

# The Diatom Flora of the Bombay and Salsette Islands

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(With 120 figures)

## INTRODUCTION

This account deals with the diatom genera, *Pinnularia*, *Amphiprora*, *Amphora*, *Cymbella*, and *Gomphonema*, collected from the year 1945-1949 onwards up to 1958 in the form of stray samples. It continues the chain of first three papers jointly published by Mrs. E. A. Gonzalves and myself (1952-54).

Since 1954 the author's work on the diatom flora of the Bombay and Salsette Islands has been disturbed by difficulties and circumstances beyond his control. However, during this long period several other collections were made at different times from the same and other localities of the said region and were examined at different institutions on account of the frequent transfers that the author suffered. With the further observations some more diatoms were recorded, making this paper more comprehensive. In this paper the distribution of individual diatoms in the area is also indicated. Several illustrations are given of certain species to suggest the form-change or variation exhibited by them.

Further, the arrangement of diatoms is mostly done according to Cleve-Euler's (1951-55) monograph in consultation with that of Hustedt (1930) and several other publications. The diatoms already recorded in the Indian literature are merely listed here with some necessary notes or remarks; the rest are fully described and illustrated. Of diatoms that are considered to be new taxa, besides their Latin diagnoses, the slide numbers are given in accordance with the International Code of Botanical Nomenclature, Art. 35, 1956. All the material relating to this paper is with the author in his own herbarium.

Again, to validate the new taxa published by the author in his earlier paper on 'Freshwater Diatoms from Kolhapur and its immediate

Environs,' *J. Bombay nat. Hist. Soc.* 55 (3) : 493-511, 1958, the following slide numbers refer to those specific taxa, thus :

*Navicula cuspidata* Kütz f. *brevirostrata* f. nov. : Typus lectus a H. P. Gandhi in lacu Rankala die 18-9-1954, et positus in herbario proprio auctoris sub numero KOP-49, (slide).

*Pinnularia kolhapurensis* sp. nov. : Typus lectus a H. P. Gandhi in lacu Rankala die 9-12-1954, et positus in herbario proprio auctoris sub numero KOP-61, (slide).

*Gomphonema lacus-rankala* sp. nov. : Typus lectus a H. P. Gandhi in lacu Rankala die 9-12-1954, et positus in herbario proprio auctoris sub numero KOP-63, (slide).

*Gomphonema lacus-rankala* v. *robusta* v. nov. : Typus lectus a H. P. Gandhi in lacu Rankala die 9-12-1954, et positus in herbario proprio auctoris sub numero KOP-64, (slide).

*Gomphonema lacus-rankala* v. *gracilis* v. nov. : Typus lectus a H. P. Gandhi in lacu Rankala die 9-12-1954, et positus in herbario proprio auctoris sub numero KOP-65, (slide).

*Gomphonema spicula* sp. nov. : Typus lectus a H. P. Gandhi in lacu Rankala die 18-9-1954, et positus in herbario proprio auctoris sub numero KOP-68, (slide).

#### Genus PINNULARIA Ehrenberg 1840

#### Section TENUISIRIATIAE Å. Berg.

##### 1. *Pinnularia appendiculata* (Ag) Cl (Fig. 1)

Schmidt, A., 1874-1944, *Atlas Diat.* t. 313, f. 10-11; Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (6) : 565, t. 20, f. 13; 1930, *Bacil* 317, f. 570a; Skvortzow, B. W., 1938, *Philipp. J. Sci.* 66 : 169, pl. 2, f. 8; Tiffany & Britton, 1952, *Alg. Illinois* 258, pl. 69, f. 796; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 18, f. 1004 a-d (=v. *genuina* A. Cl).

Valves 44-56.5  $\mu$  long and 6-8.5  $\mu$  broad, linear-lanceolate with weakly constricted, produced subcuneate ends. Raphe thin and straight with central pores unilaterally bent and terminal fissures slightly curved. Axial area quite narrow, linear-lanceolate; central area large, rhomboid, reaching the sides. Striae 12-14 in 10  $\mu$ , radial in the middle and convergent at the ends.

This species agrees well with the type described by Hustedt and others, in the outline, apices, central and axial areas and the nature of the striae. The range of dimensions recorded here closely agree with those indicated by Cleve-Euler, but appear to be larger than those given by Hustedt, Tiffany & Britton, and Skvortzow. The number of striae per 10  $\mu$  are less here than recorded by Hustedt and Tiffany & Britton but agree with

those recorded by Cleve-Euler and Skvortzow. It appears that the number of striae per 10  $\mu$  suffer reduction in larger forms as may be seen from the following table :

Author	Length	Breadth	Striae per 10 $\mu$
Hustedt	18-36 $\mu$	4-6 $\mu$	16-18
Skvortzow	35 $\mu$	5 $\mu$	12-13
Tiffany & Britton	18-36 $\mu$	4-6 $\mu$	16-18
Cleve-Euler	35-58 $\mu$	5-7 $\mu$	(12) 13-16
Local forms	44-56.5 $\mu$	6-8.5 $\mu$	12-14

Again, Berg describes a similar looking form as *P. subcapitata* Greg. (Berg, *Arkiv Bot.* 1945, 32 A(1) : 17, t. 5, f. 176) and Skvortzow as *P. gibba* Ehr (Skvortzow, 1937, *Philipp. J. Sci.* 61 : 278, pl. 5, f. 2), but I am not inclined to refer the present specimens to either *P. subcapitata* or *P. gibba*, which are obviously different species. In fact, Berg's *P. subcapitata* and Skvortzow's *P. gibba*, appear closer to *P. appendiculata* if Cleve-Euler's record is considered, as given in the above table. In any way I consider the present specimens to be *P. appendiculata* in light of the data given above

*Habitat* : Fresh water. Collected from Jogeshwari, Goregaon, Andheri, and Dahisar ponds and pools, usually in a small number.

**2. *Pinnularia molaris* Grun. (Fig. 2)**

Schmidt, 1874-1944, *Atlas Diat.* t. 313, f. 18 ; Hustedt, 1924, *Naturw. Unters. Sarek.* t. 20, f. 8 ; 1930, *Bacil.* 316, f. 568 ; Skvortzow, B. W., 1937, *Philipp. J. Sci.* 62 : 337, pl. 11, f. 9 ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 18, 1005.

Valves 28-33  $\mu$  long and 5.6-6.2  $\mu$  broad, linear-lanceolate with sub-cuneate rounded ends. Raphe thin and straight with curved terminal fissures. Axial area quite narrow ; central area large, rhomboid, reaching the sides. Striae 14-18 in 10  $\mu$ , fine, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Pools and streams at Borivli and Kanheri caves and certain ponds at Andheri, Vile-Parle, Dahisar, and other places. Usually collected as a stray form

Section SUBVIRIDES A. Cl.

**3. *Pinnularia finlandica* A. Cl. (Fig. 3)**

Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 22, f. 1027.

Valves 50-57.5  $\mu$  long and 10-11.2  $\mu$  broad, linear with parallel sides and rounded ends. Raphe thin and straight with central pores unilaterally bent and terminal fissures curved. Axial area fairly wide about 1/4

the width of the valve, linear ; central area slightly dilated and somewhat unilateral. Striae 10-11 in  $10 \mu$ , coarse, slightly radial in the middle and convergent towards the ends.

*Habitat* : Fresh water. Collected from ponds at Andheri and Goregaon, and some pools at Jogeshwari and other places. Not common.

This species agrees well with the type except that it has slightly larger dimensions.

#### Section NODOSAE A. Cl.

##### 4. *Pinnularia braunii* (Grun.) Cl. (Fig. 4)

Hustedt, 1930, Bacil. 319, f. 577 ; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 24, f. 1020 a-c (= *v. genuina* A. Cl. et etiam *v. marginata* A. Cl.) ; Schmidt, A. 1874-1944, Atlas Diat. t. 45, f. 77-78 (= *Navicula brauniana* Grun.) ; Van Heurck, 1896, Treat. Diat. 173, pl. 2, f. 95 (= *Nav. braunii* Grun.).

Valves  $43-50 \mu$  long and  $8.5-9.5 \mu$  broad, broadly lanceolate with constricted, produced capitate ends. Raphe thin and straight with central pores closely set and unilaterally bent and terminal fissures curved. Axial area very wide, lanceolate ; central area very wide, rhomboid, reaching the sides. Striae 10-12 in  $10 \mu$ , very coarse, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from several pools, ponds and tanks in the area, usually in a small number or as a stray form.

##### 5. *Pinnularia polyonca* (Bréb.) O. Müll. (Fig. 5)

Hustedt, 1930, Bacil. 319, f. 576 ; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 24, f. 1021 ; Schmidt, A., 1874-1944, Atlas Diat. t. 45, f. 54-55 (= *Navicula mesotyla* (Pinn.) Ehr.) ; Van Heurck, 1896, Treat. Diat. 174, pl. 2, f. 99 (= *Nav. polyonca* Bréb.).

Valves  $90-100 \mu$  long and  $14-15.2 \mu$  broad, lanceolate with strongly triundulate sides and strongly capitate-cuneate ends. Raphe thin and straight with closely set central pores unilaterally bent and terminal fissures curved. Axial area fairly wide, sublanceolate ; central area large reaching the sides. Striae 8-10-12 in  $10 \mu$ , coarse, radial in the middle and strongly convergent at the ends and closer.

*Habitat* : Fresh water. Collected from pond at Andheri usually as a stray form. Rare in the area.

Cleve-Euler refers *Nav. mesotyla* of Schmidt's 'Atlas' to *P. polyonca* but *N. mesotyla* has rounded ends and therefore differs from *P. polyonca* in this respect.

6. *Pinnularia acrosphaeria* (Bréb.) W. Sm.

*Habitat* : Fresh water as well as somewhat brackish water. Widely distributed in the area, mostly in marginal slime of pools, ponds, and tanks. It was noted to be gregarious in ponds at Andheri and Goregaon.

7. *Pinnularia acrosphaeria* f. *undulata* Cl.

*Habitat* : Fresh water. Sometimes collected along with the species. Not common in the locality.

8. *Pinnularia acrosphaeria* v. *minor* Cl. (Figs. 6-7)

*Habitat* : Fresh water as well as in somewhat brackish water. Widely distributed in the area, but always recorded in a small number.

9. *Pinnularia acrosphaeria* v. *sandvicensis* A. S. (Figs. 8-9)

Schmidt, A., 1874-1944, Atlas Diat. t. 43, f. 14-15, 18 ?

Valves 70-85  $\mu$  long and 12.5-13  $\mu$  broad, linear, strongly inflated in the middle, ends broadly swollen and rounded. Raphe thin and straight with central pores closely set and unilaterally bent and terminal fissures curved. Axial area very wide, about  $1/3$  the width of the valve, linear with fine scattered markings or puncta; central area slightly formed. Striae 9-10 in 10  $\mu$  coarse, weakly radial in the middle, at length perpendicular to the middle line and weakly convergent at the ends.

*Habitat* : Fresh water. Streams at Borivli and Powai lake. Rare.

This diatom is distinguished on account of the strong inflations in the middle and at the ends.

10. *Pinnularia dolosa* sp. nov. (Figs. 10-11)

Schmidt, A., 1874-1944, Atlas Diat. t. 43, f. 17 (=nomen nudum).

Valvae 60-90  $\mu$  longae atque 13-15  $\mu$  latae, lineares, tumidae in medio; apicibus vix dilatatis ac late rotundatis. Raphe evoluta in zona hyalina, ornata poris centralibus proxime positis et unilaterialiter inclinatis, fissuris terminalibus curvatis. Area axialis amplissima, circiter  $1/3$ - $1/2$  latitudinis valvae, linearis et irregulariter subtiliter punctata; area centralis paulum unilaterialiter dilatata. Striae 9-11 in 10  $\mu$ , crassae, paululum radiales in medio, tandem perpendiculares ad lineam mediam ac paulum convergentes ad apices. Typus lectus a H. P. Gandhi ad Andheri die 1945-48, et positus in herbario proprio auctoris sub numero BOM-AND.—43-45.

Valves 60-90  $\mu$  long and 13-15  $\mu$  broad, linear, tumid in the middle; ends scarcely dilated and broadly rounded. Raphe formed in the hyaline zone with central pores closely set and unilaterally bent and terminal fissures curved. Axial area very wide about  $1/3$ - $1/2$  the width of the valve, linear with fine irregularly disposed puncta; central area slightly

unilaterally dilated. Striae 9-11 in  $10\ \mu$ , thick, weakly radial in the middle, at length perpendicular to the middle line and at the ends convergent.

*Habitat* : Fresh water. Collected as a common form in a pond at Andheri. Seen as a constant form for a period of almost three years.

An illustration occurs in Schmidt's *ATLAS DIAT.*, without name, but it has been remarked that it is somewhere intermediate between *Navicula* (*Pinnularia*—Ehr. ?) *macilenta* and *Navicula* (*Pinn.*) *acrosphaeria* Bréb., 'ATLAS DIAT.', t. 43, f. 9 and 16 respectively. From my continued observation of this species, I find it to be related to *P. acrosphaeria* (Bréb) W. Sm. However, it differs from *P. acrosphaeria* in having non-dilated apices, clear hyaline zone around the raphe, much wider axial area, and the puncta in the axial area being much finer. It is therefore considered to be a new species and placed near *P. acrosphaeria*, being related to it.

11. *Pinnularia dolosa* v. *chariessa* v. nov. (Fig. 12)

Valvae 117-120  $\mu$  longae atque 16-17  $\mu$  latae, sublanceolatae, tumidae in medio ac apicibus rotundatae. Raphe, zona hyalina, atque area axialis ut in typo. Area centralis ampla, ad latera perveniens. Striae 8-9 in  $10\ \mu$ , crassae, paulum radiales in medio, tandem perpendiculares ad lineam mediam ac paulum convergentes ad apices, ut in typo. Typus lectus a H. P. Gandhi ad Andheri die 1946-48, et positus in herbario proprio auctoris sub numero BOM-AND.—47.

Valves 117-120  $\mu$  long and 16-17  $\mu$  broad, sublanceolate, tumid in the middle with rounded ends. Raphe, hyaline zone, and the axial area as in the type. Central area large and extended to the sides. Striae 8-9 in  $10\ \mu$ , thick, weakly radial in the middle and at the ends slightly convergent as in the type.

*Habitat* : Fresh water. Collected from a pond at Andheri along with the type but in a smaller number or as a stray form.

This diatom differs from the above type in being gracefully lanceolate. Moreover, the central area is extended to the sides and the striae are more widely set; therefore they count less in number than in the type.

Section *DISTANCES* Cleve

12. *Pinnularia ueno* Skvortzow v. *wadalensis* v. nov. (Figs. 13-14)

Valvae 32-47.5  $\mu$  longae atque 10-11.7  $\mu$  latae, lineares, marginibus parallelis vel paululum concavis, apicibus cuneatis, late rotundato-truncatis. Raphe crassa, poris centralibus unilateraliter inclinatis ac fissuris terminalibus aliquantum curvatis. Area axialis modica, lineari-lanceolata; area centralis ampla, rhomboidea ad latera pertingens. Striae 6.5-8 in  $10\ \mu$ , crassae, radiales in medio ac paulum convergentes

in utroque apice. Typus lectus a H. P. Gandhi ad Wadala die 31-7-1945, et positus in herbario proprio auctoris sub numero BOM-WAD.—5-7.

Valves 32-47.5  $\mu$  long and 10-11.7  $\mu$  broad, linear with parallel or weakly concave sides and cuneate, broadly truncate-rounded ends. Raphe thick with central pores unilaterally bent and terminal fissures slightly curved. Axial area moderate, linear-lanceolate; central area large, rhomboid, reaching the sides. Striae 6.5-8 in 10  $\mu$ , thick, radial in the middle and slightly convergent at the ends.

*Habitat*: Fresh water. Collected from pools and ponds at Wadala as a frequent form during post-monsoon seasons. Some stray specimens also were recorded from Powai lake.

This diatom agrees very closely with *P. ueno* Skv. (Skvortzow, 1937, *Philipp. J. Sci.* 61: 44, pl. 7, f. 1), in the outline, arrangement of striae, and other details. However, of the specimens collected here the dimensions are much smaller. Moreover, the striae are fewer in number than in *P. ueno*, hence it differs. Again, Foged has described a similar looking form as *P. microstauron* (Ehr.) Cl. (Foged, N., 1955, *Medd. om Gronland* 127: 59, pl. 11, f. 21), which is in fact very different from *P. microstauron* (Ehr.) Cl. I am not sure if it could be the same. However, I am inclined to consider it with the present diatom, since it bears great likeness. Further, I place the present diatom under 'Distantes' group on account of the robust and distantly set striae.

