $1\frac{1}{2}$ plo longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter ampliato; semicellulae semiellipticae, angulis basalibus rectangulari-rotundis, marginibus lateralibus inferioribus aliquando parallelis, apicibus paullo rectis; in vertice visae trigonae, lateribus leviter convexis, angulis late rotundis; membrana punctata. Long. $100\ \mu$, Lat. $70\ \mu$, Lat. isth. $34\ \mu$.

Hab. **Hondo**: Kanashôzu in Ise. (New to Asia) (Pl. XXXVIII, fig. 25)
Distr. N. America, Brazil.

Staurostrum Zahlbruckneri LÜTKEM. in Ann. k.k. Nat. Hist. Hofm. 15, 125, 1900.

Cellulae permagnae, late ellipticae, circiter $1\frac{1}{2}$ plus longae quam latae, profunde constrictae, sinu sublineari aperto et aliquantulum fusiformi ad apicem leviter ampliato; semicellulae semicirculares, angulis basalibus leviter productis et crassatis, oblique deorsum directis, marginibus lateralibus inferioribus subparallelis; a vertice visae triangulares, lateribus paene rectis, angulis rotundis sed retusis in medio; a basi visae angulis bilobulatis; membrana punctata, angulis crassatis. Long. $117-118\ \mu$, Lat. $99\ \mu$, Lat. isth. $36.4\ \mu$.

Hab. **Shikoku**: Yamada in Tosa. (New to Japan) (Pl. XXXVIII, fig. 23)
Distr. Central China.

Staurostrum trihedrale WOLLE in WEST Trans. Linn. Soc. Bot. 5, 260, 1896; BERGE Ark. Bot. 15, 44, 1918; PRESCOTT Trans. Amer. Micr. Soc. 61, 118, 1942; HIRANO Bot. Mag. 66, 208, 1953.

Cellulae submediocres, circiter $1\frac{1}{2}$ longiores quam latae, profunde constrictae, sinu angusto-lineari extremo ampliato; semicellulae triangulares, angulis basalibus bene rotundis, marginibus lateralibus leviter concavis, apicibus subtruncatis et leviter convexis; a vertice visae triangulares, lateribus paene rectis vel aliquando leviter concavis, angulis rotundis; membrana scrobiculata et prope scrobiculis elevata circularibus. Long. $38.7-44.8\ \mu$, Lat. $27-29.4\ \mu$, Lat. isth. $9.5-11.2\ \mu$.

Hab. **Hondo**: Kurosawano-ike of Mt. Myoko in Echigo; Gakino-tanbo, Mt. Eboshi in Etchû; Happo-ridge, Shirouma-kamino-tanbo, Mt. Kazafuki in Shinano. (Pl. XXXVIII, fig. 21)

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

Staurastrum trihedrale from Japanese Alps shows the intermediate form between the typical species and var. *rhomboideum*. The lateral margin of our form is retuse in its upper part and this does well coincide with the American form figured by W. & G. S. WEST but the apex of semicell is slightly broader than the American form and in vertical view the side is straight and this nature is coincides with var. *rhomboideum* while in the typical form of American species the side is concave.

Staurastrum Clepsydra NORDST. in WEST Monogr. Brit. Desm. 4, 152, 1911; HIRANO Bot. Mag. 66, 209, 1953. — *Staurastrum sibiricum* BORGE in KOSSINSKAJA in Act. Inst. Bot. Acad. Sci. URSS, Pl. Crypt. 3, 434, 1936.

Cellulae parvae, longiores quam latae, profunde constrictae, sinu late aperto et rectangulari; semicellulae obverse subtriangulares, marginibus lateralibus inferioribus paene rectis vel leviter convexis, marginibus lateralibus superioribus non apparentibus, gradatim continuis ad apices, apicibus semicellularum late convexis, angulis lateralibus obtuse rotundis; a vertice visae triangulares, lateribus paene rectis et leviter retusis in medio cum duobus denticulis exiguis in margine laterale, angulis rotundis; membrana glabra. Long. 30–31 μ , Lat. 28 μ , Lat. isth. 11 μ .

Hab. **Hondo**: Shirouma-kamino-tanbo in Shinano. (Pl. XXXVII, fig. 23)

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

var. **sibiricum** (BORGE) W. & G. S. WEST in Monogr. Brit. Desm. 4, 152, 1911.

Semicellulae minores quam in forma typica, isthmo latiori, sinu plus aperto, apice paene recto. Long. 15–17 μ , Lat. 15–17 μ , Lat. isth. 9.5–10.7 μ .

Hab. **Hondo**: Kurobe-goro-daira, Mt. Kaminotake, Mt. Yakushi in Etchû. (Pl. XXXVII, fig. 24)

Distr. Japan, Siberia, British Isles, U. S. A.

Staurastrum sibiricum BORGE var. **occidentale** W. & G. S. WEST in Trans. Linn. Soc. Bot. 5, 255, 1896.

Var. apicibus semicellularum leviter concavis, profunde constrictis; in vertice visis triangularibus, lateribus valide concavis, angulis obtusis. Long. 19.6 μ , Lat. 19.6 μ , Lat. isth. 5.6 μ .

Hab. **Hondo**: Ishigaki-ike in Ise (New to Asia) (Pl. XXXVIII, fig. 22)

Distr. U. S. A.

Staurastrum sibiricum var. *occidentale* in Ishigaki-pond has a retuse lateral margin but W. & G. S. WEST has recorded a form from North America that has a straight side.

Staurastrum tortum (LAGERH. & NORDST.) W. & G. S. WEST forma **trigona** W. & G. S. WEST in Journ. Linn. Soc. Bot. 39, 60, 1909; Monogr. Brit. Desm. 4, 162, 1911.

Cellulae in vertice visae triangulares, lateribus leviter convexis, angulis rotundis. Long. $19.6\ \mu$, Lat. $18.2\ \mu$, Lat. isth. $14\ \mu$.

Hab. **Hondo**: Nushiri-daira of Oze in Kôzuke; Mt. Naeba in Echigo. (Pl. XXXVIII, fig. 6)

Distr. Japan, Europe, Australia.

Staurastrum subpygmaeum WEST in Monogr. Brit. Desm. 4, 162, 1911.

Cellulae raro parvae, circiter $1\frac{1}{3}$ longiores quam latae, profunde constrictae, sinu acuminato ad verticem et exterius late aperto; semicellulae late cuneatae, angulis basalibus late rotundis, apicibus et marginibus lateralibus convexis, angulis apicalibus leviter productis et mamillatis; a vertice visae triangulares, lateribus convexis, angulis mamillatis; membrana punctata. Long. $33.8\ \mu$, Lat. $28\ \mu$, Lat. isth. $12.6\ \mu$.

Hab. **Hondo**: Takashihara in Mikawa. (New to Asia) (Pl. XXXVIII, fig. 4)

Distr. British Isles, Sweden.

Sect. **Odontastrum** TURNER emend. HIRANO

Staurastrum subgen. *Odontastrum* TURNER in K. Sv. Vet. Akad. Handl. 25, 133, 1893.

Cellulae non subcylindricae, profunde constrictae, angulis non spina ordinatis, membrana granulata, granulis regulariter vel irregulariter ordinatis.

- 1a. Semicellulae ellipticae vel subellipticae.
 - 2a. Sinu angusto-lineari **St. Donardense**
 - 2b. Sinu acute aperto.
 - 3a. Angulis semicellularum rotundis.
 - 4a. Semicellulae ellipticae **St. turgescens**
 - 4b. Semicellulae angusto-ellipticae.
 - 5a. Isthmo non torto **St. lapponicum**
 - 5b. Isthmo torto **St. alternans**
 - 4c. Semicellulae elliptico-subfusiformes.
 - 5a. Semicellulae anguste fusiformes var. **subalternans**
 - 5b. Semicellulae elliptico-fusiformes.
 - 6a. Apice convexo vel recto, angulis horizontalibus **St. dilatatum**
 - 7a. Parte basali indistincta f. **typica**
 - 7b. Parte basali distincta var. **hibernicum**
 - 6b. Apice retuso, angulis divergentibus **St. disputatum** var. **sinense**
 - 3b. Angulis semicellularum truncato-emarginatis **St. dispar**

- 1b. Semicellulae elliptico-rhomboides.
 - 1a. Angulis semicellularum rotundis sine mucro **St. punctulatum**
 - 3a. Angulis rotundis, non productis.
 - 4a. Granulis rotundis.
 - 5a. Sinu acuto, angulis semicellularum non late rotundis.
 - 6a. Cellulae 26-40 μ in longitudinem f. **typica**
 - 6b. Cellulae 22 μ in longitudinem var. **minor**
 - 5b. Sinu rectangulari, angulis semicellularum late rotundis. ... var. **Kjellmani**
 - 4b. Granulis aliquantum acutis var. **pygmaeum**
 - 3b. Angulis semicellularum leviter productis var. **subproductum**
- 2b. Angulis semicellularum leviter rotundis, cum mucro **St. granulosum**
 - 3a. Cellulae in vertice visae cum lateribus retusis in medio f. **typica**
 - 3b. Cellulae in vertice visae cum lateribus rectis var. **acutum**
- 1c. Semicellulae obverse subtrapeziformes, sinu acuminato ad extremum **St. varians** f. **truncata**
- 1d. Semicellulae obtriangulares, angulis leviter productis et serie annulari duplici granulorum ordinatis **St. biannuliferum**
- 1e. Semicellulae subquadratae, sinu angusto-lineari, serie basali verrucarum ordinata **St. asoensis**

Staurationum Donardense W. & G. S. WEST in Monogr. Brit. Desm. 4, 169, 1911.

Cellulae parvae, leviter longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo subampliato; semicellulae elliptico-subsemicirculares, angulis apicalibus et basalibus ambo late rotundis, angulis apicalibus leviter rotundioribus, apicibus in parte mediana paene truncatis; a vertice visae triangulares, lateribus leviter concavis, angulis late rotundis; membrana dense et minute granulata, granulis in seriebus concentricis ad angulos dispositis. Long. 25 μ , Lat. 15 μ , Lat. isth. 10 μ .

Hab. **Hondo**: Mt. Hachimantai in Mutsu; Inago of Kitamaki-mura in Shinano. (New to Asia) (Pl. XXXVIII, fig. 2)

Distr. British Isles.

Staurationum turgescens De NOT. in WEST Monogr. Brit. Desm. 4, 167, 1911.

Cellulae parvae, paullo longiores quam latiores, profunde constrictae, sinu acuto aperto sed acuminato ad apicem; semicellulae ellipticae; a vertice visae trigonae, lateribus concavis, angulis late rotundis; membrana fine granulata, granulis confertim ordinata. Long. 34.4 μ , Lat. 32.3 μ , Lat. isth. 9.5 μ .

Hab. **Hokkaido**: Sarufutsu in Kitami. (New to Asia) (Pl. XXXVIII, fig. 3)

Distr. Europe, central Africa, West Indies.

Staurationum lapponicum (SCHMIDLE) GRÖNBL. in MESSIKOMMER Viertelj. Naturf. Ges. Zurich 72, 346, 1927; HIRANO Journ. Jap. Bot. 20, 38, 1944.

Cellulae subparvae, circiter tam longae quam latae, profunde constrictae, sinu aperto acutangulo; semicellulae subellipticae, marginibus dorsalibus et ventralibus aequaliter convexis, angulis lateralibus bene rotundis; a vertice visae triangulares, lateribus leviter concavis, angulis rotundis; membrana dense granulata, granulis in serie concentrica prope angulos et glabris ad centrum. Long. 28-42 μ , Lat. 28-39 μ , Lat. isth. 8.4-11 μ .

Hab. **Hokkaido**: Chôbushi-numa, Onne-numa in Nemuro; Yasuushi in Teshio; Koetoi-konuma in Kitami; Moseushi, Minenobu, Nakano near Sapporo, Horomui in Ishikari; Shiraoui-poroto-numa in Iburi. **Hondo**: Koke-numa in Ugo; Hakuryu-ko, Ôishita, Chûkawa-ike, Hijiori-naganuma in Uzen; Ojiroi in Iwaki; Akai in Iwashiro; Oze, Ômine-numa in Kôzuke; Goda-numa in Shimo-fusa; Sanpôji-ike in Musashi; Gôno-ike in Hitachi; Lake Nakatsuna in Shinano; Takashihara in Mikawa; Ishigaki-ike, Tamaru in Ise. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Imuta-ike in Satsuma; Miyazaki in Hiuga. (Pl. XXXIX, fig. 7)

Distr. Japan, Europe.

Staurostrum alternans BRÉB. in RALFS Brit. Desm. 132, 1848; WEST Monogr. Brit. Desm. 4, 170, 1911; SMITH Wisc. Bull. 57, 70, 1924; ALLORGE Rev. Alg. 5, 363, 1930; SKVORTZOW Philip. Journ. Sci. 49, 154, 1932; OKADA Journ. Imp. Fish. Inst. 30, 180, 1934; TAYLOR Pap. Mich. Acad. Sci. 20, 185, 1935; PRESCOTT Pap. Mich. Acad. Sci. 25, 90, 1940; WHELDEN Nat. Mus. Canad. Bull. 97, 96, 1947; HIRANO Jap. Journ. Bot. 14, 229, 1953.

Cellulae parvae, latiores quam longiores, plerumque tortae, profunde constrictae, sinu aperto et acutangulo: semicellulae anguste ellipticae, angulis lateralibus rotundis, marginibus superioribus et inferioribus lateralibus aequaliter convexis, apicibus rectis vel leviter convexis in medio; a vertice visae trigonae raro biradiatae, angulis rotundis et unius semicellulae cum alteris alternantibus, lateribus valide concavis; membrana fine granulata, granulis in seriebus concentricis ad angulos ornatis, circa centrum reductis. Long. 25-34 μ , Lat. 28-32 μ , Lat. isth. 9.7-11 μ .

Hab. **Hokkaido**: Akan-junsai-numa, Kiritappu in Kushiro; Toyokoro-konuma in Tokachi; Moseushi, Horomui, Kumoihara of Mt. Daisetsu in Ishikari; Benten-numa, Tôasa-numa, Numanohata in Iburi. **Hondo**: Mt. Kurikoma in Ugo; Mt. Gassan, Mt. Azuma, Hijiori-onuma in Uzen; Hibushi-numa in Iwaki; Ôuchi-numa in Iwashiro; Oze-numa in Kôzuke; Mohara in Kamifusa; Kitaura in Hitachi; Mt. Naeba in Echigo; Daizahôshi-numa, Tengenohara, Tsugadaira, Ashinota-ike in Shinano; Tanuki-numa in Suruga; Ô-numa in Mikawa; Biwa-ike in Owari; Jôdo-ike in Ise; Fuse-ike in Oomi; Shakuhachi-ike, Ariga-ike, Takaraga-ike in Yamashiro. **Shikoku**: Matsuyama in Iyo. **Kiushiu**: Kôga-muta of Aso in Higo. (Pl. XXXIX, fig. 8)

Distr. Japan, Korea, Kuriles, Siberia, India, Thailand, whole Europe, Iceland, Nova Zembla, Spitzbergen, Greenland, N. America, Brazil, Australia, Newzealand, central Africa.

Var. subalternans MASKELL in Trans. & Proc. New Zeal. Inst. **21**, 22, 1888.

Cellulae leviter tortae, semicellulae subrhomboidae, apicibus convexis, angulis lateralibus horizontalibus. Long. $25\ \mu$, Lat. $24.5\ \mu$, Lat. isth. $5.6\ \mu$.

Hab. **Hondo**: Chûkawa-ike in Uzen. (New to Asia) (Pl. XXXIX, fig. 9)

Distr. New Zealand.

Staurostrum dilatatum EHRENB. in RALFS Brit. Desm. 133, 1848; WEST Monogr. Brit. Desm. **4**, 172, 1911.

Cellulae parvae, circiter tam longae quam latae vel aliquantum leviter longiores, profunde constrictae, sinu late aperto et paulo subacuminato ad verticem; semicellulae elliptico-subfusiformes, marginibus dorsalibus convexis, marginibus ventralibus in parte mediana inflatis, angulis lateralibus rotundis vel rotundato-truncatis; a vertice visae 3-5-gonae, lateribus valide concavis, angulis rotundis vel rotundato-truncatis; membrana granulata, granulis in serie concentrica ad angulos, prope centrum glabra vel minute punctata. Long. $22.4-29.4\ \mu$, Lat. $22.4-33.6\ \mu$, Lat. isth. $8.6-9.8\ \mu$.