#### Section BREVISIRIAIAE Cleve em.

##### 13. *Pinnularia brevicostata* Cl. v. *indica* v. nov. (Fig 15)

Valvae 90-95  $\mu$  longae atque 19.8-20.5  $\mu$  latae, lineari-ellipticae ac apicibus rotundatis. Raphe tenuis vel crassa, ornata poris centralibus distinctis, unilateraliter inclinata ac fissuris terminalibus paulum curvatis. Area axialis amplissima, circiter 1/3-1/2 latitudinis valvae, sublanceolata; area centralis obscura. Striae 5.5-6 in 10  $\mu$ , crassissimae, aliquantum radiales in medio atque in utroque apice convergentes. Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—18.

Valves 90-95  $\mu$  long and 19.8-20.5  $\mu$  broad, linear-elliptical with rounded ends. Raphe thin or thick with central pores distinct and unilaterally bent and terminal fissures slightly curved. Axial area very wide, about 1/3-1/2 the width of the valve, sublanceolate; central area not obvious. Striae 5.5-6 in 10  $\mu$  very coarse, slightly radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from Borivli streams and Powai lake as a stray form.

This diatom in its general features agrees well with *P. brevicostata* Cl. (Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 37, f. 1045 a-b) (= *v. genuina* A. Cl.) and its other varieties. However, the present specimens differ from the type in having more uniformly convex sides, somewhat smaller size, and coarser and therefore fewer striae. It is, therefore, tentatively regarded as a new variety.

14 *Pinnularia meisteri* A. Cl. *v. scandica* A. Cl. (Fig. 16)

Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 40, f. 1050 b.

Valves 61-68  $\mu$  long and 11-13  $\mu$  broad, broadly linear, slightly swollen in the middle with somewhat inflated rounded ends. Raphe thin and straight with terminal fissures curved. Axial area narrow, linear; central area only slightly dilated. Striae about 12 in 10  $\mu$ , coarse, slightly radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from some pools and ponds at Wadala, Goregaon, Vile-Parle, and streams at Borivli. Not common.

Section LUNULAE A. Cl.

15. *Pinnularia stomatophora* Grun. *v. triundulata* Font. (Fig. 17)

Hustedt, 1942, *Int. Rev. Hydrobiol. Hydrogr.* 42 (1/3): 88, f. 168-170; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 41, f. 1053 d (= *P. stomatophoroides* Mayer f. *triundulata* (Font.) A. Cl.).

Valves 115-118  $\mu$  long and 13.7-14  $\mu$  broad, sublinear, with triundulate sides and produced capitate rounded ends. Raphe slightly thick and straight with bayonet-shaped terminal fissures. Axial area somewhat narrow, linear; central area without lunulae, large, rhomboid, reaching the sides. Striae 10-12 in 10  $\mu$ , coarse, strongly radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Tansa lakes, mostly as a stray form.

Some specimens of this diatom found in the collections, none showed lunulae in the central area, which are supposed to be the characteristic feature of the type. However, Hustedt illustrated a form (fig. 169) without lunulate markings and in the remarks stated that a good deal of variation seemed to occur in the species. Cleve-Euler has treated the same as *P. stomatophoroides* Mayer f. *triundulata* (Font.) A. Cl., without assigning any reasons as I believe. I do not favour Cleve-Euler's diagnosis, since *P. stomatophoroides* was established in 1940, much later than *P. stomatophora* Grun. *v. triundulata* Font. 1917.

Further, the present diatom also agrees with *P. gibba* f. *subundulata* Mayer (Hustedt, 1930, Bacil. 327, f. 601) in the outline, central and axial areas, and the number of striae. However, I separate the same on



the basis of thicker raphe and bayonet-shaped terminal fissures taking them as characteristic features of *P. stomatophora*. A more or less similar diatom has been described by Skvortzow as *P. platycephala* (Ehr.) Cl. v. *hattoriana* Skv. (Skvortzow, 1935, *Philipp. J. Sci.* 57 : 470, pl. 2, f. 4 ; 1937, *ibid* 61 : 41, pl. 6, f. 2), having bayonet-shaped terminal fissures and triundulate sides. However, this diatom has not been well understood, since Skvortzow illustrated the type somewhat differently in the papers hitherto cited. Moreover, *P. platycephala* has terminal fissures bent in opposite directions, and this feature being of diagnostic importance for the type finds no appearance in the variety v. *hattoriana* Skv.

#### Section PARALLELAE A. Cl.

##### 16. *Pinnularia episcopalis* Cleve (Fig. 18)

Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (6) : 569, t. 21, f. 1 ; 1930, *Bacil.* 323, f. 592 ; Mills, F., 1932, *J. roy. microsc. Soc.* 52 : 389, pl. 3, f. 30 ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 47, f. 1063 c (= v. *elliptica* A. Cl.).

Valves 108-112  $\mu$  long and 24.6-25  $\mu$  broad, subelliptical with rounded ends. Raphe thin, slightly bent with central pores large, somewhat hook-like and terminal fissures oblique and slightly curved. Axial area linear ; central area somewhat quadrate, reaching the sides. Striae 8-9 in 10  $\mu$ , thick, closely set, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from Powai and Tansa lakes in a smaller number. Stray specimens also were collected from some hill-streams at Borivli.

##### 17. *Pinnularia platycephala* (Ehr.) Cl. (Fig. 19)

Schmidt, A., 1874-1944, *Atlas Diat.* t. 310, f. 6-8 ; Hustedt, 1930, *Bacil.* 324, f. 593 ; Berg, 1945, *Ark. Bot.* 32 A (1) : 15, t. 4, f. 155 ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 47, f. 1065 a-b. (= v. *genuina* A. Cl.).

Valves 81-95  $\mu$  long and 16.5-17.5  $\mu$  broad, linear or sublinear, sides distinctly triundulate, ends broadly capitate-rounded (two ends somewhat differ in appearance). Raphe thin, not quite straight, with large central pores and terminal fissures thick, sharply curved in the opposite directions. Axial area somewhat narrow, linear ; central area quadrate, somewhat narrow while reaching the sides. Striae 9-11 in 10  $\mu$ , coarse, strongly radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from ponds at Andheri, Dahisar, and Goregaon, streams at Borivli, and Powai lake. It occurred in a small number. Not common.

## Section DIVERGENIES Cleve em.

18. *Pinnularia legumen* Ehr. v. *florentina* (Grun.) Cl.

*Habitat* : Fresh water. Collected from streams at Borivli, Powai and Tansa lakes, usually in a small number.

19. *Pinnularia scythica* (Pant.) Gandhi, comb. nov. (Fig 20)

*Navicula scythica* Pantocsek, Beitr. Kenn. foss. Bacil.—III, 81, t. 23, f. 335, 1905; Schmidt, A., 1874-1944, Atlas Diat. t. 45, f. 30? (= *P. decurrens* Ehr.); t. 391, f. 9-10 (= *P. krasskei* Hust. v. *ventricosa* Hust.).

Valves 87.4-92  $\mu$  long and 16.6  $\mu$  broad, linear-lanceolate with uniformly convex sides and constricted, broadly produced rounded ends. Raphe thin or somewhat thick with central pores distinct and terminal fissures curved. Axial area about 1/5-1/4 the width of the valve, sub-linear; central area large and more or less elliptical. Striae 9-10 in 10  $\mu$ , thick, closely set, strongly radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from Powai and Tansa lakes in good number, and some stray specimens were recorded from a tank at Bandra and some other larger ponds. Not quite common.

This agrees well with Pantocsek's *Nav. scythica* Pant., which from the illustration evidently appears to be *Pinnularia* on account of the smooth costae. Here, therefore, Pantocsek's *Nav. scythica* is emended. From further survey of the literature, *P. decurrens* Ehr. (Schmidt's 'Atlas' t. 45, f. 30) more or less compares here, except that it has more evident lanceolate shape and less apparently constricted produced ends. Again, in the 'Atlas' *P. krasskei* Hust. v. *ventricosa* Hust. (t. 391, f. 9-10) is illustrated, which very closely agrees with the present specimens as well as with Pantocsek's *Nav. scythica* in the outline, apices, central and axial areas, and the number and arrangement of the striae. I, therefore, consider *P. krasskei* v. *ventricosa* Hust. identical with *Nav. scythica* Pant., the latter needing emendment of its generic name, which I here-with effect.

20. *Pinnularia divergens* W. Sm. (Fig 21)

Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (6) : 568, t. 22, f. 4; 1930, *Bacil.* 323, f. 589; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 51, f. 1071 a (= v. *minor* A. S.); Schmidt, A., 1874-1944, *Atlas Diat.* t. 44, f. 42, (= *Nav. divergens* (Pinn.) W. Sm. f. *minor* A. S.).

Valves 80-87.5  $\mu$  long and 14.4-15  $\mu$  broad, linear-lanceolate with constricted, broadly produced, rounded ends. Raphe thin and somewhat undulate with central pores unilaterally bent and terminal fissures thick and more or less bayonet-shaped. Axial area linear; central area large, rhomboid, reaching the sides with conical projections formed on

the sides. Striae 9-11 in  $10\ \mu$ , thick, congested, strongly radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from Borivli streams, Powai and Tansa lakes, as a less frequent form. It was usually found in brownish masses of decaying vegetable matter lying on the margins.

21. *Pinnularia divergens* v. *undulata* Hér. & Perag. (Fig. 22)

Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (5) : 568, t. 22, f. 5 ; 1930, *Bacil.* 323, f. 591 ; Skvortzow, B. W., 1938, *Philipp. J. Sci.* 66 : 171, pl. 1, f. 28 ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 52, f. 1071 d.

Valves  $68-75\ \mu$  long and  $13-13.5\ \mu$  broad, linear-lanceolate with distinctly triundulate sides and constricted, broadly produced rounded ends. Striae 10 in  $10\ \mu$ . In all other features alike the above type.

*Habitat* : Fresh water. Collected from Powai and Tansa lakes and ponds at Andheri, Goregaon, and Vile-Parle. Not quite common.

22. *Pinnularia divergens* v. *elliptica* Grun. (Fig. 23)

Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (6) : t. 21, f. 1 ; 1930, *Bacil.* 323, f. 590 ; Mills, F. W., 1932, *J. roy. microsc. Soc.* 52, 389, pl. 1, f. 14 ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 52, f. 1071 e.

Valves  $68-90\ \mu$  long and  $15-18\ \mu$  broad, linear-elliptical with rounded ends. Striae 8-10 in  $10\ \mu$ . In all other details like the type described above.

*Habitat* : Fresh water. Collected as a common form from Andheri and Goregaon ponds. Stray specimens were also collected from some larger pools and streams at Borivli.

23. *Pinnularia divergens* v. *capitata* Mills (Fig. 24)

Mills, F. W., 1932, *J. roy. microsc. Soc.* 52 : 389, pl. 2, f. 15.

Valves  $65-81\ \mu$  long and  $12.8-14\ \mu$  broad, linear-lanceolate with weakly triundulate sides and constricted, broadly capitate rounded ends. Axial area somewhat narrow, linear. Striae 10-12 in  $10\ \mu$ . In all other details like the type described above.

*Habitat* : Fresh water. Collected from Powai, Vihar, and Tansa lakes, inhabiting decaying mass of vegetable matter. Fairly common. Isolated specimens also were recorded from a pond at Andheri.

This diatom agrees well with the specimen described by Mills, except that the breadth here is much less. From the measurement of the illustration given by Mills it appears that some mistake has crept in, since the breadth given in the text is  $0.025\ \text{mm}$ . whereas by measurement it comes out to be  $0.01566\ \text{mm}$ . With the measured dimensions, therefore, my specimens agree more or less quite well with those of Mills ; so I treat my speci-

mens. Moreover, some smaller specimens also have been recorded from the present region.

Again, a reference is cited by Mills, which refers to Schmidt's 'Atlas' t. 44, f. 12 (an illustration without name), to be *P. divergens* v. *capitata*. I think this to be different, since Mills's illustration clearly shows triundulate sides whereas in the 'Atlas' that is not the case.

Further, Cleve-Euler described a diatom under a similar name, i.e. *P. divergens* v. *capitata* n. v. (Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 53, f. 1071 k), which befits *P. divergens* characteristics, but greatly differs from Mills's and present specimens. According to the International Code of Botanical Nomenclature, one name for two different specimens cannot hold good and at the same time rule of priority has to be observed. Under the circumstances, therefore, Cleve-Euler's specimen needs a new name.

#### 24. *Pinnularia brébissonii* (Kütz.) Cl. (Fig. 25)

Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 53, f. 1071a (= v. *genuina* O. Müll.); Schmidt, A., 1874-1944, Atlas Diat. t. 44, f. 17-19 (= *Navicula brébissonii* Kütz.); Van Heurck, 1896, Treat. Diat. 171, pl. 2, f. 82 (= *Nav. brébissonii* Kütz.); Pantocsek, J., 1905, *Beitr. z. Kenn. foss. Bacil.* III, 65, t. 19, f. 279 (= *Nav. brébissonii* v. *fossilis* Pant.); Hustedt, 1930, *Bacil.* 321, f. 584 (= *P. microstauron* (Ehr.) Cl. v. *brébissonii* (Kütz.) Hust.); Foged, N., 1949, *Dansk Bot. Ark.* 13 (6) : 30, II, f. 11 (= *P. microstauron* v. *brébissonii*); Jurilj, A., 1954, *Jugoslav Akad. Znan. Umjet* 1954 : 141, f. 44 a-b (= *P. microstauron* v. *brébissonii*).

Valves 60  $\mu$  long and 14.8  $\mu$  broad, linear-elliptical to subelliptical with subcuneate rounded ends. Raphe thin and straight with unilaterally bent central pores and slightly curved terminal fissures. Axial area fairly wide, linear-lanceolate; central area large, rhomboid, reaching the sides. Striae 10-11 in 10  $\mu$ , coarse, radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from ponds at Andheri and Goregaon, usually in a small number. Stray specimens were also observed in some of the samples from Powai lake.

The present species conforms well with illustrations given in the 'Atlas' and by Pantocsek, Van Heurck, Foged, and Jurilj. However, Foged and Jurilj show somewhat narrower axial area. Hustedt's illustration differs much more than in the works hitherto cited in as much as that it has more linear outlines and somewhat distinctly cuneate ends. It is possible to keep Hustedt's specimen apart to be treated as variety of the present species, which is being done by Cleve-Euler (v. *acuta* A. Cl.)

25. *Pinnularia brébissonii* v. *producta* A. Cl. (Fig. 26)

Some larger specimens were recorded from the area than those found from paddy and millet fields at Mugad. Moreover, the present specimens have comparatively a fewer striae (dimensions  $53-63 \times 12-14 \mu$ , str. 8.5-10 in  $10 \mu$ ).

*Habitat*: Fresh water. Collected from several ponds, large pools and tanks in the area. More frequently noted in a pond at Goregaon.

26. *Pinnularia brébissonii* v. *producta* f. *biundulata* (O. Müll.) A. Cl. (Fig. 27)

The specimens recorded from the area are comparatively smaller than those recorded from Mugad area (dimensions recorded here:  $29-40 \times 6.2-8 \mu$ , str. 10-12 in  $10 \mu$ ).

*Habitat*: Fresh water. Collected from lakes, ponds, and tanks in the area. Fairly distributed.

27. *Pinnularia balatonis* (Pant.) Gandhi, comb. nov. (Fig. 34)

*Navicula balatonis* Pantocsek, *Res. Wiss. Erf. Balat.* 2 (2): 33, t. 3, f. 64, 1902; Skvortzow, B. W., 1928-32, *Ceylon J. Sci.* 11: 256, pl. 33, f. 4 (= *P. microstauron*  $\beta$  *brébissonii* (Kütz.) May. v. *ceylonica* Skv.); Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 55, f. 1072 t. (= *P. brébissonii* v. *acuta* A. Cl.)

Valves  $46-51.3 \mu$  long and  $10-12 \mu$  broad (in the middle  $8-9 \mu$ ), linear with concave sides and subcuneate rounded ends. Raphe thin and more or less straight, terminal fissures curved. Axial area narrow, sublinear; central area large, rhomboid, reaching the sides. Striae 9-10 in  $10 \mu$ , coarse, radial in the middle and convergent at the ends, middle striae gradually abbreviated.

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Vihar lakes. Not common.

This species agrees very closely with Pantocsek's *Nav. balatonis* Pant., which is in fact a *Pinnularia* type as suggested by the illustration. Cleve-Euler also probably considers it to be a *Pinnularia* as suggested by the remark: 'a plumper form than that of Hustedt's *P. microstauron* v. *brébissonii* (Kütz.) Hust.' I, therefore, merit the remarks of Cleve-Euler and effect the emendment by recognising *Nav. balatonis* as *Pinnularia balatonis*.