Hab. **Hokkaido**: Okineppe, Onne-numa in Nemuro; Kiritappu, Akan-junsai-numa in Kushiro; Shimoyûbetsu, Komukai-ponto, Nikuru-numa in Kitami; Horomui, Minenobu, Nakano near Sapporo in Ishikari; Tomakomai, Yûfutsu in Iburi; Shizukari, Junsai-akanuma, Konuma in Oshima. **Hondo**: Komozuchi in Mutsu; Moritake-ôtsutsumi, Aka-numa, Megata, Hirumo-numa, Kariwano in Ugo; Hizume in Rikuchû; Kobuchi-numa, Kesho-numa in Rikuzen; Mazawano-naganuma, Ôishita, Chûkawa-ike in Uzen; Kôriyama in Iwashi-ro; Kashima-cho in Iwaki; Kitaura in Hitachi; Higusa-numa in Shimo-fusa; Mt. Kirigamine, Inago of Kitamaki-mura, Okemi-ike, Kanori-ike, Lake Kizaki in Shinano; Biwa-ike in Owari; Kanashôzu in Ise; Matsubara-naiko, Shinohara-ike, Fuse-ike in Oomi. **Shikoku**: Yodo-mura, Dôgo (near Matsuyama in Iyo; **Kiushiu**: Imuta-ike, Nakahama of Lake Ikeda in Satsuma; Miyazaki in Hiuga; Ahira in Ôsumi. (Pl. XXXIX, fig. 1)

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

var. hibernicum W. & G. S. WEST in Monogr. Brit. Desm. **4**, 175, 1911; PRESCOTT Pap. Mich. Acad. Sci. **25**, 92, 1940; HIRANO Act. Phytotax. Geobot. **12**, 162, 1943.

Semicellulae aliquando subcampanulatae, partibus basis semicellularum leviter elongatis, punctulis in seriebus concentricis ad angulos et in parte altera

irregulariter et sparsim dispositis, seriebus transversis granulorum ad basim semicellularum juxta isthmum. Long. 25–28 μ , Lat. 25–30 μ , Lat. isth. 7–8.5 μ .

Hab. **Hondo**: Mt. Hira in Oomi; Mizoroga-ike, Ariga-ike in Yamashiro; Ikejiri-ike in Tanba. (Pl. XXXIX, fig. 2)

Distr. Japan, British Isles, U. S. A.

Staurostrum disputatum W. & G. S. WEST var. **sinense** (LÜTKEM.) W. & G. S. WEST in Monogr. Brit. Desm. 4, 176, 1911; KRIEGER Arch. Hydrobiol. suppl. 11, 198, 1932; HIRANO Jap. Journ. Bot. 14, 229, 1954. — *Staurostrum sinense* LÜTKEM. in Ann. k.k. Nat. Hist. Hofm. 15, 124, 1900.

Cellulae minores quam in forma typica, angulis plus productis et leviter cylindricis, annulis 4–5 granulorum specialium ad angulos. Long. 18–25.8 μ , Lat. 18–28 μ , Lat. isth. 5.6–7.6 μ .

Hab. **Hokkaido**: Onne-numa in Nemuro; Toyokoro-konuma in Tokachi; Nakano near Sapporo in Ishikari; Shizukari, Junsai-akanuma in Oshima. **Hondo**: Mt. Hakkoda in Mutsu; Nishi-numa, Megata, Hirumo-numa, Kariwano in Ugo; Hakuryu-ko in Uzen; Izu-numa in Rikuzen; Akaiyachi in Iwashiro; Oze-numa in Kôzuke; Kitaura in Hitachi; Inago of Kitamaki-mura, Kizaki in Shinano; Tanuki-numa in Suruga; Kotsutsumi-nishi-ike in Mikawa; Ishigaki-ike in Ise; Shinohara-ike in Oomi; Mizoroga-ike in Yamashiro. **Kiushiu**: Ahira in Ôsumi. (Pl. XXXIX, fig. 3)

Distr. Japan, central China, Sumatra, Macedonia, central Africa.

Staurostrum dispar BRÉB. in Monogr. Brit. Desm. 4, 187, 1911; HIRANO Bot. Mag. 66, 207, 1953.

Cellulae parvae, tam longae quam latae, profunde constrictae, sinu aperto acutangulo; semicellulae anguste elliptico-rhomboides vel elliptico-fusiformes, margine dorsali conuexiore quam ventre, angulis lateralibus acute rotundis; a vertice visae 3-gonae, lateribus concavis, granulis in serie concentricis ad angulos autem irregulariter et gradatim prope apicem. Long. 25.8–32.8 μ , Lat. 25.8–33.6 μ , Lat. isth. 7–11 μ .

Hab. **Hokkaido**: Wakkanai in Kitami; Moere-numa near Sapporo in Ishikari. **Hondo**: Mt. Hakkoda in Mutsu; Mt. Kurikoma in Ugo; Hakuryu-ko in Uzen; Akaiyachi in Iwashiro; Ojiroi in Iwaki; Oze in Kôzuke; Higusanuma in Shimofusa; Kurosawano-ike of Mt. Myoko in Echigo, Ôniu-ike, Sennin-ike in Etchû; Shigakôgen, Daimon-pass, Kazafuki-ôike, Ashinota-ike in Shinano; Tanuki-numa in Suruga; Fuse-ike in Oomi; Shakuhachi-ike in Yamashiro. **Kiushiu**: Mt. Ôhatayama of Kirishima in Hiuga. (Pl. XXXIX, fig. 4)

Distr. Japan, British Isles.

Staurastrum punctulatum BRÉB. in RALFS Brit. Desm. 133, 1848; MIGULA Krypt. Fl. 2, 530, 1907; WEST Monogr. Brit. Desm. 4, 179, 1911; HIGASHI in OKAMURA's Nipp. Sorui Meii, 281, 1916; TAYLOR Pap. Mich. Acad. Sci. 20, 197, 1935; PRESCOTT l. c. 25, 94, 1940; HIRANO Bot. Mag. 66, 208, 1953.

Cellulae parvae, leviter longiores quam latae, profunde constrictae, isthmo tortuoso, sinu aperto acutangulo; semicellulae rhomboido-ellipticae, marginibus dorsalibus et ventralibus aequaliter convexis, angulis lateralibus rotundis; a vertice visae generaliter triangulares, lateribus leviter concavis, angulis acute rotundis, angulis unius semicellulae cum aliis alternantibus; membrana granulata, granulis regulariter ornatis in serie ad angulos. Long. 24–34 μ , Lat. 21–31 μ , Lat. isth. 8.4–15 μ .

Hab. **Hokkaido**: Tōfutsu-ko, Sarufutsu in Kitami; Yasuushi in Teshio; Susoai-daira of Mt. Daisetsu, Horomui in Ishikari. **Hondo**: Mt. Hakkoda, Mt. Hachimantai in Mutsu; Kurikoma, Onaishiro-ko of Mt. Iwate in Rikuchū; Hijiori-onuma in Uzen; Akai in Iwashiro; Ojiroi in Iwaki; Ozegahara in Kōzuke; Higusa-numa in Shimofusa; Tsuruga-ike, Ōniu-ike on Mt. Norikura in Etchū; Midoriga-ike of Mt. Yatsugatake in Shinano; Biwa-ike in Owari; Mt. Hira, Fuse-ike in Oomi; Ogura, Shakuhashi-ike in Yamashiro. **Kiushiu**: Bōgatsuru of Mt. Kujū in Bungo; Hirabaru of Yabakei in Bunzen; Kagamiga-ike in Satsuma. (Pl. XXXVIII, fig. 13)

Distr. Japan, Siberia, Manchuria, India, Ceylon, Java, whole Europe, Iceland, Greenland, Spitzbergen, N. & S. America, Australia, New Zealand, S. Africa, Azores.

forma **minor** W. & G. S. WEST in Monogr. Brit. Desm. 4, 181, 1911.

Cellulae minores quam in forma typica. Long. 22.4 μ , Lat. 22.4 μ , Lat. isth. 7 μ .

Hab. **Hokkaido**: Moseushi in Ishikari. (New to Asia) (Pl. XXXVIII, fig. 14)
Distr. British Isles.

var. **Kjellmani** WILLE in MIGURA Krypt. Fl. 2, 530, 1907; WEST Monogr. Brit. Desm. 4, 182, 1911; TAFT Ohio Journ. Sci. 45, 204, 1945; HIRANO Journ. Jap. Limnol. 16, 16, 1952.