Further, I consider *P. balatonis* (Pant.) Gandhi to be a distinct species, since I never found it in association of *P. brébissonii* (Kütz.) Cl. Moreover, its outline and the arrangement of striae appear to be different from *P. brébissonii*, which can be appreciated only on close comparison. However, it may be remarked that it has a close affinity with *P. brébissonii*.

Again from the literature it appears that Skvortzow described a form from Ceylon which is almost identical with the present one, except that it has slightly smaller range of dimensions (dimensions :  $40-43 \times 8.5 \mu$ , str. 12 in  $10 \mu$ ). Likewise Cleve-Euler's *P. brébissonii* v. *acuta* 'fig. 1072 t' agrees well here (dimensions :  $37-43 \times 8-10 \mu$ , str. 13 in  $10 \mu$ ). Giving little importance to these size differences, I herewith propose to refer Skvortzow's *P. microstauron*  $\beta$  *brébissonii* v. *ceylonica* Skv. and Cleve-Euler's *P. brébissonii* v. *acuta* 'fig. 1072 t only' to *P. balatonis* (Pant.) Gandhi, having range of dimensions :  $37-51.3 \times 8-13 \mu$ , striae 9-13 in  $10 \mu$ .

28. *Pinnularia microstauron* (Ehr.) Cl (Figs 28-29)

*Habitat*: Fresh water. Collected from various small and large bodies of water in the region. It was usually found in rotting masses of vegetable matter spread on the edges of pools. Common but never found to be gregarious.

29. *Pinnularia divergentissima* (Grun.) Cl (Fig 30)

Schmidt, A., 1874-1944, Atlas Diat. t. 45, f. 59-60? (without name); t. 388, f. 23-24; Hustedt, 1930, Bacil. 320, 581; Berg, Å., 1945, *Ark. Bot.* 32 A (1): 15, t. 4, f. 159; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 57, f. 1077 a-d (= v. *genuina* A. Cl.).

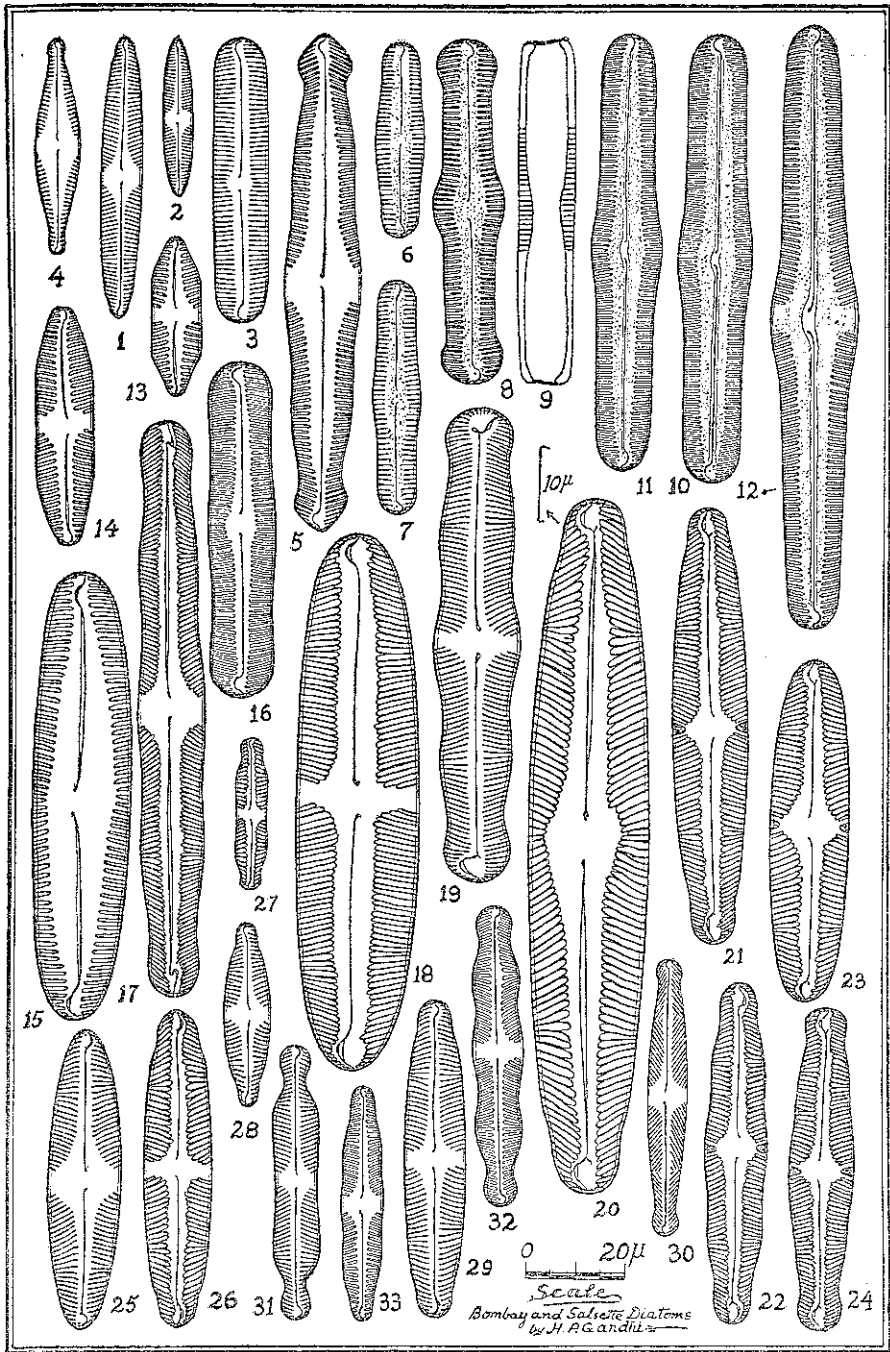
Valves  $50-55.2 \mu$  long and  $7.6 \mu$  broad, narrowly lanceolate with broadly rounded capitate ends. Raphe thin and straight with central pores slightly unilaterally bent and terminal fissures curved. Axial area very narrow, linear; central area large, rhomboid, reaching the sides. Striae 11-13 in  $10 \mu$ , very strongly radial in the middle and convergent at the ends, the angle formed between radial and convergent striae is about  $115^\circ$ .

*Habitat*: Fresh water. Collected from ponds at Goregaon, Andheri, Vile-Parle, and other places. Stray forms also were collected from Powai lake and streams at Borivli. Not common.

30. *Pinnularia termes* Ehr. v. *termitina* (Ehr.) A. Cl. (Fig. 31)

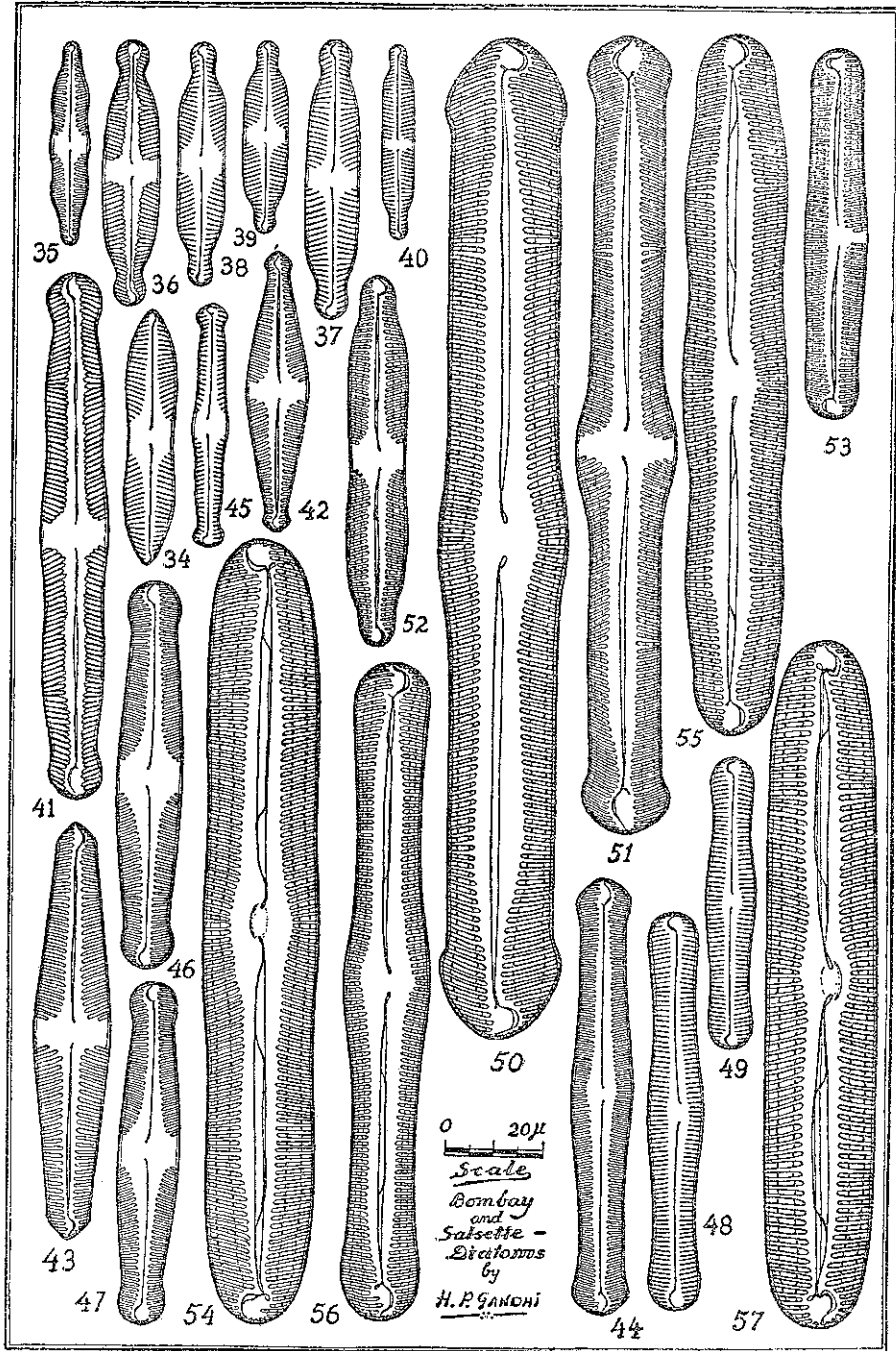
Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 60, f. 1085 c; Schmidt, A., 1874-1944, Atlas Diat. t. 45, f. 64 (= *Navicula termitina* Ehr.).

Valves  $50-55 \mu$  long and  $7.2 \mu$  broad, narrowly linear with distinctly concave sides and strongly constricted, somewhat produced, broadly capitate rounded ends. Raphe thin and straight with central pores unilaterally bent and terminal fissures curved. Axial area linear; central area wide, rhomboid, reaching the sides. Striae  $10-12 \mu$   $10 \mu$ , well marked, radial in the middle and convergent at the ends.



FIGURES 1-33

Fig. 1. *Pinnularia appendiculata* (Ag.) Cl.; 2. *Pinnularia molaris* Grun.; 3. *Pinnularia finlandica* A. Cl.; 4. *Pinnularia braunii* (Grun) Cl.; 5. *Pinnularia polyonca* (Bréb.) O Müll.; 6-7. *Pinnularia acrosphaeria* (Bréb.) W. Sm v. *minor* Cl.; 8-9. *Pinnularia acrosphaeria* v. *sandvicensis* A. S.; 10-11. *Pinnularia dolosa* sp. nov.; 12. *Pinnularia dolosa* v. *chariessa* v. nov.; 13-14. *Pinnularia ueno* Skv. v. *wadalensis* v. nov.; 15. *Pinnularia brevicostata* Cl. v. *indica* v. nov.; 16. *Pinnularia meisteri* A. Cl. v. *scandica* A. Cl.; 17. *Pinnularia stomatophora* Grun. v. *triundulata* Font.; 18. *Pinnularia episcopalis* Cleve; 19. *Pinnularia platycephala* (Ehr.) Cl.; 20. *Pinnularia scythica* (Pant.) Gandhi; 21. *Pinnularia divergens* W. Sm.; 22. *Pinnularia divergens* v. *undulata* Hér & Perag.; 23. *Pinnularia divergens* v. *elliptica* Grun.; 24. *Pinnularia divergens* v. *capitata* Mills; 25. *Pinnularia brébissonii* (Kütz.) Cl.; 26. *Pinnularia brébissonii* v. *producta* A. Cl.; 27. *Pinnularia brébissonii* v. *producta* f. *biundulata* (O. Müll.) A. Cl.; 28-29. *Pinnularia microstauron* (Ehr.) Cl.; 30. *Pinnularia divergentissima* (Grun.) Cl.; 31. *Pinnularia termes* Ehr. v. *termitina* (Ehr.) A. Cl.; 32. *Pinnularia mesolepta* Ehr v. *stauroneiformis* Grun; 33. *Pinnularia mesolepta* v. *indica* v. nov.



FIGURES 34-57

Fig. 34. *Pinnularia balatonis* (Pant.) Gandhi; 35. *Pinnularia mesolepta* v. *indica* v. nov.; 36. *Pinnularia lundii* Hust.; 37-39. *Pinnularia interrupta* W. Sm.; 40. *Pinnularia subcapitata* Greg v. *hilseana* (Jan.) O. Müll.; 41. *Pinnularia graciloides* Hust.; 42. *Pinnularia lacus-biwa* Skv. f. *minor* f. nov.; 43. *Pinnularia nakaii* Skv. v. *indica* v. nov.; 44. *Pinnularia stauroptera* (Rabh.) Cl. ? Grun.; 45. *Pinnularia stauroptera* v. *clevei* Meister f. *hyalina* (Perag. & Hér.) A. Cl.; 46-47. *Pinnularia gibba* Ehr.; 48-49. *Pinnularia simplex* sp. nov.; 50. *Pinnularia major* (Kütz.) Cl. v. *sendaiensis* Hust.; 51. *Pinnularia hartleyana* Grev. v. *pulchella* Mills; 52. *Pinnularia nipponica* Skv.; 53. *Pinnularia kiusiuensis* Skv.; 54. *Pinnularia neglecta* (Mayer) A. Berg.; 55. *Pinnularia neglecta* v. *undulata* v. nov.; 56. *Pinnularia pseudoluculenta* sp. nov.; 57. *Pinnularia streptoraphe* Cleve.



*Habitat* : Fresh water. Collected from Powai and Vihar lakes quite frequently. Stray specimens also were collected from ponds at Andheri and Goregaon and a tank at Bandra. Not common.

31. *Pinnularia mesolepta* Ehr. v. *stauroneiformis* Grun. (Fig. 32)

Hustedt, 1914, *Arch. Hydrobiol.* 10 : 142, t. 1, f. 12 ; Skvortzow, B. W., 1928, *Philipp. J. Sci.* 35 : 43, pl. 2, f. 20 ; Schmidt, A., 1874-1944, *Atlas Diat.* t. 45, f. 71½ (= *Navicula mesolepta* Ehr. v. *stauroneiformis* A. S. ?).

Valves 57.6-60  $\mu$  long and 9-10  $\mu$  broad, linear with strongly triundulate sides and somewhat narrowed, produced, broadly rounded capitate ends. Raphe thin and straight with central pores unilaterally bent or not ; terminal fissures curved. Axial area somewhat narrowly linear ; central area large, quadrate, reaching the sides. Striae 9-10 in 10  $\mu$ , coarse, strongly radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from ponds at Goregaon, Dahisar, Vile-Parle, Jogeshwari, streams at Borivli, tank at Bandra, and Powai lake, mostly in a small number.

32. *Pinnularia mesolepta* v. *indica* v. nov. (Figs. 33, 35)

Valvae 38.7-50  $\mu$  longae atque 8.2-8.8  $\mu$  latae, lineari-lanceolatae, marginibus distincte triundulatis, apicibus leniter constrictis, elongato-rotundatis. Raphe tenuis et recta, fissuris terminalibus curvatis. Area axialis sublinearis; area centralis magna, rhomboidea, ad latera perveniens. Striae circiter 9 in 10  $\mu$ , crassae, radiales in medio ac in utroque apice convergentes. Typus lectus a H. P. Gandhi ad Wadala die 31-7-1945, et positus in herbario proprio auctoris sub numero BOM-WAD.—4.

Valves 38.7-50  $\mu$  long and 8.2-8.8  $\mu$  broad linear-lanceolate with distinct triundulate sides and softly constricted, produced rounded ends. Raphe thin and straight with terminal fissures curved. Axial area, sublinear ; central area large, rhomboid, reaching the sides. Striae about 9 in 10  $\mu$ , coarse, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from pools and ponds at Wadala as a frequent form.