Var. sinu apertiore, paene rectangulari, angulis lateralibus bene rotundis, in vertice visis lateribus rectis vel leviter convexis, angulis bene rotundis (non acute rotundis); membrana densior punctata, punctulis tenuioribus. Long. 28–34 μ , Lat. 22.4–26.6 μ , Lat. isth. 9.8–11 μ .

Hab. **Hokkaido**: Sarufutsu in Kitami. **Hondo**: Ozegahara in Kōzuke; Ōniu-ike on Mt. Norikura in Etchū; Shigakōgen in Shinano. (Pl. XXXVIII, fig. 15)

Distr. Japan, Manchuria, Siberia, whole Europe, Faeroes, Spitzbergen, Greenland, Nova Zembla, Canada.

var. **pygmaeum** (BRÉB.) W. & G. S. WEST in RALFS Brit. Desm. 213, 1848; WEST Monogr. Brit. Desm. 4, 184, 1911.

Var. *isthmo latiore*, *granulis leviter acutis*, *lateribus in vertice visis leviter convexis*. Long. 31–36.4 μ , Lat. 28–33.6 μ , Lat. *isth.* 11–14 μ .

Hab. **Hondo**: Ôyachi of Mt. Hachimantai in Rikuchu; Fuse-ike in Oomi. (Pl. XXXVIII, fig. 16)

Distr. Siberia, Sumatra, whole Europe, Faeroes, Nova Zembla, Spitzbergen, Greenland, U. S. A., S. America, E. Africa.

var. **subproductum** W. & G. S. WEST in Monogr. Brit. Desm. 4, 182, 1911.

Var. *cellulis leviter latoribus*, *angulis lateralibus leviter productis*; in *vertice visis lateribus leviter convexis*, *angulis leviter productis*. Long. 30.8 μ , Lat. 33.4 μ , Lat. *isth.* 10 μ .

Hab. **Hondo**: Hibushi-numa in Iwaki. (New to Asia) (Pl. XXXVIII, fig. 17)

Distr. British Isles.

Staurastrum granulosum (EHRENB.) RALFS in Brit. Desm. 217, 1848; WEST Trans. Roy. Irish Acad. 32, 45, 1902; Monogr. Brit. Desm. 4, 188, 1911; BERGE Bot. Notis. 30, 1913; MESSIKOMMER Viertelj. Naturf. Ges. Zurich 73, 209, 1928; SKVORTZOW Philip. Journ. Sci. 49, 154, 1932; TAFT Ohio Journ. Sci. 45, 203, 1945.

Cellulae parvae, circiter tam longae quam latae, profunde constrictae, sinu subrectangulari aperto autem leviter acuminato ad verticem; semicellulae obverse subcirculares, apicibus convexis, angulis apicalibus leviter rotundis cum spinis minutis; a vertice visae trigonae, lateribus retusis in medio, angulis acute rotundis cum spinis minutis ornatis; membrana granulata, granulis in serie concentrica ad angulos ornatis, prope centrum irregulariter reductis. Long. 22.4–25 μ , Lat. 22.4–26.6 μ , Lat. *isth.* 7–8.4 μ .

Hab. **Hondo**: Nagatai in Mutsu; Fuse-ike in Oomi. (New to Asia) (Pl. XXXIX, fig. 5)

Distr. Europe, Arctic Canada.

var. **acutum** (BRÉB.) W. & G. S. WEST in Trans. Roy. Irish Acad. 32, 45, 1902; Monogr. Brit. Desm. 4, 190, 1911.

Cellulae elliptico-fusiformes, margine ventre et dorsali plus convexiore quam in forma typica; in vertice visae lateribus paene rectis. Long. 35 μ , Lat. 33.6 μ Lat. *isth.* 14 μ .

Hab. **Hondo**: Karekinuma of Mt. Takahara in Shimotsuke. (New to

Japan) (Pl. XXXIX, fig. 6)

Distr. British Isles, France, Germany.

Staurastrum varians RACIB. forma **truncata** GUTW. in MESSIKOMMER Viertelj. Naturf. Ges. Zurich **72**, 348, 1927; HIRANO Bot. Mag. **66**, 209, 1953. — *Staurastrum punctulatum* BRÉB. var. *striatum* W. & G. S. WEST in Monogr. Brit. Desm. **4**, 186, 1911; KAISER Krypt. Forsch. **1**, 383, 1924.

Hab. **Hokkaido**: Kiritappu, Tôro in Kushiro; Shizukari in Oshima. **Hondo**: Naga-numa of Mt. Hachimantai in Rikuchu; Jiuemon-ike in Kôzuke; Happo-ridge, Myojin-ike of Kamikôchi, Ashinota-ike in Shinano; Nukigawa in Oomi. (New to Asia) (Pl. XXXVIII, fig. 10)

Distr. Europe.

Staurastrum biannuliferum HIRANO in Act. Phytotax. Geobot. **14**, 2, 1949.

Cellulae parvae, circiter longae quam latae, profunde constrictae, sinu aperto et acuminato ad verticem; semicellulae obtriangulares, marginibus ventralibus leviter inflatis, apicibus paene rectis, angulis apicalibus leviter productis divergentibusque et in apice truncatis cum serie duabus annularibus granulorum prope angulos; in vertice visae 4-gonae, lateribus concavis, angulis leviter productis et in apice truncato-convexis cum serie duabus prominentibus granulorum, altero serie juxta infra apicem et altero ad basim processuum. Long. et Lat. $25.2\ \mu$, Lat. isth. $8.4\ \mu$.

Hab. **Hondo**: Fuse-ike in Oomi. (Pl. XXXVIII, fig. 11, 12)

Distr. Japan.

Staurastrum Asoensis HIRANO, sp. nov.

Cellulae parvae, circiter $1\frac{1}{2}$ longiores quam latiores, profunde constrictae, sinu angusto-lineari extremo leviter dilatato; semicellulae subquadrato-trilobae, in parte superiore semicellulae late rectangulares, in parte inferiore subtrapeziformes, aliquantum rectangulares, angulis basalibus rectangularibus, marginibus lateralibus inferioribus convexis, marginibus lateralibus superioribus rectis, convexis aliquantum leviter divergentibus, marginibus omnibus minute undulatis, semicellulis aliquantum leviter constrictis ad medium aliquantum retusis, apicibus truncatis rectis vel leviter retusis, angulis apicalibus rectangulari-rotundis, semicellulae cum serie duplici et serie singulo transversali granulorum trans basim semicellulae, serie similari granulorum infra apicem ordinatis; in vertice visae triangulares, lateribus convexis, angulis rotundis, intra marginem cum serie radialibus puncto-verrucarum, verrucis circa 9 in forma radiali ordinatis, verrucis omnibus mamillato et semielliptico-formis. Long. $36.4\ \mu$, Lat. $25.2\ \mu$, Lat. isth. $16.8\ \mu$.

Hab. **Kiushiu**: Kôga-muta of Aso in Higo. (Pl. XXXVIII, fig. 1)

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2.	<i>E. sinuosum</i> LENORM. var. <i>parallelum</i> KRIEGER.....	251
3.	<i>E. ansatum</i> EHRENB.	244
4, 5.	<i>E. didelta</i> RALFS var. <i>japonicum</i> HIRANO.	250
6.	<i>E. inerme</i> (RALFS) LUND.	247
7.	<i>E. sinuosum</i> LENORM. var. <i>perforatum</i> KRIEGER.	252
8.	<i>E. ansatum</i> EHRENB. var. <i>dideltiforme</i> DUCELLIER.	245
9.	<i>E. platycerum</i> REINSCH.	238
10.	<i>E. elegans</i> (BRÉB.) KUTZ.	259
11.	<i>E. oblongum</i> (GREV.) RALFS	255
12.	<i>E. cuneatum</i> JENNER	246
13.	<i>E. ansatum</i> EHRENB. var. <i>javanicum</i> (GUTW.) KRIEGER ...	245
14.	<i>E. gnathophorum</i> W. & G. S. WEST.	250
15.	<i>E. indicum</i> KRIEGER var. <i>capitatum</i> KRIEGER	248
16.	<i>E. humerosum</i> RALFS	257
17.	<i>E. didelta</i> RALFS.....	249
18.	<i>E. affine</i> RALFS.....	256

1—18. (×450)

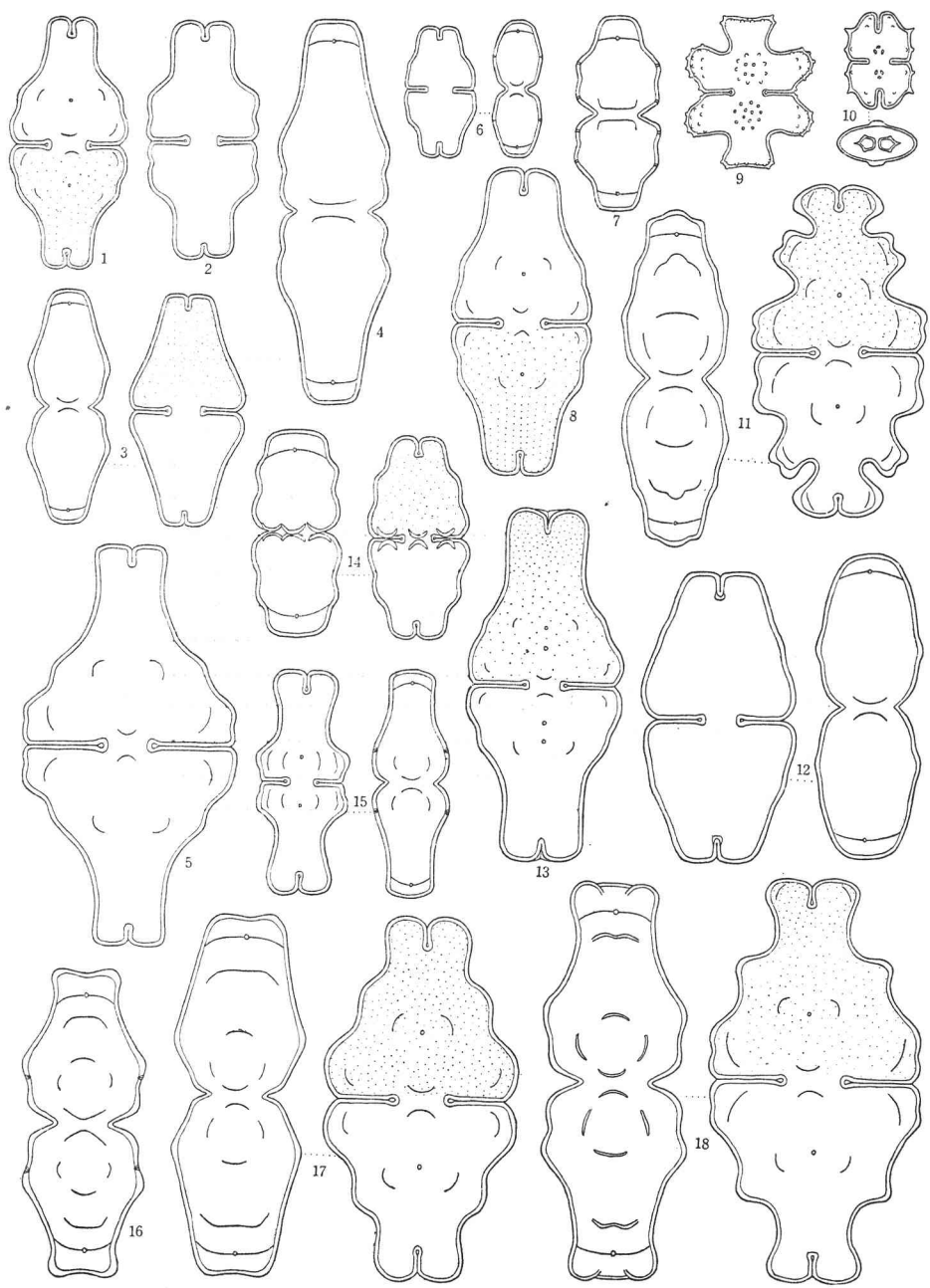


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1. <i>E. sinuosum</i> LENORM. var. <i>aböense</i> (ELFV.) CEDERGR.	253
2. <i>E. sinuosum</i> var. <i>gangense</i> (TURNER) KRIEGER	252
3. <i>E. sinuosum</i> var. <i>reductum</i> W. & G. S. WEST	253
4. <i>E. sinuosum</i> var. <i>germanicum</i> (RACIB.) LÜTKEM.	251
5. <i>E. sinuosum</i> var. <i>perforatum</i> KRIEGER.	252
6. <i>E. sinuosum</i> var. <i>subjenneri</i> W. & G. S. WEST.	251
7. <i>E. exile</i> JOSHUA	234
8. <i>E. ampullaceum</i> RALFS	248
9. <i>E. montanum</i> W. & G. S. WEST	229
10. <i>E. sinuosum</i> LENORM. var. <i>dideltoides</i> KRIEGER	250
11. <i>E. ozense</i> HIRANO	254
12. <i>E. humerosum</i> RALFS	257
13. <i>E. cuneatum</i> JENNER	246
14. <i>E. crassum</i> (BRÉB.) KÜTZ.....	254
15. <i>E. pinnatum</i> RALFS	255

1—15. (×450)

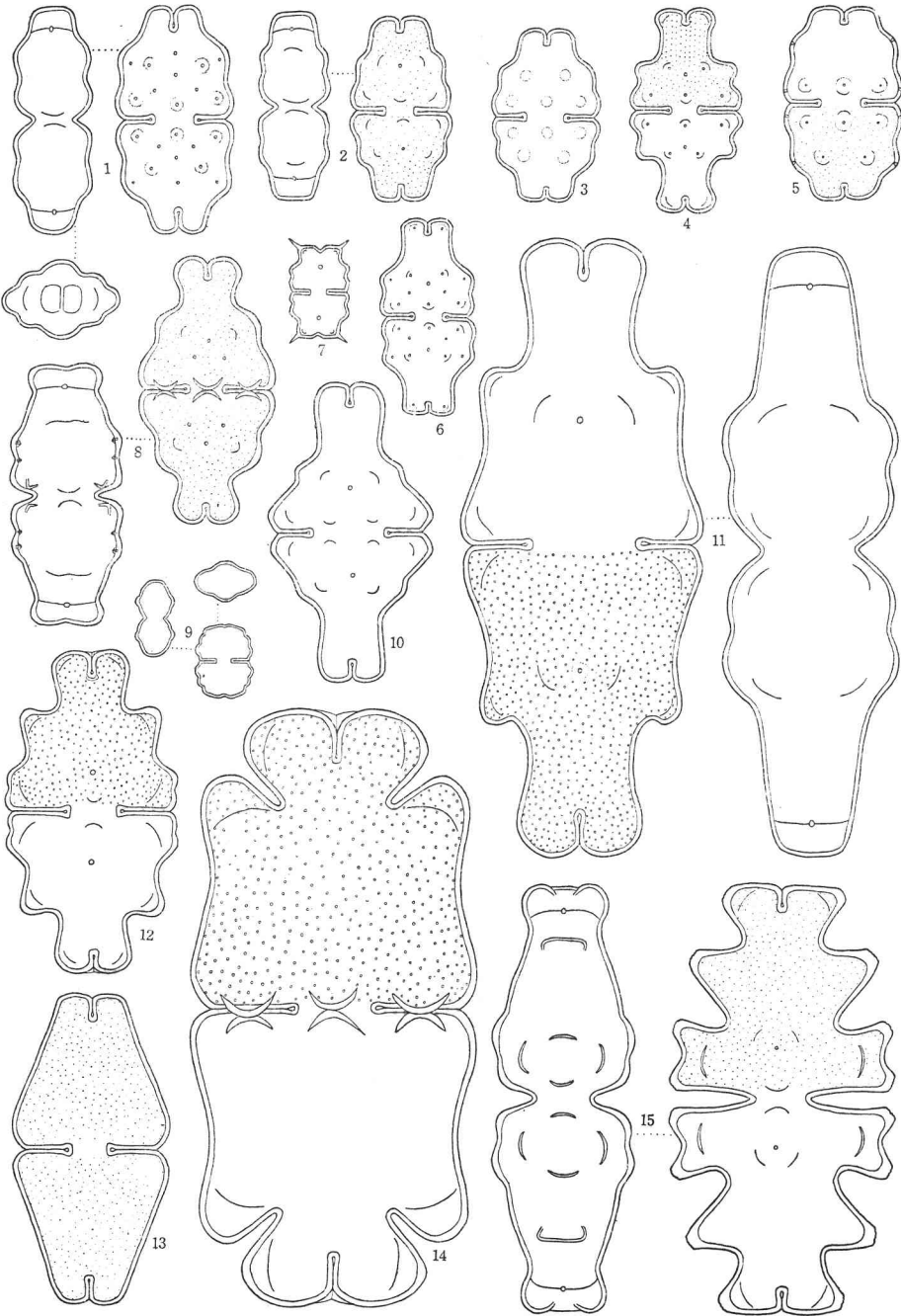


Plate XXXIII.