This diatom agrees closely with *P. mesolepta* Ehr. and its forms and varieties (Hustedt, 1930, *Bacil.* 319, f. 575 a-b ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 60-61; f. 1087), in triundulate sides, raphe, axial and central areas and the arrangement of striae. However, it differs from them in having linear-lanceolate outline with softly constricted produced ends. It is a more robust diatom than *P. mesolepta* f. *angusta* Cl. (Hustedt, *op. cit.* f. 575 b = *P. pulchra* Østr. v. *gemina* A. Cl. Cleve-Euler, *op. cit.* 27, f. 1025 d), since the length to breadth proportions here are 4.7-5.7 : 1, in contrast to 7-8 : 1 as indicated by Hustedt. With

these differing features, therefore, the present specimens are tentatively considered to be a new variety.

33. *Pinnularia lundii* Hust. (Fig. 36)

Hustedt, 1954, *Arch. Hydrobiol.* 48 (4) : 474, f. 61-63

Valves 40-53.7  $\mu$  long and 9.5-11.5  $\mu$  broad, linear-lanceolate or linear-elliptical with constricted, broadly capitate rounded ends. Raphe thin and straight with central pores unilaterally bent and terminal fissures curved. Axial area moderate, narrowly lanceolate; central area wide, reaching the sides. Striae 11-13 in 10  $\mu$ , coarse, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from Borivli streams, Powai and Vihar lakes, in good number; elsewhere seen rather as a stray form.

A form in my earlier paper described as *P. biceps* Greg. v. *amphicephala* (May.) A. Cl. (Gandhi, 1958, *J. Bombay nat. Hist. Soc.* 55 : 498, f. 23), I am not sure if it could be this species, since my Kolhapur form shows slightly a different arrangement of the middle striae as a result of which the central area appears to be much enlarged.

34. *Pinnularia interrupta* W. Sm. (Figs. 37-39)

*Habitat* : Fresh water. Collected from various wet situations in the region. It was found to be a variable species and the typical forms noted from the region are herewith depicted. Quite common in the area.

35. *Pinnularia subcapitata* Greg v. *hilseana* (Jan.) O. Müll. (Fig. 40)

Hustedt, 1930, *Bacil.* 317, f. 572; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 65, 1090 n-r; Schmidt, A., 1874-1944, *Atlas Diat.* t 45, f. 65 (= *Navicula hilseana* Janisch).

Valves 39-42  $\mu$  long and 6  $\mu$  broad, narrow, linear with or without indistinctly concave sides and constricted, produced subcapitate rounded ends. Raphe thin and straight, terminal fissures curved. Axial area very narrow; central area large, reaching the sides. Striae 11-13 in 10  $\mu$ , radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from Powai and Vihar lakes as a common form. Isolated or stray specimens also were noted from streams at Borivli.

36. *Pinnularia graciloides* Hust. (Fig. 41)

*Habitat* : Fresh water. Collected from Powai and Vihar lakes as a common form and stray specimens were recorded from Borivli streams.

37. *Pinnularia conica* Gandhi

*Habitat* : Fresh water. Collected from various ponds, large pools and tanks. It occurred mostly in small number. Common.

38. *Pinnularia lacus-biwa* Skv f. *minor* f. nov. (Fig. 42)

Valvae 54-56  $\mu$  longae atque 12.4  $\mu$  latae, lanceolatae, apicibus constrictis, capitato-cuneatis. Raphe crassa sed simplex, ornata poris aliquantum unilateraliter inclinatis, fissuris terminalibus curvatis. Area axialis lanceolata; area centralis ampla, rhomboidea, ad latera perveniens. Striae 8-9 in 10  $\mu$ , crassae, radiales in medio ac convergentes ad apices. Typus lectus a H. P. Gandhi in lacu Powai die 28-1-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—18.

Valves 54-56  $\mu$  long and 12.4  $\mu$  broad, lanceolate with constricted capitate-cuneate ends. Raphe thick but simple with central pores slightly unilaterally inclined and terminal fissures curved. Axial area lanceolate; central area large, rhomboid, reaching the sides. Striae 8-9 in 10  $\mu$ , thick, radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Vihar lakes. Rather rare, since only a few specimens were seen.

This diatom agrees well with *P. lacus-biwa* Skv (Skvortzow, B. W., 1937, *Philipp. J. Sci.* 61: 280, pl. 6, f. 8) in the outline, raphe, axial and central areas, and the arrangement of the striae. However, the present specimens differ in being much smaller than the type. It is, therefore, provisionally considered to be a new form.

39. *Pinnularia nakaii* Skv v. *indica* v. nov. (Fig. 43)

Valvae 80-83.6  $\mu$  longae atque 15.4  $\mu$  latae, lanceolatae, apicibus aliquantum productis late cuneatis. Raphe crassa sed simplex et recta, ornata poris centralibus unilateraliter inclinatis, fissuris terminalibus curvatis. Area axialis ampla, lineari-lanceolata; area centralis magna, ad margines perveniens. Striae 7-8 in 10  $\mu$ , crassae, radiales in medio atque in utroque apice convergentes. Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—20

Valves 80-83.6  $\mu$  long and 15.4  $\mu$  broad, lanceolate with slightly produced, broadly cuneate ends. Raphe thick but simple and straight with central pores unilaterally bent and terminal fissures curved. Axial area fairly wide, linear-lanceolate; central area large, reaching the sides. Striae 7-8 in 10  $\mu$ , thick, radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from Powai lake rather as a stray diatom.

This diatom agrees well with *P. nakaii* Skv., as described by Skvortzow (Skvortzow, B. W., 1937, *Philipp. J. Sci.* 61: 280, pl. 8, f. 4), in the outline, raphe, axial and central areas, and the nature of striae and their arrangement. However, the local specimens differ in being comparatively

smaller, broader hence more lanceolate, and the ends are not marked to be capitate. With these differences observed, it is therefore considered to be a new variety.

Section TABELLARIAE Cleve

40. *Pinnularia stauroptera* (Rabh.) Cl. ? Grun (Fig. 44)

Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 66, f. 1091 a-c (=v. *genuina* Mayer); Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (6) : 569, t. 19, f. 9-10 (= *P. stauroptera* Grun); 1930, Bacil. 327, f. 600 a-b (= *P. gibba* Ehr.); Donkin, A. S., 1871-73, Brit. Diat. III, 70, pl. 12, f. 3 (= *Navicula tabellaria* Ehr.); Schmidt, A., 1874-1944, Atlas Diat. t. 45, f. 50-51 (= *N. gibba* (Pinn.) Ehr.); Van Heurck, 1896, Treat. Diat. 172, pl. 2, f. 86 (= *N. tabellaria* Ehr.).

Valves 66-88.7  $\mu$  long and 12.6-13  $\mu$  broad, linear, inflated in the middle with swollen rounded ends somewhat cuneate. Raphe thin and straight with central pores approximate and unilaterally bent and terminal fissures curved. Axial area very broad, linear-lanceolate; central area not quite defined. Striae about 10 in 10  $\mu$ , coarse, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from Borivli streams, Powai and Vihar lakes, tank at Bandra, and as a stray form in several large bodies of water in the region. Fairly distributed.

This species I have referred to *P. stauroptera* according to Cleve-Euler, since from my some years of collections and observations I felt it to be different from *P. gibba* Ehr., which is described in the following. The references cited here all more or less point out the present species and it appears that no two opinions are the same for it.

41. *Pinnularia stauroptera* v. *clevei* Meister f. *hyalina* (Perag. & Hér.)  
A. Cl. (Fig. 45)

Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 57, f. 1091 f

Valves 49-52  $\mu$  long and 7.2  $\mu$  broad, weakly silicified, linear-lanceolate with weakly triundulate sides, middle inflation rather more wide and prominent, ends very broad capitate-rounded-cuneate. Raphe thin and straight with central pores unilaterally bent and terminal fissures curved. Axial area fairly wide, linear or sublinear; central area large, rhomboid, reaching the sides. Striae about 10 in 10  $\mu$ , somewhat delicate, radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from hilly streams at Chembur, Borivli, and Powai lake, rather as a stray form.

42. *Pinnularia gibba* Ehr. (Figs. 46-47)

Schmidt, A., 1874-1944, Atlas Diat. t. 45, f. 45-47; Skvortzow, B. W., 1937, *Philipp. J. Sci.* 61: 42, pl. 7, f. 2-3; Van Heurck, 1896, *Treat. Diat.* 172, pl. 2, f. 88 (= *Navicula gibba* Ehr.); Pantocsek, J., 1902, *Res. Wiss. Erf. Balat.* 2 (2): 33, t. 3, f. 66 (= *Nav. stauoptera* Grun. v. *parva* Grun.); Schönfeldt, H., 1913, *Bacil.* 109, f. 235 (= *P. gibba* W. Sm. ? Ehr.); Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 57, f. 1091 bb (= *P. stauoptera* ?).

Valves 68-79  $\mu$  long and 11-12.6  $\mu$  broad, linear-lanceolate with slight but uniformly convex sides and at the extremities abruptly swollen, broadly rounded ends. Raphe thin and straight with central pores unilaterally bent and terminal fissures curved. Axial area narrowly lanceolate; central area very large, rhomboid, reaching the sides. Striae 8-9 rarely up to 10  $\mu$ , very coarse, radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from Powai, Vihar, and Tansa lakes as a frequent form but stray specimens were obtained from several large bodies of water in the region. Common.

Krishnamurthy has described a form under *P. gibba* Ehr. (Krishnamurthy, V., 1954, *J. Indian bot. Soc.* 33: 369, f. 43). This is shown to be an arcuate type with clear longitudinal bands on the striae, which are characteristically apparent only in 'Majores, Complexae, Vitreatae' groups. Moreover, it is shown to have complex or subcomplex raphe. These features as given by Krishnamurthy for *P. gibba* appear to be strange and unknown in the literature, particularly the one he has cited. It seems that the said author has erroneously determined this as well as several other diatoms of his paper.

43. *Pinnularia simplex* sp. nov. (Figs. 48-49)

Valvae 59-80  $\mu$  longae atque 9-11.4  $\mu$  latae, lineares, marginibus concavis centrum inter et polos, apicibus late-rotundatis. Raphe tenuis et recta, ornata poris centralibus aliquantum unilateraliter inclinatis ac fissuris terminalibus curvatis. Area axialis angusta, linearis; area centralis paulum dilatata. Striae 9-11 in 10  $\mu$ , aliquantum radiales in medio ac in utroque apice convergentes. Typus lectus a H.P. Gandhi ad Wadala die 31-7-1945, et positus in herbario proprio auctoris sub numero BOM-WAD—10.

Valves 59-80  $\mu$  long and 9-11.4  $\mu$  broad, linear with margins concave in between the middle and the ends, ends broadly rounded. Raphe thin and straight with central pores slightly unilaterally bent and terminal fissures curved. Axial area narrow, linear; central area slightly widened. Striae 9-11 in 10  $\mu$ , slightly radial in the middle and convergent at the ends.

*Habitat* : Fresh water. Collected from pools and ponds at Wadala, Goregaon, Jogeshwari, Andheri, and some other places. It occurred usually in a small number.

This diatom does not agree well with any of the similar looking species of *Pinnularia*. It is, therefore, tentatively considered to be a new species.

#### Section MAJORES Cleve

#### 44. *Pinnularia major* (Kütz.) Cl. v. *sendaiensis* Hust. (Fig. 50)

Schmidt, A., 1874-1944, Atlas Diat. t. 387, f. 3.

Valves 201-207  $\mu$  long and 26.2-27  $\mu$  broad, linear, distinctly inflated in the middle, sides parallel, ends swollen and subcuneate-rounded. Raphe thick with central pores unilaterally bent and terminal fissures somewhat obliquely curved. Axial area wide 1/4 to nearly 1/3 the width of the valve, linear; central area dilated. Striae 5-5.5 in 10  $\mu$ , thick, radial in the middle and convergent at the ends with fairly wide longitudinal bands quite evident.

*Habitat* : Fresh water. Collected from Powai lake rather in a small number. Rare.

This diatom agrees well with the type illustrated in the 'Atlas', in the outline, raphe, and striae. However, it appears to be somewhat smaller and has rounded cuneate ends, hence it slightly differs. Skvortzow has described a form *P. hustedii* Meister (Skvortzow, B. W., 1937, *Philipp. J. Sci.* 61 : 43, pl. 8, f. 5) which is very much like the present one in the outline, apices, raphe, striae, and other details. However, *P. hustedii* is a larger and slimmer form (221 x 17  $\mu$ , striae 9 in 10  $\mu$ ) with more number of striae per 10  $\mu$ , than is the case with the present form. Again, the material of the present species is very scarce. It is therefore difficult to remark in any way. Presently, I refer my specimen to Husted's *P. major* v. *sendaiensis*, of course provisionally, since the striae number as also many other details approximate to it.

#### 45. *Pinnularia hartleyana* Grev. v. *pulchella* Mills (Fig. 51)

Mills, F. W., 1932, *J. roy. microsc. Soc.* 52 : 390, pl. 2, f. 19-20.

Valves 149-160  $\mu$  long and 18-21  $\mu$  broad, linear, strongly inflated in the middle, sides almost parallel, ends swollen and subrounded. Raphe thick and straight with central pores conspicuous and unilaterally bent and terminal fissures large comma-shaped. Axial area about 1/4-1/3 the width of the valve, linear; central area large and reaching the sides. Striae 8-9 in 10  $\mu$ , thick, strongly radial in the middle and convergent at the ends with faint longitudinal bands.

*Habitat* : Fresh water. Collected from streams at Borivli, Powai and Vihar lakes. Rather rare.

This diatom agrees well with the type described and illustrated by Mills except that the local forms have smaller size

46. *Pinnularia nipponica* Skvortzow (Fig. 52)

Skvortzow, B. W., 1937, *Philipp. J. Sci.* 61 : 45, pl. 7, f. 12 ; 281, pl. 3, f. 8, pl. 8, f. 5.

Valves 70-75  $\mu$  long and 11.2-12  $\mu$  broad, linear, sides concave in the middle with constricted, broadly produced rounded ends. Raphe thick, subcomplex with central pores unilaterally bent and terminal fissures curved. Axial area linear or sublinear; central area large, reaching the sides. Striae 8-10 in 10  $\mu$ , thick, radial in the middle and convergent at the ends with longitudinal bands faintly visible.

*Habitat* : Fresh water. Collected from ponds and pools at Wadala and Powai lake usually as a stray form. Rare.

Section COMPLEXAE Cleve

47. *Pinnularia kiusiuensis* Skvortzow (Fig. 53)

Skvortzow, B. W., 1937, *Philipp. J. Sci.* 62 : 206, pl. 3, f. 4.

Valves 72-75  $\mu$  long and 13.6  $\mu$  broad, linear, slightly swollen in the middle with swollen rounded ends. Raphe thick, more or less complex with central pores unilaterally bent and terminal fissures thick and curved. Axial area linear about 1/5 the width of the valve; central area large and unilaterally reaching the side. Striae 9-10 in 10  $\mu$ , thick, slightly radial in the middle and convergent at the ends with longitudinal bands somewhat narrow but distinct.

*Habitat* : Fresh water. Collected from Powai and Vihar lakes in a small number. Rare in the locality.

This species agrees well with the type described by Skvortzow, except that the ends here are somewhat more rounded.

48. *Pinnularia neglecta* (Mayer) Å. Berg (Fig. 54)

Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 80, f. 1112.

Valves 157.5-163  $\mu$  long and 23-24  $\mu$  broad, linear, slightly inflated in the middle with gradually swollen, weakly narrowed rounded ends. Raphe thick and complex with central pores unilaterally bent and terminal fissures thick, slightly obliquely large-comma-shaped. Axial area fairly wide, about 1/4-1/3 the width of the valve; central area somewhat dilated and apparent. Striae 6-7 in 10  $\mu$ , thick radial in the middle and convergent at the ends with fairly broad, clear longitudinal bands.

*Habitat* : Fresh water. Collected from Powai and Vihar lakes in good numbers.

49. *Pinnularia neglecta* v. *undulata* v. nov. (Fig. 55)

Valvae 137-140.2  $\mu$  longae atque 21.6-22  $\mu$  latae, robustae, lineares, ad margines triundulatae, apicibus constrictis, late elongato-rotundatis. Raphe crassa et complexa, ornata poris centralibus unilateraliter inclinatis, fissuris terminalibus curvatis. Area axialis  $1/4-1/3$  latitudinis valvae, linearis; area centralis aliquantum dilatata. Striae 6-7 in 10  $\mu$ , crassae, radiales in medio ac convergentes in utroque apice, vittis longitudinalibus distincte evolutis. Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW—62.