1. <i>Euastrum bidentatum</i> NAG.	265
2. <i>E. Turnerii</i> W. WEST	266
3. <i>E. divaricatum</i> LUND.	265
4. <i>E. sublobatum</i> BRÉB.	232
5. <i>E. sublobatum</i> var. <i>obtusatum</i> (GUTW.) KRIEGER	232
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7. <i>E. elegans</i> (BRÉB.) KÜTZ. var. <i>pseudelegans</i> (TURNER) W. & G. S. WEST	260
8. <i>E. simplicius</i> TURNER	260
9. <i>E. spinulosum</i> DELP.	240
10. <i>E. attenuatum</i> WOLLE	236
11. <i>E. Turnerii</i> W. WEST	266
12. <i>E. bidentatum</i> NAG.	265
13. <i>E. Lütkenmülleri</i> DUC. var. <i>carniolicum</i> (LÜTKEM.) KRIEGER. .	228
14. <i>E. praemorsum</i> (NORDST.) SCHMIDLE.	264
15. <i>E. germanicum</i> (SCHMIDLE) KRIEGER.	239
16. <i>E. spinulosum</i> DELP. var. <i>inermius</i> NORDST.	240
17. <i>E. ceylanicum</i> (W. & G. S. WEST) KRIEGER.	237
18. <i>E. gemmatum</i> BRÉB.	241
19. <i>E. subamoenum</i> SCHMIDLE	263
20. <i>E. diplostauron</i> SKUJA	233
21. <i>E. pectinatum</i> BRÉB.	235
22. <i>E. bilobum</i> LÜTKEM.	259
23. <i>E. Crameri</i> RACIB.	263
24. <i>E. turgidum</i> WALL	238
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28. <i>E. sinuosum</i> var. <i>scrobiculatum</i> NORDST.	252

1—28. (×450)

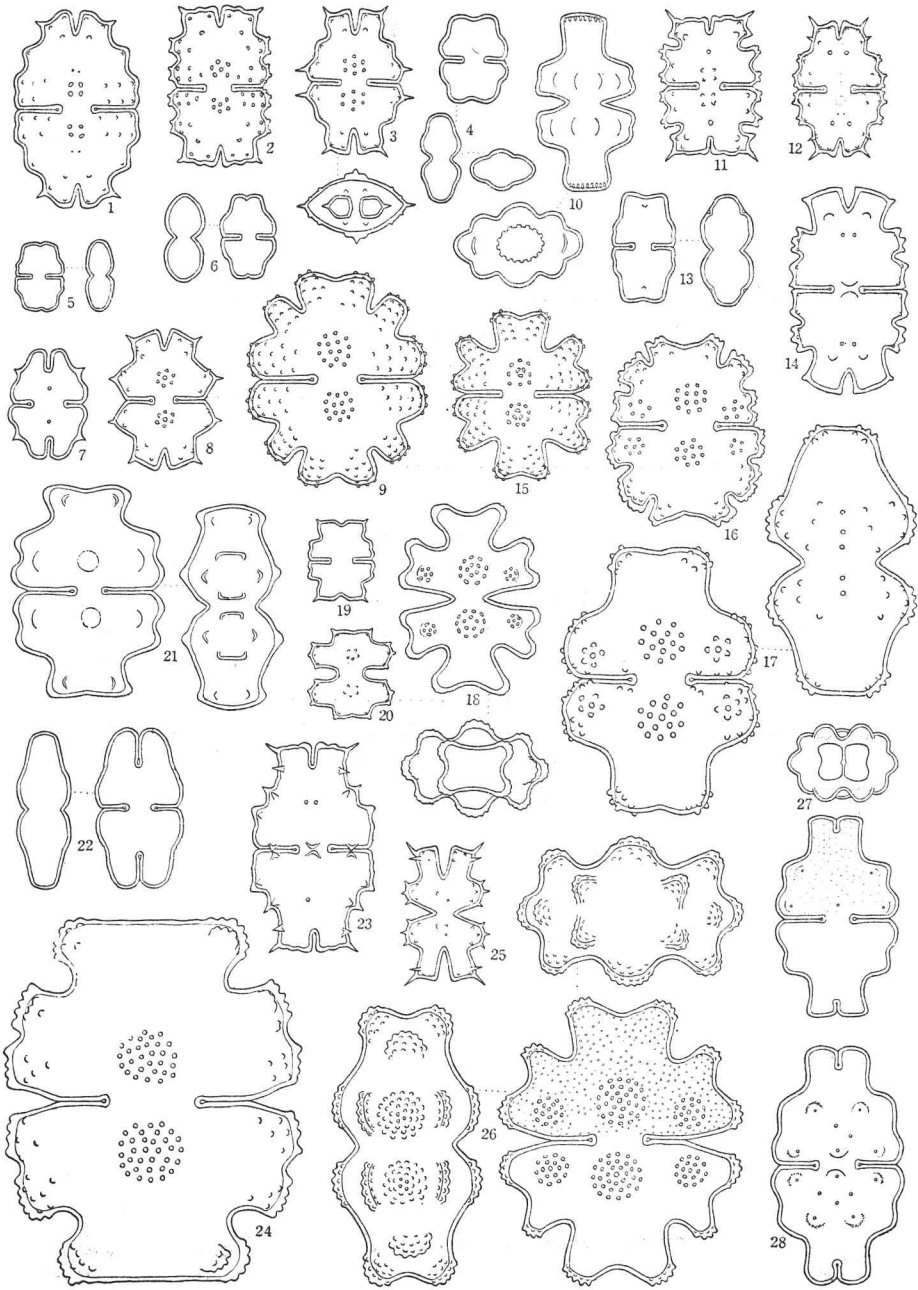


Plate XXXIV.

1.	<i>Euastrum crassum</i> (BRÉB.) KÜTZ. var. <i>tumidum</i> OKADA ...	255
2.	<i>E. pingue</i> ELFV.....	247
3, 4.	<i>E. glaberrimum</i> HIRANO	235
5.	<i>E. binale</i> (TURP.) EHRENB.....	229
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8.	<i>M. denticulata</i> var. <i>angusto-sinuata</i> GAY	275
9.	<i>M. pinnatifida</i> (KÜTZ.) RALFS	268
10.	<i>Euastrum insulare</i> (WITTR.) ROY.....	228
11.	<i>E. platycerum</i> REINSCH.....	238
12.	<i>E. binale</i> (TURP.) EHRENB. var. <i>Gutwinskii</i> SCHMIDLE.	232
13.	<i>E. binale</i> var. <i>Koreana</i> (SKV.) OKADA.	230
14.	<i>E. subalpinum</i> MESSIK.	262
15.	<i>Micrasterias Crux-Melitensis</i> (EHRENB.) HASS.	271
16.	<i>M. denticulata</i> BRÉB. var. <i>notata</i> NORDST.	276
17.	<i>M. decemdentata</i> NAG.	269

2—5, 9—14, 17. (×450); 1, 6—9, 15—16. (×280)