Valves 137-140.2  $\mu$  long and 21.6-22  $\mu$  broad, robust, linear with triundulate sides and constricted, broadly produced rounded ends. Raphe thick and complex with central pores unilaterally bent and terminal fissures curved. Axial area  $1/4-1/3$  the width of the valve, linear; central area slightly dilated. Striae 6-7 in 10  $\mu$ , thick, radial in the middle and convergent at the ends with longitudinal bands distinct.

*Habitat*: Fresh water. Collected from Powai lake and streams at Borivli. Stray forms also were recorded from Vihar and Tansa lakes. Rather rare.

This diatom agrees well with *P. neglecta* (May) Å. Berg, described above, in all the features except that the valves are more robust with distinct triundulate sides and constricted, broadly produced rounded ends. It is, therefore, considered to be a new variety.

50. *Pinnularia pseudoluculenta* sp. nov. (Fig. 56)

Valvae 132-140  $\mu$  longae atque 17.6-18  $\mu$  latae, anguste lineares, marginibus concavis centrum inter et polos, apicibus gradatim tumidis ac late rotundatis. Raphe crassa et complexa, ornata poris centralibus unilateraliter inclinatis conspicuis, fissuris terminalibus oblique curvatis. Area axialis circiter  $1/3$  latitudinis valvae, lineari-lanceolata; area centralis fere dilatata vel quadrata. Striae 7-8 in 10  $\mu$ , crassae, aliquantum radiales in medio atque in utroque apice convergentes, vittis tenuibus sed distinctis. Typus lectus a H. P. Gandhi ad Borivli in rivulis die 1944, 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR—35.

Valves 132-140  $\mu$  long and 17.6-18  $\mu$  broad, narrowly linear with concave sides between the middle and the ends, ends gradually swollen and broadly rounded. Raphe thick and complex with central pores conspicuous and unilaterally bent and terminal fissures obliquely curved. Axial area about  $1/3$  the width of the valve, linear-lanceolate; central area almost dilated to quadrate. Striae about 7-8 in 10  $\mu$ , thick, slightly radial in the middle and convergent at the ends with bands narrow but distinct.



*Habitat* : Fresh water. Collected from streams at Borivli, Powai and Vihar lakes, as a frequent form. Not common in the region.

This species resembles *P. conspicua* (A.S.) Cl., as illustrated by Mills (Mills, F. W., 1932, *J. roy. microsc. Soc.* 52 : 390, pl. 2, f. 22), in the outline and the arrangement of the striae. However, the present specimens are much smaller and very sleek and have comparatively much wider axial area ; hence they differ. Moreover, in the reference cited by Mills [Schmidt, A., 1874-1944, *Atlas Diat.* t. 43, f. 10-11 (= *Navicula conspicua* A. S.)] the illustrations appear to be very different from that of Mills (Mills seems to recognise the fact) and the present forms ; hence the comparison is difficult. Further, Cleve-Euler's *P. alandica* A. Cl. (Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 80, f. 1112 A) also appears to be different as it has broader valves, produced-cuneately-rounded apices, and fewer striae per 10  $\mu$ , although it has somewhat a similar shape. Again, the present forms compare well with *Navicula luculenta* A. S. which is in fact a *Pinnularia* type (Schmidt, A., *op. cit.* t. 43, f. 12) in the outline, range of dimensions, and perhaps the striae. However, the present specimens show much wider axial area, well defined quadrate central area, comparatively shorter striae with narrow longitudinal bands ; hence they differ. In the literature no other species are known with which the satisfactory comparison could be made, hence the present specimens are considered to be a new species.

#### Section VI I R E A I A E Å. Berg

##### 51. *Pinnularia streptoraphe* Cleve (Fig. 57)

Hustedt, 1924, *Naturw. Unters. Sarek.* 3 (6) : 572, t. 19, 8 ; 1930, *Bacil.* 337, f. 620 ; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 85, f. 1117 a-c (= *v. genuina* A. Cl.) ; Schmidt, A., 1874-1944, *Atlas Diat.* t. 42, f. 7 (= *nomen nudum*).

Valves 140-160  $\mu$  long and 22.5-24  $\mu$  broad, linear with broadly rounded ends. Raphe thick, very strongly complex and folded with central pores prominent and unilaterally bent and terminal fissures thick and obliquely comma-shaped. Axial area about 1/4 the width of the valve, linear ; central area only slightly dilated. Striae 5-5.5, rarely 6 in 10  $\mu$ , thick, radial in the middle and convergent at the ends with fairly broad very conspicuous longitudinal bands.

*Habitat* : Fresh water. Borivli streams, Powai, Vihar, and Tansa lakes. Fairly common

Genus **AMPHIPRORA** Ehrenberg 1843, emend. Cleve 1891

52. **Amphiprora alata** Kütz. (Fig. 58)

Hustedt, 1930, Bacil. 340, f. 625; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—V, 32, f. 1402 a-d (=v. *genuina* A. Cl.).

Frustules 48-59  $\mu$  long and 21-23  $\mu$  broad in the middle and 35-37  $\mu$  at the broadest, strongly siliceous, torsive in the longitudinal plane, oblong-elliptical, deeply constricted in the middle with rounded truncate ends in the girdle view. Connecting zone with numerous longitudinal plaits, broad and somewhat sigmoid. Keel sigmoid with undulate keel projections. Striae 16-18 in 10  $\mu$ , fine and punctuate.

*Habitat*: Brackish water. Collected from Mahim and Chembur creeks in good numbers and as a common form.

53. **Amphiprora lata** Grev. v. **angustior** McCall (Fig. 59)

McCall, D., 1933, *J. Linn. Soc. (Bot.)* 49 : 268, 26.

Frustules 98-116  $\mu$  long and 21.6-22  $\mu$  broad in the middle and 30-33.5  $\mu$  at the broadest, weakly siliceous, oblong, constricted in the middle with truncate rounded ends in the girdle view. Connecting zone with numerous longitudinal plaits almost straight with about 22 fine striae in 10  $\mu$ . Keel broad, sigmoid with uniformly arcuate keel projections. Striae about 13-14 in 10  $\mu$ , rather fine.

*Habitat*: Brackish water. Collected from Mahim creek usually in a small number. Very stray specimens also were collected from Chembur and Bhayandar creeks.

Genus **AMPHORA** Ehrenberg 1840

54. **Amphora ovalis** Kütz. v. **gracilis** (Ehr.) Cl. (Fig. 60)

Van Heurck, 1896, *Treat. Diat.* 127, pl. 1, f. 16; Hustedt, 1930, Bacil. 342 (=f. *gracilis* (Ehr.) Cl.); Cleve-Euler, A. 1951-55, Diat. Schwed. Finn.—III, 91, f. 667 b; Schmidt, A., 1874-1944, *Atlas Diat.* t. 26, f. 108 (=A. *ovalis* Kütz.).

Frustules 65-70  $\mu$  long and 27-29.5  $\mu$  broad, slender than the type, elliptical with truncate ends in girdle view. Valves lunate with convex dorsal side and concave ventral side with rounded ends. Raphe arcuate with dorsally bent conspicuous central pores. Axial area very narrow; central area large, quadrate, reaching the ventral side. Striae 12-13 in 10  $\mu$ , coarsely punctuate, radial on the dorsal side but on the ventral side radial in the middle and convergent at the ends.

*Habitat*: Fresh water. Collected from pools and ponds at Wadala, Vile-Parle, Goregaon, and some other places. Usually collected in a small number.

This diatom agrees well with the type described by Van Heurck and others. The maximum length given by Cleve-Euler is 40  $\mu$ , from which the present specimens differ in being much larger. It also resembles *A. libyca* Ehr. (Cleve-Euler, *op. cit.* 90 f. 666 a-b (=v. *typica* A. Cl.), but differs in not having clearly defined longitudinal hyaline bands.

55. *Amphora ovalis* Kütz. v. *pediculus* Kütz.

*Habitat*: Fresh water. Widely distributed in the locality and sometimes abundant.

56. *Amphora acutiuscula* Kütz. (Fig. 61)

Van Heurck, 1896, *Treat. Diat.* 134, pl. 1, f. 5; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—III, 98, f. 686 a-b; Schmidt, A., 1874-1944, *Atlas Diat.* t. 26, f. 59 (= *A. lineata* Greg.); Foged, N., 1957, *Nat. Hist. Rennell Isl.* 3 : 75, pl. 9, f. 5? (= *A. sp.*)

Frustules 32-38  $\mu$  long and 15-16  $\mu$  broad with abruptly constricted produced truncate ends in girdle view. Valves semi-lanceolate, 7-8  $\mu$  broad, with straight ventral side and produced, somewhat capitate ends. Raphe thin and straight rather delicate. Axial area very narrow. Striae 14-18 in 10  $\mu$ , radial, indistinctly punctuate and rudimentary on the ventral side.

*Habitat*: Brackish water. Collected from Mahim and Chembur creeks fairly frequently.

Genus **CYMBELLA** Agardh 1830

57. *Cymbella turgida* (Greg.) Cl.

*Habitat*: Fresh water. Widely distributed in the area but always collected in smaller numbers. Common.

58. *Cymbella ventricosa* Kütz.

*Habitat*: Fresh water and wet soils. Common throughout the region.

59. *Cymbella gracilis* (Rabh.) Cl. (Fig. 62)

Hustedt, 1930, *Bacil.* 359, f. 663; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 129, f. 1184 a-b (=v. *schmidtii* A. Cl.); Schmidt, A., 1874-1944, *Atlas Diat.* t. 10, f. 36-37, 39-40 (= *Encyonema gracile* Rabh.)

Valves 32.4-36  $\mu$  long and 5.4-  $\mu$  broad, asymmetrical, narrow semi-lanceolate with ventral side almost straight, ends acutely rounded sometimes slightly constricted and weakly bent on the ventral side. Raphe thin and straight, strongly excentric and close to the ventral side. Axial

area very narrow; central area very small. Striae 12-14 in 10  $\mu$ , fine and slightly radial, ventral side striae marginal.

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Vihar lakes usually in good number.

This species agrees well with the type described Cleve-Euler and others except that the ventral side sometimes noted to be slightly concave as indicated by Cleve-Euler in f. 1184 a.

60. *Cymbella yarrensii* (A. S.) Cl. (Fig. 63)

Schmidt, A., 1874-1944, Atlas Diat. t. 379, f. 21-22; t. 71, f. 16 (= *Encyonema ? yarrensii* A. S.)

Valves 75-80  $\mu$  long and 12.6-13  $\mu$  broad, asymmetrical-lanceolate with dorsal side more convex than the ventral one with acutely rounded ends. Raphe thin and straight, clearly excentric with terminal fissures dorsally directed. Axial area narrow very narrowly lanceolate; central area slightly widened. Striae 12-14 in 10  $\mu$ , strongly radial in the middle but less so towards the ends and somewhat closer. In some cases the end striae tended to be probably perpendicular to the middle line.

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Vihar lakes. Only stray specimens were recorded.

This species agrees well with the type illustrated in the 'Atlas', in the outline, length-breadth proportions, raphe and strongly radial striae in the middle. However, the end striae noted in the local forms are not necessarily perpendicular to the middle line. I have referred these specimens to the said species with some amount of hesitation, but these definitely do not agree with any other similar-looking species.

61. *Cymbella amphicephala* Naeg

*Habitat*: Fresh water. Collected from streams at Borivli, pools at Kanheri caves, Powai and Vihar lakes, usually as a common form.

62. *Cymbella leptoceros* (Ehr. ?) Grun. v. *rostrata* Hust. f. *indica* f. nov. (Fig. 64)

Valvae 38-43  $\mu$  longae atque 12-12.5  $\mu$  latae, asymmetricae, sub-rhomboidae, latere dorsali valde convexo, ventrali aliquantum convexo, apicibus constrictis ac elongato-rotundatis. Raphe crassa, arcuata, leniter centrica, poris centralibus conspicuis, fissuris terminalibus ad marginem dorsalem versus flexis. Area axialis sat ampla, anguste lanceolata; area centralis paululum dilatata. Striae 9-12 in 10  $\mu$ , crasse lineatae bis seriatae, ubique radiales ac in utroque apice proxime positae. Typus lectus a H. P. Gandhi ad Borivli in rivulis die 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR.—48.

Valves 38-43  $\mu$  long and 12-12.5  $\mu$  broad, asymmetrical, subrhomboid, dorsal side strongly convex than the ventral side with constricted, slightly produced rounded ends. Raphe thick, arcuate, somewhat **centric** with central pores conspicuous and terminal fissures dorsally bent. Axial area fairly wide and narrowly lanceolate; central area very slightly dilated. Striae 9-12 in 10  $\mu$ , coarsely lineate in double rows, throughout radial and at the ends closely set.

*Habitat*: Fresh water. Collected from streams at Borivli and Powai lake in a small number.

This diatom agrees well with *Cymbella leptoceros* (Ehr. ?) Grun. v. *rostrata* Hust (Hustedt. 1944, *Arch. Hydrobiol.* 39 : 132, f. 52-54) in the outline, striae and other details. However, the present forms show rather rhombic shape and less conspicuously produced rostrate ends. It is, therefore, considered to be a new form.

63. *Cymbella austriaca* Grun. v. *subrhomboidea* (Østrup) A. Cl.

*Habitat*: Fresh water. Collected from streams at Borivli and Kanheri caves. Fairly common.

64. *Cymbella tumida* (Bréb.) V. H. (Figs. 65-66)

Schmidt, A., 1874-1944, *Atlas Diat.* t. 376, f. 4-7; t. 10, f. 28-30 (= *C. stomatophora* Grun.); Van Heurck, 1896, *Treat. Diat.* 148, pl. 1, f. 42; Hustedt, 1930, *Bacil.* 366, f. 677; Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 166, f. 1255 a [=v. *genuina* (Grun.) A. Cl.].

Valves 53-65  $\mu$  long and 18-19.5  $\mu$  broad, asymmetrical, boat-shaped, strongly convex on the dorsal side, on ventral side straight, medially gibbous, feebly concave or triundulate with strongly constricted, broadly produced rounded-truncate ends. Raphe thick, arcuate, excentric with distinct central pores and dorsally reflexed terminal fissures. Axial area rather narrow, linear; central area large roundish or subquadrate with a luna on the dorsal side and a pore or elongated marking on the ventral side. Striae 7.5-9 in the middle up to 11 in 10  $\mu$  towards the ends, clearly and coarsely punctate and radial throughout.

*Habitat*: Fresh water. Collected from Powai, Vihar, and Tansa lakes as a common and frequent form. A smaller number of forms also were collected from Bandra tank and some other places. Not widely distributed.

65. *Cymbella powaiana* sp. nov. (Fig. 67)

Valvae 57.6-60  $\mu$  longae atque 18-19  $\mu$  latae, asymmetricae, cymbiformes, latere dorsali valde convexo, ventrali vero recto sed paululum tumido ad medium, apicibus constrictis in dorso, distincte productis et

subtruncatis. Raphe crassa, arcuata, leniter centrica, ornata poris centralibus distinctis atque fissuris terminalibus ad marginem dorsalem versus flexis. Area axialis sat ampla, linearis; area centralis ampla subrotundata absque stigmatibus. Striae 7-8 in 10  $\mu$ , crasse lineatae, punctis circiter 18-20 in 10  $\mu$ , ubique radiales. Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—77

Valves 57.6-60  $\mu$  long and 18-19  $\mu$  broad, asymmetrical, boat-shaped, dorsal side strongly convex, ventral side straight with a slight inflation in the middle; ends constricted on the dorsal side, distinctly produced and subtruncate. Raphe thick, arcuate, nearly central with central pores distinct and terminal fissures reflexed towards the dorsal side. Axial area fairly wide, linear; central area large somewhat roundish without any stigmata. Striae 7-8 in 10  $\mu$ , coarsely lineate with puncta about 18-20 in 10  $\mu$ , throughout radial.

*Habitat*: Fresh water. Collected from Powai lake along with the above type in a small number. Stray specimens also were collected from streams at Borivli and Vihar lake.

This species does not satisfactorily agree with any other similar looking types in the literature, hence it is regarded as a new species.

66. *Cymbella aspera* (Ehr.) Cl.

*Habitat*: Fresh water. Collected from streams at Borivli, Chembur hills, Powai, Vihar and Tansa lakes, usually in good number, from among the dead vegetable matter scattered around the borders. It was also found to form slimy encrustations on stony or rocky substratum.

67. *Cymbella bengalensis* Grun.

*Habitat*: Fresh water. Mostly collected from the streams at Borivli and Powai lake. Not common.

Genus *GOMPHONEMA* Agardh 1824

68. *Gomphonema constrictum* Ehr. v. *capitata* (Ehr.) Cl (Fig. 68)

Schmidt, A., 1874-1944, Atlas Diat. t. 247, f. 33; Hustedt, 1930, Bacil. 377, f. 715; Van Heurck, 1896, Treat. Diat. 270, pl. 7, f. 297 (= *G. constrictum* v. *capitatum* Ehr.); Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 173, f. 1261 e-f? [= *G.*—v. *capitatum* (Ehr.) Cl. f. *typica* May.].

Valves 47.5-50  $\mu$  long and 12.5-13  $\mu$  broad, broadly clavate with feebly constricted broadly produced subtruncate apex and attenuated rounded base. Raphe thick and straight. Axial area narrow, linear; central

area somewhat rhomboid, slightly unilateral with a stigma on the opposite side. Striae 10-12 in  $10\ \mu$ , fine but clearly punctate and slightly radial.

*Habitat* : Fresh water. Collected from streams at Borivli and Powai lake, in good number

69. **Gomphonema constrictum** v. **indica** v. nov. (Fig 69)

Valvae 45-47.5  $\mu$  longae atque 12.5  $\mu$  latae, clavatae, apice constricto, late elongato-rotundato. Striae circiter 11-12 in  $10\ \mu$ , radiales atque distincte punctatae. Caetera ut in typo. Typus lectus a H. P. Gandhi in lacu Powai die 28-1-1945, et positus in herbario proprio auctoris sub numero BOM-POW. —78.

Valves 45-47.5  $\mu$  long and 12.5  $\mu$  broad, clavate, apex constricted broadly produced and rounded. Striae about 11-12 in  $10\ \mu$ , radial and clearly punctate. In all other characters resembles the type.

*Habitat* : Fresh water. Collected from streams at Borivli and Powai lake, usually in a smaller number along with the type.

This diatom agrees well with above mentioned type in all characters except that the apical part is rather short, distinctly constricted, broadly produced and rounded. It is, therefore, considered as a new variety.

70. **Gomphonema acuminatum** Ehr. v. **turris** (Ehr) Cl. (Figs. 70-71)

Valves 46-71.5  $\mu$  long and 11-14.4  $\mu$  broad and striae 9-10 to 12-13 in  $10\ \mu$ .

While going through the literature, there appears to be some difficulty regarding the present species. The figure 70 very exactly agrees with Hustedt's *G. acuminatum* v. *turris* (Hustedt, 1911, *Abh. Nat. Ver. Bremen*, 20 : 293, t. 3, f. 36) and in the said reference, Schmidt's 'Atlas Diat.' t. 239, f. 31-36, illustrations are considered to be identical. In fact, of the 'Atlas' t. 239, f. 32, 34 are rather more closely so, with the present as well as that of Hustedt (1911, *op. cit.*)

Cleve-Euler, however, considered Hustedt's (1911, *op. cit.*) specimens to be *G. montanum* Schum. v. *turriforme* A. Cl. (Cleve-Euler, A, 1951-55. *Diat. Schwed. Finn.*—IV, 182, f. 1276 a-b). The illustrations represented by her actually correspond more or less well with Hustedt's *G. lanceolatum* Ehr. v. *turris* (Ehr. e. p.) Hust. (Hustedt, 1936, *Arch. Hydrobiol.*, suppl. 14 : 166, t. 3, f. 23). Hustedt renamed his 1936 (*op. cit.*) forms as *G. lanceolatum* f. *turris* (Ehr. e.p.) Hust. in his later work (Hustedt, 1938-39, *Arch. Hydrobiol.*, suppl., 15 : 437, t. 26, f. 8-11). If the illustrations of these two papers were to be compared, they differ much among themselves. The Java (1938, *op. cit.*) forms appear to be more broadly clavate

from the middle part upwards with broadly cuneate ends and in the smaller forms therein the appearance goes as far as to suggest that *G. augur* Ehr. is getting evolved. These forms more or less come closer to *G. acuminatum* v. *turris* Ehr., 'Atlas' t. 239, particularly the figures 31, 33, 35 except that the figs. in the 'Atlas' have rather more pointed apex. But in any way all these are obviously dissimilar to present specimens as well to the one illustrated by Hustedt (1911, *op. cit.*).

Cleve-Euler's *G. montanum* v. *suecicum* Grun. (Cleve-Euler, *op. cit.*, 182, f. 1276 c) as well as of 'Atlas Diat.' t. 239, f. 32, 34 (= *G. acuminatum* v. *turris*) and t. 240, f. 4 (regarded as intermediate form between *G. acuminatum* and *G. augur* Ehr.) agree well here and with Hustedt's (1911, *op. cit.*)

Hustedt's *G. acuminatum* v. *turris* (Ehr.) Cl (Hustedt, 1930, Bacil. 372, f. 687) befits anywhere between *G. acuminatum* v. *turris* of the 'Atlas' and *G. lanceolatum* v. *f. turris* (Ehr. e.p) Hust., is being referred by Cleve Euler to *G. montanum* v. *turriforme* A. Cl. This form more or less corresponds well with my illustration (fig. 71). It also corresponds to a certain degree with 'Atlas' t. 240, f. 18-20, particularly with f. 18 which is *G. acuminatum* v. *brasiliensis* Ehr., and much more with Skvortzow's *G. acuminatum* v. *turris* (Skvortzow, B. W., 1935, *Philipp. J. Sci.*, 57 : pl. 3, f. 9 ; 1937, 61 : 51, pl. 12, f. 4 ; 1938, 66 : 356, pl. 1, f. 5?). Skvortzow recorded denser striae for some of his forms, particularly in forms collected from Kizaki lake

Looking at *G. acuminatum* Ehr. itself which is a highly variable species, it may be assumed that *G. acuminatum* v. *turris* Ehr. is as well variable under different climatic, topographical, and habitat conditions, and as a result of that the same or different workers have given different illustrations and sometimes the considerations

Yet, with a good deal of uncertainty and far fetched considerations, I presume the present diatoms to be *G. acuminatum* v. *turris* (Ehr.) Cl. a poly-phasic type. The references hitherto mentioned, all probably go to represent manifestations of the indicated type as has been suggested by Geitler (1932) in the case of several Pennate diatoms, Hendey (1951) in the case of *Achnanthes longipes* Ag., Lund (1945-46), and others. I believe, nothing better than this could be thought of, at least for the present. The two illustrations depicted here show the extremes that have been recorded from among several specimens collected from different localities in the region.

*Habitat* : Fresh water. Collected from several places in the region usually in a small number.



71. *Gomphonema augur* Ehr. (Figs. 72-73)

*Habitat* : Fresh water. Collected from several pools, ponds, and other large bodies of water in the region. Quite common.

72. *Gomphonema subapicatum* Fritsch & Rich (Figs. 74-80)

*Habitat* : Fresh water. Collected from several wet situations in the Bombay and Salsette region. In certain ponds and tanks it was found to be gregarious. Its distribution so far known in India : Punjab, whole of South-Western Zone, and N. Gujarat.

Having collected and observed this species in varying quantity for almost fifteen years from various parts of South-Western Zone of India (an area comprised of approximately 900 miles long and 100 miles broad) reaching up to parts of N. Gujarat, I am convinced that it is a distinct species. Therefore, I appreciate the diagnosis given by Fritsch & Rich (Fritsch, F. E. & Rich, F., 1929, *Trans. roy. Soc. S. Afr.* 18 : 109, f. 6 A-D). From this long tenure of work, I have found quite an amount of structural and size variations in the species which perhaps does not appear in the literature ; hence, I set it forth in the record by giving several illustrations and a table of dimensions. The forma *curta* Frit. & Rich of the said species is included within the type since I have observed all the intergrading sizes and forms from the same and different localities during different times.

Further, Hustedt has regarded such specimens of his Sunda-Expedition material as *G. gracile* Ehr. f. *turris* Hust. (Hustedt, 1938, *Arch. Hydrobiol., Suppl.* 15 : 439, t. 28, f. 14-16), calling them as tropical deviation of *G. gracile*. However, I consider them to be *G. subapicatum*, since they are so very alike in all characters. Again, I have found this species to be rather independent of *G. gracile*, frequent and sometimes gregarious. Looking at its manifestations which I have recorded, it appears that it has probably found its expression from *G. acuminatum* Ehr. and *G. augur* Ehr. series rather than from *G. gracile*. This fact may be derived from considering the apex and apicule, organisation of striae and their punctate nature, raphe, central area, and as a rule the whole of the general plan of the valve. It is assumed that the probable line of deviation might have taken through *G. acuminatum* v. *turris*, like forms which I have described earlier and my figures 70-71 perhaps bear the testimony of the same.

I herewith give in the following table the range of dimensions recorded by previous workers and here, thus :

Author	Length	Breadth	Striae per 10 $\mu$
Fritsch & Rich (1929)	77-55 $\mu$ 40-28 $\mu$	14-12 $\mu$ 11-10 $\mu$	10-12 10-12 f. <i>curta</i>
Abdul-Majeed (1935)	same range as given by Fritsch & Rich		
Hustedt (1938)	no dimensions given		(= <i>G. gracile</i> v. <i>turris</i> Hust.)
Gandhi (1956)	99-48 $\mu$	15.6-12 $\mu$	9-12
present forms	85.6 $\mu$ 72 $\mu$ 70 $\mu$ 67 $\mu$ 60 $\mu$ 50 $\mu$ 49.5 $\mu$ 44 $\mu$ 36 $\mu$ 30 $\mu$ 26 $\mu$	15.5 $\mu$ 14.4 $\mu$ 14.5 $\mu$ 12.5 $\mu$ 12.6 $\mu$ 12.7 $\mu$ 13.2 $\mu$ 9.5-11 $\mu$ 9.5 $\mu$ 9 $\mu$ 8.7-9 $\mu$	8-10 12-13 13 11-13 12-14 12 11-12 10-13 11-12 10-12 10-12
forms collected from N. Gujarat area	48-62 $\mu$	10-12.5 $\mu$	9-11

73. *Gomphonema subapicatum* v. *okamurae* (Skv.) emend. (Fig. 81)

Skvortzow, B. W., 1937, *Philipp J. Sci.* 62 : 209, pl. 4, f. 13 (= *G. augur* Ehr. v. *okamurae* Skv.).

Valves 49-55  $\mu$  long and 13.7-14  $\mu$  broad, lanceolate-clavate with broad abruptly narrowed subapiculate apex and from the middle gradually attenuated base. Central area with two stigmata. Striae 9-11 in 10  $\mu$ , radial and punctate. In all other features like the above type

*Habitat* : Fresh water. Collected from streams at Borivli, Andheri, Goregaon and Dahisar ponds, Powai and Vihar lakes, and other places.

It was recorded usually as a stray form with the species.

This diatom strongly agrees with *G. subapicatum* Frit. & Rich rather than with *G. augur* Ehr.; hence it is considered to be a variety of the former, and Skvortzow's nomenclature is emended.

74. *Gomphonema sphaerophorum* Ehr.

*Habitat* : Fresh water. Collected from several wet situations from the region of Bombay and Salsette. A common type.

75. *Gomphonema subtile* Ehr. v. *malayensis* Hust (Fig. 82)

Hustedt, 1942, *Int. Rev. Ges. Hydrobiol. Hydrogr.* 42 (1/3) : 119, f. 258-260.

Valves 45-50  $\mu$  long and 8.5-9  $\mu$  broad, lanceolate-clavate with only

slightly produced, narrowly capitate rounded apex and gradually attenuated base. Raphe thin and straight. Axial area narrow, linear; central area small, very slightly unilaterally expanded with an isolated stigma on the other side. Striae 9-10 in  $10\ \mu$ , radial and coarsely lineate.

*Habitat* : Fresh water. Collected from streams at Borivli, Powai and Vihar lakes, ponds at Dahisar, Goregaon, and Andheri. Mostly recorded as a stray form

76. **Gomphonema parvulum** Kütz. (Figs. 83, 120)

*Habitat* : Fresh water and rarely somewhat brackish water. A widely distributed diatom. Common.

The two illustrations given show much deviation among themselves in the outline. The figure 120 is typical of the type and 83 is a variant but it agrees well with Cleve-Euler's fig. 1269 a, and Berg's illustration (Berg, A., 1953, *Bot. Not.* 1 : 63, f. 4).

77. **Gomphonema parvulum** v. **subellipticum** Cl.

*Habitat* : Fresh water. Collected from several wet situations but usually in small numbers along with the type.

78. **Gomphonema parvulum** v. **micropus** (Kütz.) Cl.

*Habitat* : Fresh water. Collected from several pools, ponds, tanks, and other wet situations. Fairly common.

79. **Gomphonema parvulum** v. **lagenula** (Grun.) Hust. (Fig. 110)

Hustedt, 1930, *Bacil.* 373; 1949, *Expl. Parc. Nat.-Albert Miss. H. Damas* 1935-36, 8 : 119, t. 11, f. 8-10.

Valves 26-30.6  $\mu$  long and 7.2  $\mu$  broad, lanceolate-clavate with constricted subcapitate apex and slightly produced base. Raphe thin and straight. Axial area narrow, linear; central area somewhat unilateral with an isolated stigma on the opposite side. Striae about 14 in  $10\ \mu$ , radial.

*Habitat* : Fresh water. Collected from streams at Borivli and various ponds, puddles, and pools in the region. It occurred usually with the type but in small numbers. Fairly common.

80. **Gomphonema angustatum** (Kütz.) Rabh. v. **producta** Grun f. **indica** f. nov. (Fig. 84)

Valvae 30-32  $\mu$  longae atque 6.5  $\mu$  latae, lineari-clavatae, apice constricto, breviter elongato et rotundato, basi constricta capitata. Raphe tenuis et recta. Area axialis angusta; area centralis parva ac unilaterally dilatata, stigmatate unico in latere opposito. Striae circiter 10-11 in  $10\ \mu$ , aliquantum radiales atque indistincte punctate. Typus lectus a

H. P. Gandhi ad Borivli in rivulis die 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR. —97

Valves 30-32  $\mu$  long and 6.5  $\mu$  broad, linear-clavate, apex constricted, shortly produced and rounded; base constricted and capitate. Raphe thin and straight. Axial area narrow; central area small and unilaterally dilated with an isolated stigma on the opposite side. Striae about 10-11 in 10  $\mu$ , slightly radial and indistinctly punctate.

*Habitat*: Fresh water. Collected from streams at Borivli and Kanheri caves in a small number.

This diatom agrees with *C. angustatum* Kütz. (Schmidt, A., 1874-1944, Atlas Diat. t. 234, f. 34-36) and *G. angustatum* (Kütz.) Rabh v. *producta* Grun. (Hustedt, 1930, Bacil. 373, f. 693) in the outline, axial and central areas, and the organisation of the striae. However, it differs in having shortly produced apex and rather capitate base; hence it is considered to be a new form.

#### 81. *Gomphonema martini* Fricke (Fig. 85)

Schmidt, A., 1874-1944, Atlas Diat. t. 238, f. 22-25, particularly f. 24; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 181, f. 1275 c-f (=v. *genuinum* A. Cl.).

Valves 80-97  $\mu$  long and 14-16  $\mu$  broad, narrowly lanceolate-clavate, inflated in the middle with apex acutely cuneate and base gradually attenuated. Raphe somewhat thick and straight. Axial area narrow, linear; central area fairly large, unilateral with an isolated stigma on the opposite side. Striae about 7.5-10 in 10  $\mu$ , middle 1-2 striae are abbreviated, radial and indistinctly punctate or lineolate.

*Habitat*: Fresh water. Collected from streams at Borivli, Kanheri caves, and Powai lake, usually in a small number.

This species agrees well with the type in all respects except that from this locality larger specimens have been recorded.

#### 82. *Gomphonema montanum* Schum. (Fig. 86)

Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 182, f. 1276 l-n (=v. *genuinum* Mayer); Schmidt, A., 1874-1944, Atlas Diat. t. 238, f. -11, particularly f. 1, 2, 8 (= *G. subclavatum* Grun v. *montana* Schum.) 1; Hustedt, 1930, Bacil. 375, f. 708 (= *G. longiceps* Ehr. v. *montana* (Schum.) Cl. f. *suecica* Grun.).

Valves 38.7-50  $\mu$  long and 7.7-5  $\mu$  broad, linear-clavate with undulate sides, apex broadly produced-wedge-shaped and from the middle narrowed gradually attenuated at the base. Raphe thick with part in the centre slightly unilaterally inclined. Axial area narrow, linear; central area large, somewhat quadrate, unilaterally expanded with an isolated stigma

on the opposite side. Striae 8-10 in  $10\ \mu$ , slightly radial and indistinctly punctate, 1-middle striae very short.