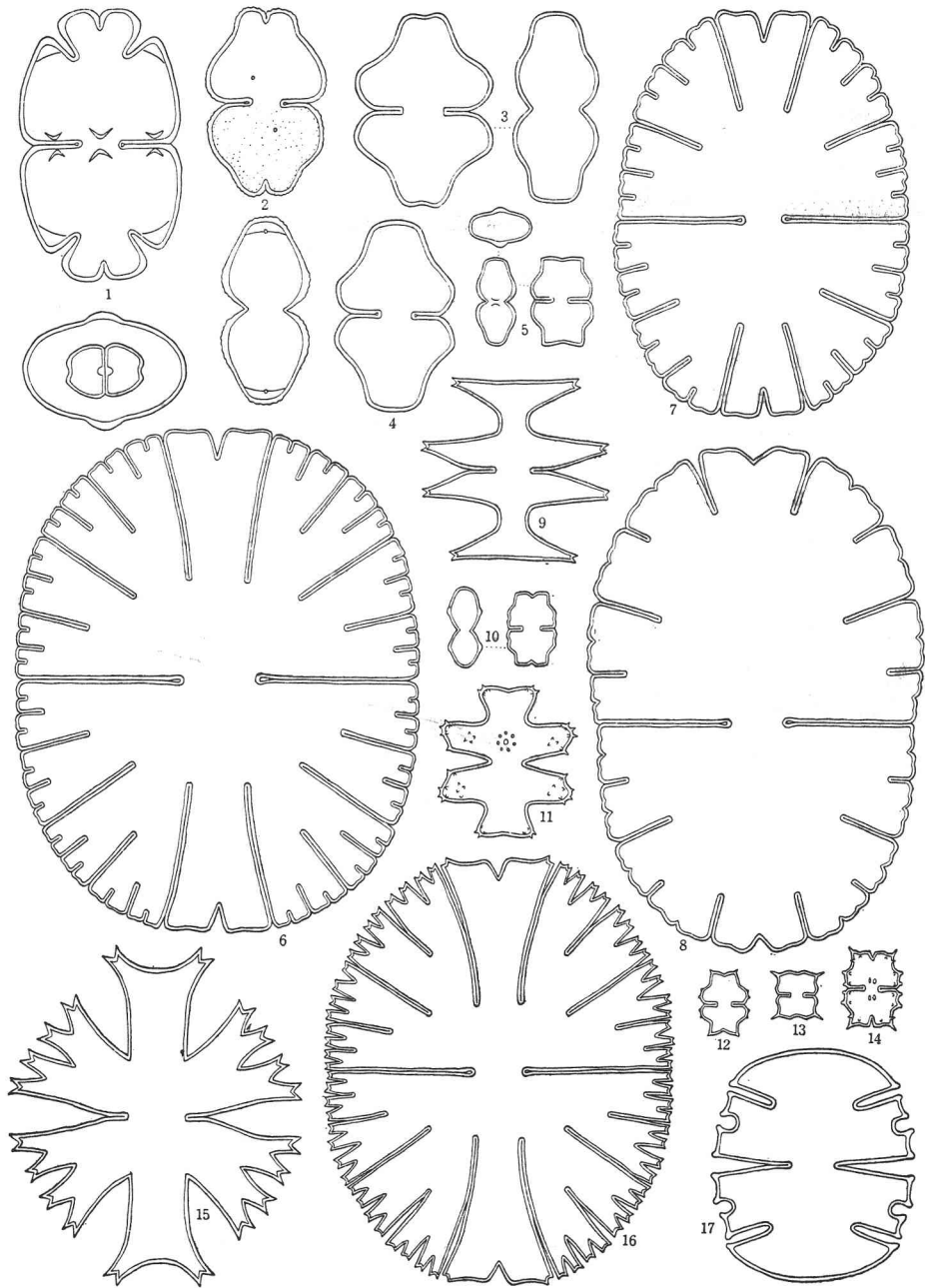


Plate XXXV.

1. <i>Microsterias rotata</i> (GREV.) RALFS	277
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5. <i>M. decemdentata</i> NAG.	269
6, 7. <i>Euastrum dubium</i> NAG.	262
8. <i>Microsterias Thomasiana</i> ARCH.	276
9. <i>M. radiata</i> HASS.	272
10. <i>M. papillifera</i> BRÉB.	274
11. <i>M. papillifera</i> var. <i>glabra</i> NORDST.	274
12. <i>M. Sol</i> (EHRENB.) KÜTZ. var. <i>ornata</i> NORDST.	278

1, 4, 8—12. (×280); 2, 3, 5—7. (×450)

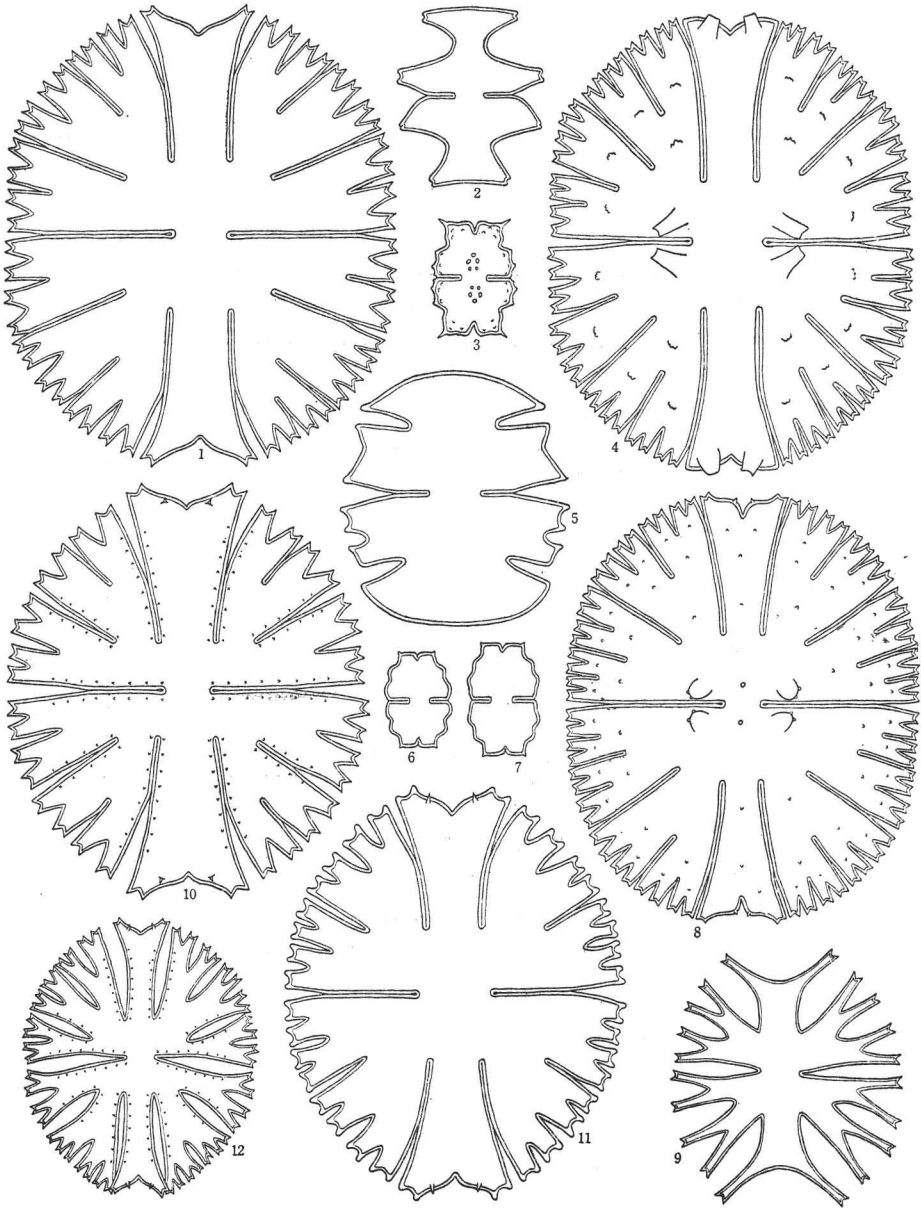


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2. <i>M. mahabuleshwarensis</i> var. <i>Wallichii</i> (GRUN.) W. & G. S. WEST	282
3. <i>M. Crux-Melitensis</i> (EHRENB.) HASS. var. <i>superflua</i> TURNER	272
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6. <i>M. tropica</i> NORDST. var. <i>polonica</i> RACIB.	281
7. <i>M. Sol</i> (EHRENB.) KUTZ.	278
8. <i>M. papillifera</i> BRÉB.....	254
9. <i>Euastrum acanthophorum</i> TURNER var. <i>bigranulatum</i> HIRANO	234
10. <i>E. dubium</i> NAG. var. <i>tritum</i> W. & G. S. WEST	263
11. <i>E. insulare</i> (WITTR.) ROY var. <i>silesiacum</i> GRÖNBL.	228
12. <i>Micrasterias mahabuleshwarensis</i> HOBSON	281
13. <i>M. Murrayi</i> W. & G. S. WEST	274
14. <i>Euastrum denticulatum</i> BRÉB. var. <i>angusticeps</i> GRÖNBL.	262
15. <i>E. binale</i> (TURP.) EHRENB. var. <i>hians</i> W. WEST	231
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18. <i>Euastrum excavatum</i> HIRANO	234
19. <i>E. crassicole</i> LUND. var. <i>incisum</i> HIRANO	229

1—8, 12, 13, 17. (×280); 9—11, 14—16, 18, 19. (×450)