*Habitat*: Fresh water. Collected from streams at Borivli, Kanheri caves, and Powai lake, in a good number. Elsewhere in the locality it occurred as a stray form.

83. *Gomphonema montanum* v. *acuminatum* Mayer (Figs. 100-101)

Valves  $39.6-53\ \mu$  long and  $12.3-12.6\ \mu$  broad, striae about 9-10 in  $10\ \mu$ .

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Vihar lakes. Stray specimens also were obtained from other larger bodies of water.

Skvortzow has described almost identical forms as *G. acuminatum* v. *sinica* Skv. (Skvortzow, B. W., 1935, *Philipp. J. Sci.* 57: 474, pl. 3, f. 10-11) from Poyang lake material, which I include here.

84. *Gomphonema aequatoriale* Hust. (Figs. 87, 102)

Hustedt, 1949, *Expl. Parc Nat. Albert, Miss. H. Damas* (1935-36), 8: 119, t. 10, f. 6-8.

Valves  $48.6-80\ \mu$  long and  $10.8-15\ \mu$  broad, sublinear-clavate with broad subtruncate-rounded apex and gradually attenuated base, may be sometimes concave. Raphe thick with central part slightly unilaterally bent. Axial area moderately linear; central area large, somewhat unilaterally expanded with an isolated stigma on the opposite side. Striae 8-10 rarely up to 12 in  $10\ \mu$ , clearly lineate, radial and somewhat closely set at the ends.

*Habitat*: Fresh water. Collected from streams at Borivli, Kanheri caves, Powai, Vihar, and Tansa lakes, rather frequent. Stray specimens also were recorded from ponds at several places.

This species appears to be closely related to *G. subclavatum* Grun.

85. *Gomphonema clavatoides* sp. nov. (Figs. 88-89, 103)

Valvae  $26.2-36\ \mu$  longae atque  $7.2-8.7\ \mu$  latae, late clavatae, apice plus minus late rotundato, basi gradatim attenuata vel raro subcapitata. Raphe tenuis et recta. Area axialis angusta, sublinearis; area centralis plus minus ampla, unilateraliter dilatata, stigmatate unico in latere opposito. Striae 6-8 in  $10\ \mu$ , crasse lineatae atque aliquantum radiales. Typus lectus a H. P. Gandhi ad Borivli in rivulis die 10-8-1946, et positus in herbario auctoris sub numero BOM-BOR—99-102.

Valves  $26.2-36\ \mu$  long and  $7.2-8.7\ \mu$  broad, broadly clavate with more or less broadly rounded apex and gradually attenuated to rarely subcapitate base. Raphe thin and straight. Axial area narrow, sublinear; central area more or less large, unilaterally dilated with an isolated

stigma on the opposite side. Striae 6-8 in  $10\ \mu$ , coarsely lineate and slightly radial.

*Habitat*: Fresh water. Collected from streams at Borivli, Powai and Vihar lakes, in good number. It is also known from Kolhapur—Rankala tank, and Katyani hills and Ahmedabad—Chandola lake

This species does not agree with any of the similar looking forms in the literature, hence it is considered to be a new species.

86. *Gomphonema clavatoides* v. *valida* v. nov. (Fig. 104)

Valvae  $37.8-40\ \mu$  longae atque  $6.4-6.5\ \mu$  latae, lanceolato-clavatae, apice acute cuneato, ad basim gradatim attenuatae. Raphe aliquantum crassa et recta. Striae 7-8 in  $10\ \mu$ , crasse lineatae atque aliquantum radiales. Caetera ut in typo. Typus lectus a H. P. Gandhi ad Borivli in rivulis die 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR.—102.

Valves  $37.8-40\ \mu$  long and  $6.4-6.5\ \mu$  broad, lanceolate-clavate with acutely cuneate apex and gradually attenuated base. Raphe somewhat thick and straight. Striae 7-8 in  $10\ \mu$ , coarsely lineate and slightly radial. In all other characters like the type

*Habitat*: Fresh water. Collected from streams at Borivli and Powai lake along with the type, as stray specimens

This diatom differs from the above type in having acutely cuneate apex, slimmer valves and more attenuated base. It is therefore considered to be a new variety.

87. *Gomphonema lanceolatum* Ehr. (Figs 105-107)

*Habitat*: Fresh water. Collected from several wet situations in the region, as a common and frequent form.

Some of the forms recorded from Bombay and Salsette region were found to be comparatively broader than the type described in the literature.

88. *Gomphonema lanceolatum* v. *insignis* (Greg.) Cl

*Habitat*: Fresh water. Collected from streams at Borivli and Powai and Vihar lakes as a common form, but elsewhere seen as scarce.

89. *Gomphonema magnifica* sp. nov. (Fig. 108)

Valvae  $80-90\ \mu$  longae atque  $18-19.8\ \mu$  latae, lanceolato-clavatae, apicibus acute rotundatis, basi interdum concava. Raphe crassa et recta. Area axialis angusta, linearis; area centralis parva, aliquantum unilateralis stigmatate unico in latere opposito. Striae 6.5-8 in  $10\ \mu$ , paululum radiales, distincte punctatae, punctis circiter 13-15 in  $10\ \mu$ ,

singulae striae mediae remote evolutae Typus lectus a H. P. Gandhi ad Borivli in rivulis die 1944, 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR—106.

Valves 80-90  $\mu$  long and 18-19.8  $\mu$  broad, lanceolate-clavate with acutely rounded apices, the base sometimes concave. Raphe thick and straight. Axial area narrow, linear; central area small, slightly unilateral with an isolated stigma on the opposite side. Striae, 6.5-8 in 10  $\mu$ , very slightly radial, distinctly punctate, puncta about 13-15 in 10  $\mu$ , single middle striae distantly formed.

*Habitat*: Fresh water. Collected from streams at Borivli and Powai and Vihar lakes as a common form. From other bodies of water it is recorded to be very stray.

This species agrees with *G. lanceolatum* Ehr. in the outline, raphe, and punctate striae, but greatly differs in having much broader valves and larger size. Moreover, the striae are only slightly radial, very clearly punctate, and much fewer per 10  $\mu$  than in *G. lanceolatum*. It is therefore considered to be a different type, and as it does not agree with any other known species it is regarded as a new species.

90. *Gomphonema magnifica* v. *rhomboida* v. nov. (Fig. 109)

Valvae 79-85  $\mu$  longae atque 19.8-20  $\mu$  latae, rhomboideo-lanceolato-clavatae, apicibus acute rotundatis, basi interdum paululum concava. Striae 6.5-7 in 10  $\mu$  vel rarius 8 in 10  $\mu$ , distincte punctatae. Caetera ut in typo. Typus lectus a H. P. Gandhi ad Borivli in rivulis die 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR—106.

Valves 70-85  $\mu$  long and 19.8-20  $\mu$  broad, rhomboid-lanceolate-clavate with acutely rounded ends, the base sometimes slightly concave. Striae 6.5-7 to rarely 8 in 10  $\mu$ , distinctly punctate. In all other characters like the type.

*Habitat*: Fresh water. Collected from streams at Borivli and Powai lake along with the type, usually in a small number.

This diatom differs from the type in having rhomboid-lanceolate-clavate shape and more clearly marked punctate striae.

91. *Gomphonema gracile* Ehr. (Figs. 111-112)

*Habitat*: Fresh water. Collected from several pools, ponds, tanks, and other wet situations in the region. A common form.

The two illustrations given here suggest the range of variation that was recorded among the forms collected from the area. The figure 112 corresponds well with Schmidt's 'Atlas Diat' t. 236, f. 16, whereas the other does with those given by Hustedt and Cleve-Euler.

92. *Gomphonema gracile* v. *naviculoides* (W. Sm.) Grun. (Figs. 113-114)

Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 186, f. 1281 c ; Schmidt, A., 1874-1944, Atlas Diat. t. 236, f. 18-19 (= *G.*—v. *naviculacea* W. Sm.)

Valves 49-70  $\mu$  long and 8.5-10.8  $\mu$  broad, almost isopolar, lanceolate-weakly-clavate, slightly bent with attenuated ends. Raphe thin and straight, feebly excentric. Axial area narrow, linear-lanceolate ; central area roundish and somewhat unilaterally expanded with an isolated stigma on the opposite side. Striae 12-16 in 10  $\mu$ , radial and indistinctly punctate.

*Habitat* : Fresh water. Collected from ponds at Andheri, Jogeshwari, Goregaon, streams at Borivli, and Powai lake, usually in a small number along with the type. Fairly distributed.

93. *Gomphonema gracile* v. *aurita* A. Br. (Fig. 115)

Schmidt, A., 1874-1944, Atlas Diat. t. 236, f. 20-24 ; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 186, f. 1281 i (= *G.*—v. *auritum* A. Br.)

Valves 56-59  $\mu$  long and 9.2-9.6  $\mu$  broad, lanceolate-clavate, somewhat rhomboid with acutely rounded ends. In living cells ends are often provided with gelatinous apicules. Raphe thin and straight. Axial area very narrow ; central area slightly unilaterally formed with an isolated stigma on the opposite side. Striae 13-17 in 10  $\mu$ , strongly radial and more closely set towards the ends, one middle striae quite distant than the rest.

*Habitat* : Fresh water. Collected from Powai and Vihar lakes in good number but elsewhere seen as very stray specimens.

94. *Gomphonema gracile* v. *lanceolata* (Kütz.) Cl. (Fig. 116-117)

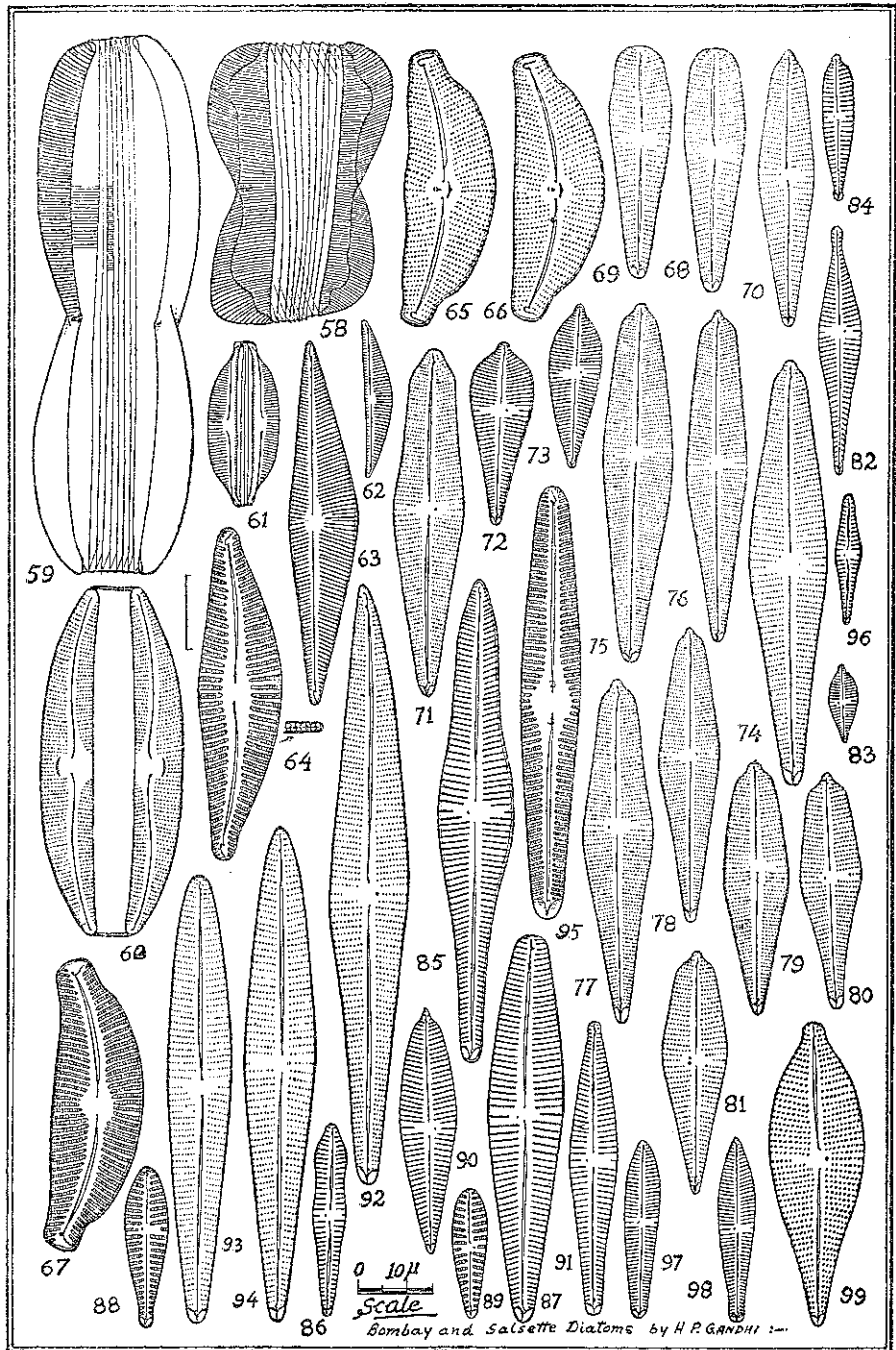
Schmidt, A., 1874-1944, Atlas Diat. t. 236, f. 25-28, t. 237, f. 9-10 (= *G.*—v. *lanceolata* Kütz.) ; Hustedt, 1938, *Arch. Hydrobiol., Suppl.*, 15 : 439, t. 28, f. 11-13 ; Cleve-Euler, A., 1951-55, Diat. Schwed. Finn.—IV, 186, f. 1281 m-o (= *G.*—v. *lanceolatum* (Kütz.) Cl. ?)

Valves 45-49  $\mu$  long and 9-10  $\mu$  broad, distinctly lanceolate-clavate with more acutely rounded apex than the base, sometimes feebly constricted and produced. Raphe coarse and straight. Axial area very narrow ; central area small, slightly unilateral with an isolated stigma. Striae 14-16 in 10  $\mu$ , radial and indistinctly lineolate.

*Habitat* : Fresh water. Collected from several wet situations in the region but usually in a small number along with the type.