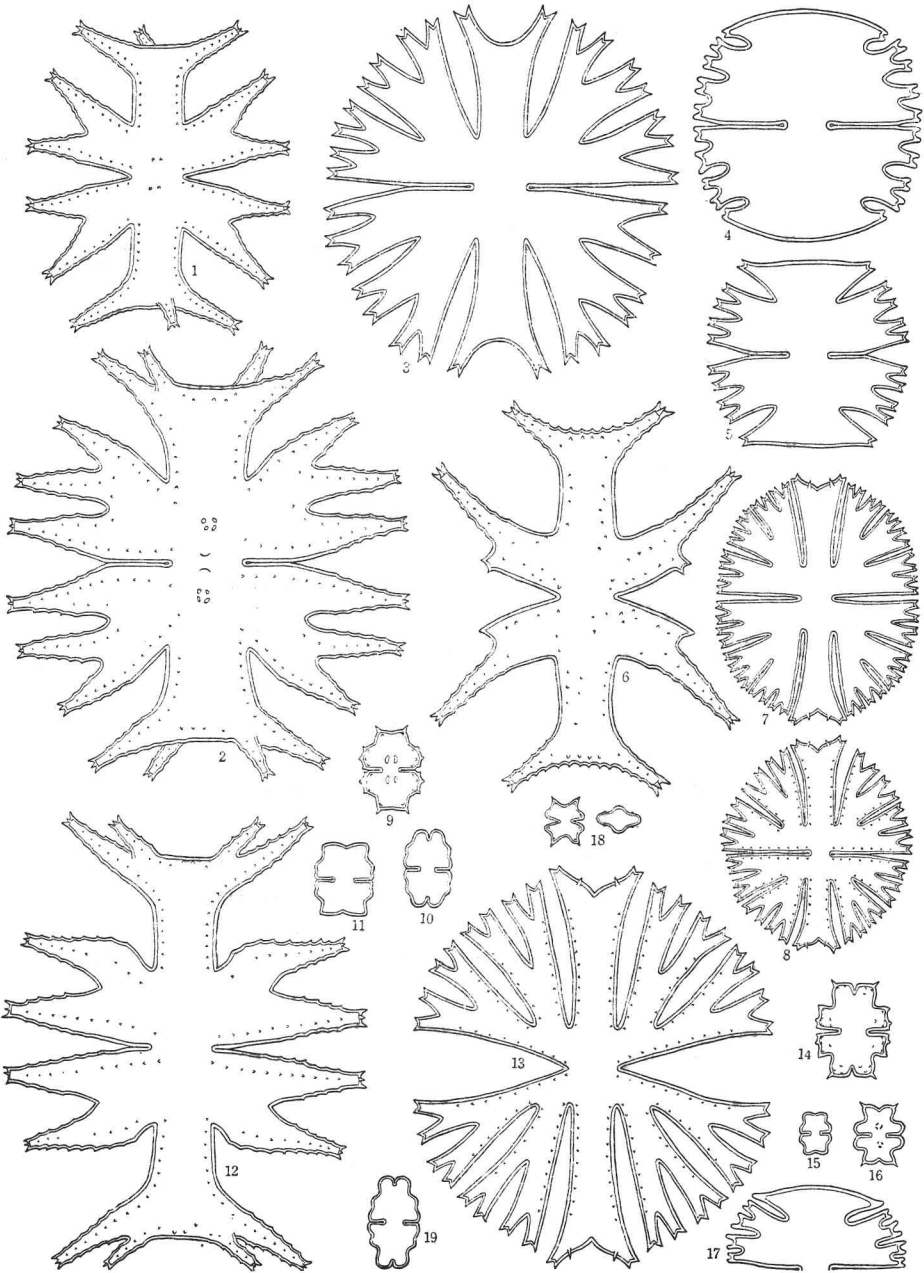


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1. <i>Microsterias lux</i> JOSHUA	273
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13. <i>M. apiculata</i> (EHRENB.) MENEGH.....	279
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20. <i>St. insigne</i> LUND.	287
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23. <i>St. Clepsydra</i> NORDST.	293
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1—4, 11—13 (×280); 5—10, 14—27. (×450)

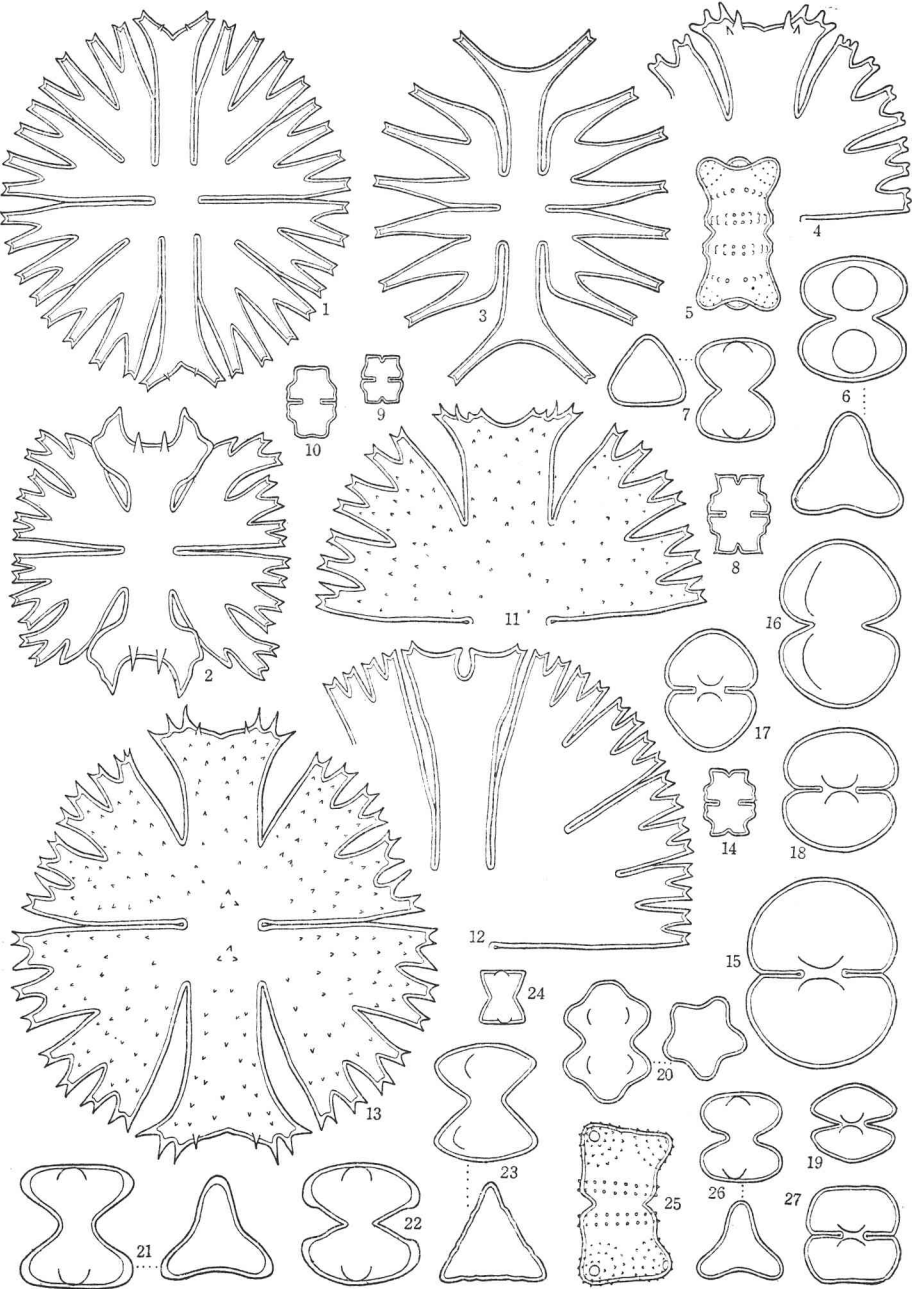


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9.	<i>St. subgrande</i> BORGE forma <i>minor</i> SMITH	286
10.	<i>St. varians</i> RACIB. forma <i>truncata</i> GUTW.	301
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13.	<i>St. punctulatum</i> BRÉB.	299
14.	<i>St. punctulatum</i> forma <i>minor</i> W. & G. S. WEST	299
15.	<i>St. punctulatum</i> var. <i>Kjellmani</i> WILLE	299
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17.	<i>St. punctulatum</i> var. <i>subproductum</i> W. & G. S. WEST	300
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25.	<i>St. cosmarioides</i> NORDST.	292
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