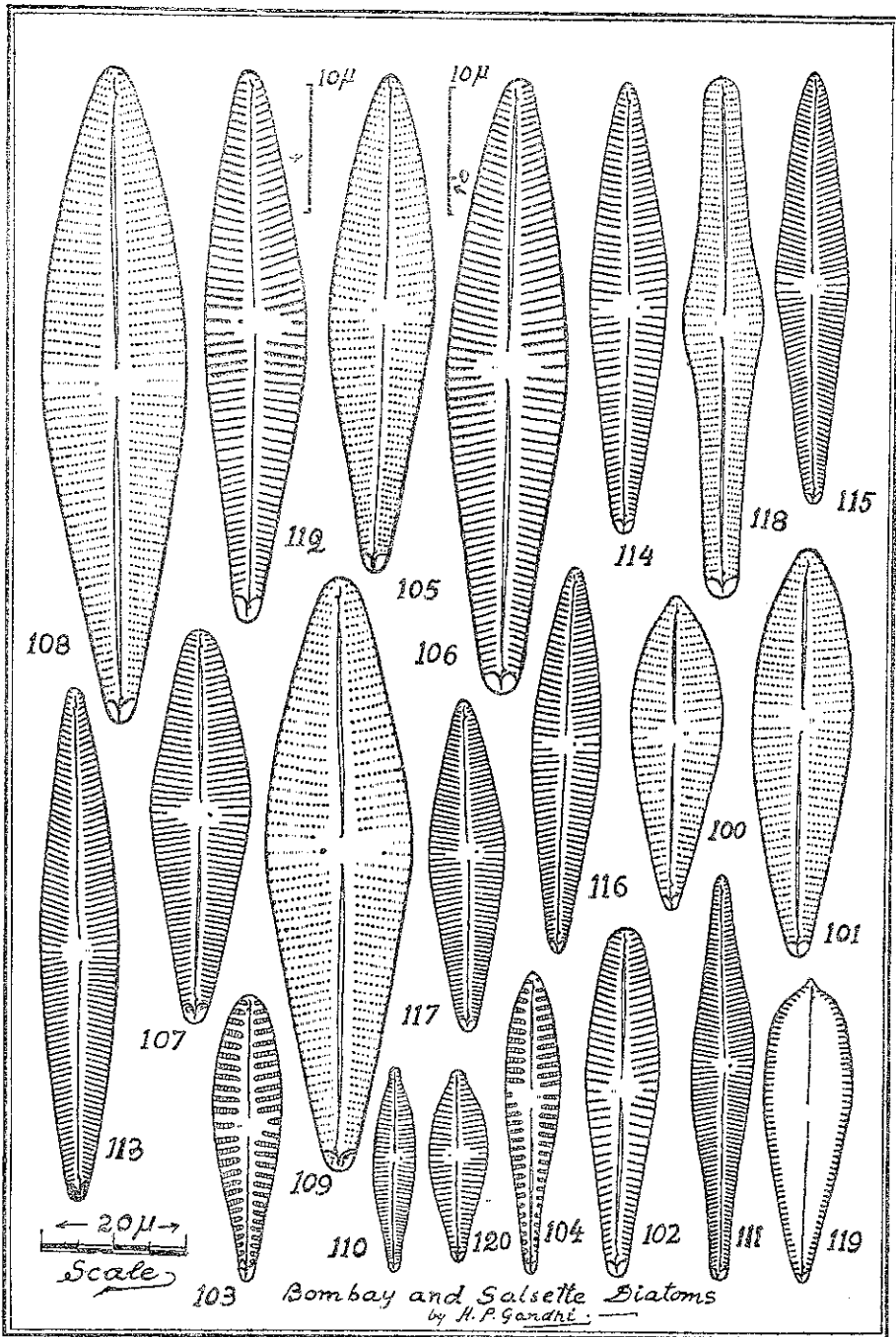
The present diatoms differ from Cleve-Euler's specimens in not having clearly defined apiculate apex. Moreover, the outline here is





FIGURES 58-99

Fig. 58. *Amphiprora alata* Kütz.; 59. *Amphiprora lata* Grev. v. *angustior* McCall; 60. *Amphora ovalis* Kütz. v. *gracilis* (Ehr.) Cl.; 61. *Amphora acutiuscula* Kütz.; 62. *Cymbella gracilis* (Rabh.) Cl.; 63. *Cymbella yarrensii* (A. S.) Cl.; 64. *Cymbella leptoceros* (Ehr.?) Grun. v. *rostrata* Hust. f. *indica* f. nov.; 65-66. *Cymbella tumida* (Bréb.) V. H.; 67. *Cymbella powaiana* sp. nov.; 68. *Gomphonema constrictum* Ehr. v. *capitata* (Ehr.) Cl.; 69. *Gomphonema constrictum* v. *indica* v. nov.; 70-71. *Gomphonema acuminatum* Ehr. v. *turris* (Ehr.) Cl.; 72-73. *Gomphonema augur* Ehr.; 74-80. *Gomphonema subapicatum* Fritsch & Rich; 81. *Gomphonema subapicatum* v. *okamurae* (Skv.) emend; 82. *Gomphonema subtile* Ehr. v. *malayensis* Hust.; 83. *Gomphonema parvulum* Kütz.; 84. *Gomphonema angustatum* (Kütz.) Rabh. v. *producta* Grun. f. *indica* f. nov.; 85. *Gomphonema martini* Fricke; 86. *Gomphonema montanum* Schum; 87. *Gomphonema aequatoriale* Hust.; 88-89. *Gomphonema clavatooides* sp. nov.; 90. *Gomphonema gracile* v. *frickei* v. nov.; 91. *Gomphonema gracile* v. *subcapitata* v. nov.; 92. *Gomphonema spiculoides* v. *major* v. nov.; 93. *Gomphonema balatonis* Pant.; 94. *Gomphonema balatonis* v. *lanceolata* v. nov.; 95. *Gomphonema sumatrense* Fricke; 96. *Gomphonema undulatum* Hustedt; 97-98. *Gomphonema tenuis* sp. nov.; 99. *Gomphonema moniliforme* sp. nov.



FIGURES 100-120

Fig. 100-101. *Gomphonema montanum* v. *acuminatum* Mayer; 102. *Gomphonema aequatoriale* Hust; 103. *Gomphonema clavatooides* sp nov.; 104. *Gomphonema clavatooides* v. *valida* v nov.; 105-107. *Gomphonema lanceolatum* Ehr; 108. *Gomphonema magna* sp. nov.; 109. *Gomphonema magna* v. *rhomboides* v. nov.; 110. *Gomphonema parvulum* v. *lagenula* (Grun.) Hust.; 111-112. *Gomphonema gracile* Ehr; 113-114. *Gomphonema gracile* v. *naviculoides* (W. Sm.) Grun.; 115. *Gomphonema gracile* v. *aurita* A. Br.; 116-117. *Gomphonema gracile* v. *lanceolatum* (Kütz) Cl.; 118. *Gomphonema intricatum* v. *vibrio* (Ehr) Cl; 119. *Gomphonema lingulatum* Hust; 120. *Gomphonema parvulum* Kütz

rather more lanceolate than clavate. Hustedt's *G. gracile* v. *lanceolata* (Kütz.) Cl. (Hustedt, 1930, Bacil. 376, f. 703) differs in having more drawnout apex. However, the present specimens very closely agree with those illustrated in the 'Atlas' and recorded by Hustedt (1938).

95. *Gomphonema gracile* v. *frickei* v. nov. (Fig. 90)

Valvae 50-52  $\mu$  longae atque 11-11.2  $\mu$  latae, clavato-lanceolatae, apice constricto, distincte apiculato, basi gradatim attenuata. Raphe tenuis et recta. Area axialis angustissima; area centralis aliquantum unilateraliter dilatata, stigmati unico in latere opposito. Striae 8-12 in 10  $\mu$ , radiales atque indistincte punctatae. Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—60.

Valves 50-52  $\mu$  long and 11-11.2  $\mu$  broad, clavate-lanceolate with constricted distinctly apiculate apex and gradually attenuated base. Raphe thin and straight. Axial area very narrow, central area slightly unilaterally dilated with an isolated stigma on the opposite side. Striae 8-12 in 10  $\mu$ , radial and indistinctly punctate.

*Habitat*: Fresh water. Collected from Powai lake as a stray form.

This diatom more or less agrees well with "*G. gracile* v", as given in the 'Atlas Diat.' t. 236, f. 31, in the outline and sharply pointed apiculate apex. However, the present valves are clearly clavate, i.e. the apex region is distinctly broad; thus they differ. As the figure 31 on t. 236 of the 'Atlas' has no complete name, it has been named here and the present specimens are included under the same with the noted differences.

96. *Gomphonema gracile* v. *subcapitata* v. nov. (Fig. 91)

Valvae 50-60  $\mu$  longae atque 9-10  $\mu$  latae, lanceolato-clavatae, apice constricto subcapitato, basi aliquantum concava, attenuato-rotundata. Raphe tenuis et recta. Area axialis angustissima; area centralis magna, unilateraliter dilatata, stigmati unico in latere opposito. Striae 8-9 in medio ac 9-13 in 10  $\mu$  in utroque apice, radiales atque indistincte punctatae. Typus lectus a H. P. Gandhi ad Wadala die 31-7-1945, et positus in herbario proprio auctoris sub numero BOM-WAD—16.

Valves 50-60  $\mu$  long and 9-10  $\mu$  broad, lanceolate-clavate with constricted subcapitate apex and slightly concave, gradually attenuated rounded base. Raphe thin and straight. Axial area very narrow; central area large, unilateral with an isolated stigma on the opposite side. Striae 8-9 in the middle and 9-13 in 10  $\mu$ , towards the ends, radial and indistinctly punctate.

*Habitat* : Fresh water. Collected from pools and ponds at Wadala in a small number along with the type. It is also recorded from the Jog falls.

This diatom agrees well with *G. gracile* Ehr. in the general outline, range of dimensions, and the nature and arrangement of the striae. However, the forms observed during different times always showed the apex slightly constricted and subcapitate ; hence such specimens are considered to be a new variety

97. *Gomphonema spiculoides* Gandhi, nov. nom.

*G. spicula* Gandhi, *J. Bombay nat. Hist. Soc.* 55 : 501, f. 28, 1958 (non *G. spicula* Manguin).

*Habitat* : Fresh water. Collected from pools and ponds at Wadala, ponds at Andheri, Goregaon, Vile-Parle, and streams at Borivli. Fairly common.

I have to introduce here a new nomenclature for my *G. spicula*, since my esteemed friend Dr. J. W. G. Lund informed me of the same name existing in the literature. Unfortunately, I did not have the publication in which the other *G. spicula* was described, nor could I avail the same from any other source. Naturally, I approached Dr. Manguin who so kindly furnished me with the full information regarding his *G. spicula*, and I understand that my *G. spicula* is a different species altogether. I, herewith, extend my grateful thanks to both these friends for furnishing me with the valuable information

98. *Gomphonema spiculoides* v. *major* v. nov. (Fig. 92)

Valvae 90-123  $\mu$  longae atque 12.5-16  $\mu$  latae, anguste lanceolato-clavatae, aliquantum arcuatae, apice acutissimo, ad basim gradatim attenuatae. Raphe crassa, parte centrali unilateraliter inclinata. Area axialis angustissima ; area centralis unilateraliter dilatata, stigmatem unico in latere opposito. Striae 7-8 in medio ac 8-11 in 10  $\mu$  in utroque apice, radiales atque distincte punctatae, punctis 16-18 in 10  $\mu$ . Typus lectus a H. P. Gandhi ad Wadala die 31-7-1945, et positus in herbario proprio auctoris sub numero BOM-WAD —18

Valves 90-123  $\mu$  long and 12.5-16  $\mu$  broad, narrowly lanceolate-clavate, slightly arcuate, apex very acute, towards the base gradually attenuated. Raphe thick with central part unilaterally bent. Axial area very narrow ; central area unilaterally dilated with an isolated stigma on the opposite side. Striae 7-8 in the middle and 8-11 in 10  $\mu$  towards the ends, radial and distinctly punctate, punctae about 16-18 in 10  $\mu$ .

*Habitat* : Fresh water. Collected from ponds at Wadala in good number, but stray specimens also were collected from ponds at Gore-

gaon, Andheri, Vile-Parle, and Borivli streams. Fairly distributed in the region

This diatom agrees well with *G. spiculoides* Gandhi, collected here and from Kolhapur and Jog falls, in the shape, raphe, and the organisation of the striae. However, these forms are very large with comparatively very few striae per 10  $\mu$ . Unfortunately, I have so far not come across any such intergrading specimens which might connect these two extreme ranges of dimensions. I, therefore, regard the present specimens to be a new variety of *G. spiculoides*, till the other intergrading individuals are discovered.

99 *Gomphonema intricatum* Kütz.

*Habitat*: Fresh water. Collected from ponds at Goregaon, Dahisar, Sion, streams at Borivli, and Powai, Vihar, and Tansa lakes. Fairly common

100 *Gomphonema intricatum* v *vibrio* (Ehr.) Cl. (Fig 118)

*Habitat*: Fresh water. Collected from pools, ponds, and tanks around Andheri, Goregaon, Vile-Parle, and other wet situations in the region, usually in a small number

101. *Gomphonema balatonis* Pant. (Fig 93)

Pantocsek, J., 1902, *Res. Wiss. Erf. Balat.* 2 (2) : 64, t. 7, f. 164.

Valves 86-90  $\mu$  long and 12-12.6  $\mu$  broad, narrowly lanceolate-clavate with rounded ends without constrictions. Raphe thick and straight, terminal fissures distinct. Axial area narrow, linear; central area slightly unilaterally enlarged with an isolated stigma on the opposite side. Striae 6-7 in 10  $\mu$  in the middle up to 8.5 towards the ends, slightly radial, fine but clearly punctate, punctae about 13-15 in 10  $\mu$

*Habitat*: Fresh water. Collected from Powai and Vihar lakes in a small number. It was also collected from Someshwar tank at Dharwar as a stray form.

This species agrees well with the type described by Pantocsek, except that the local forms were found to be somewhat of larger size. Cleve-Euler regards the same as *G. lanceolatum* Ehr. v. *affine* (Kütz.) A. Cl. (Cleve-Euler, A., 1951-55, *Diat. Schwed. Finn.*—IV, 185, f. 1280 g-p), but the illustrations given do not agree well either with Pantocsek's or the present forms. Moreover, the striae do not appear to be very closely set towards the apices as are being indicated by Cleve-Euler (striae at the ends shown to be around 11-13 in 10  $\mu$ ). I, therefore, consider *G. balatonis* Pant. to be different from *G. lanceolatum* v. *affine*, of Cleve-Euler.

Further, Hustedt has described a diatom as *G. dubravicense* Pant.

(Hustedt. 1938, *Arch. Hydrobiol.*, *Suppl.* 15 : 437, t. 28, f. 1) which agrees with the present form in all respects except that it has two stigmata in the central area. While referring to Pantocsek's original paper (Pantocsek, J., 1905, *Beit. z. Kenn. foss. Bac.*—III, 54, t. 20, f. 294, 296), illustrations given in the 'Atlas Diat.' t. 238, f. 32-34, and by Cleve-Euler (Cleve-Euler, *op. cit.* IV, 190, f. 1286 a-b), it appears that *G. dubravicense* Pant. is more or less tumid in the middle with axial and central areas comparatively large and the central area has more than two stigmata in one or more rows situated on one or both sides of the central nodule. Evidently, Hustedt's *G. dubravicense* seems to be different from that of Pantocsek's. However, I am presently not quite sure if it could be referable to *G. balatonis* or otherwise, since my own material has been too little to allow more detailed study.

102. *Gomphonema balatonis* Pant. v. *lanceolata* v. nov. (Fig. 94)

Valvae 100-108  $\mu$  longae atque 14-14.4  $\mu$  latae, anguste lanceolato-clavatae, apice acute cuneato, basi gradatim attenuata. Striae 6-8 in 10  $\mu$ , aliquantum radiales atque distincte punctatae. Caetera ut in typo. Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—108.

Valves 100-108  $\mu$  long and 14-14.4  $\mu$  broad, narrowly lanceolate-clavate with acutely cuneate apex and gradually attenuated base. Striae 6-8 in 10  $\mu$ , slightly radial and distinctly punctate. In all other characters like the type.

*Habitat* : Fresh water. Collected from Powai lake along with the type in a small number. A few specimens also were available from streams at Borivli. A rare type.

This diatom differs from the type in having acutely cuneate apex and somewhat more distinctly punctate striae. It also bears some resemblance with *G. hungaricum* Pant (Pantocsek, J., 1905, *Beit. z. Kenn. foss. Bac.*—III, 54, t. 2, f. 28), but the present form differs in having more narrowly cuneate apex and only a single shortened striae in the middle part. However, it may be stated that further observations are necessary regarding this diatom to draw any conclusions.

103. *Gomphonema sumatrense* Fricke (Fig. 95)

Schmidt, A., 1874-1944, *Atlas Diat.* t. 248, f. 2-3.

Valves 87.7-94  $\mu$  long and 12-12.4  $\mu$  broad, narrowly-lanceolate-clavate with broadly rounded ends. Raphe thick and straight with part in the central nodule transversely comma-shaped and terminal fissures distinct, bayonet-shaped. Axial area narrowly lanceolate, gradually widened in the middle to form a wide, more or less elliptical central area, stigma formed on one side. Striae 7-8.5 in 10  $\mu$ , coarsely lineate, radial, lineations about 18-20 in 10  $\mu$ .

*Habitat* : Fresh water. Collected from ponds at Goregaon, Andheri, Vile-Parle, streams at Vajreshwari, Powai and Vihar lakes. It mostly occurred as a stray form.

104. **Gomphonema undulatum** Hustedt (Fig 96)

Hustedt, 1936, *Arch. Hydrobiol., Suppl.* 14 : 166, t. 5, f. 34 ; 1938, *ibid.*, 15 : 441, t. 28, f. 2-8.

Valves 25-35  $\mu$  long and 5.2-5.8  $\mu$  broad, lanceolate-clavate with sides between the middle and ends somewhat concave, apex more broad than the base. Raphe coarse and clearly undulate with central part unilaterally bent. Axial area very narrow; central area quite large and unilateral with an isolated stigma on the opposite side. Striae 10-11 in 10  $\mu$ , coarse, radial, indistinctly punctate and the middle striae very much shortened.

*Habitat* : Fresh water. Collected from streams at Borivli, Chembur hills, Powai and Vihar lakes, usually in a small number.

105. **Gomphonema tenuis** sp. nov. (Figs. 97-98)

Valvae 30-37.5  $\mu$  longae atque 6.4-7.4  $\mu$  latae, clavato-lanceolatae, apice acuto-cuneato, basi gradatim attenuata, late rotundata, aliquando producta vel producto-subcapitata. Raphe tenuis et recta. Area axialis angustissima; area centralis magna, unilateraliter dilatata, stigmatum unico in latere opposito. Striae 13-15 in 10  $\mu$ , radiales, subtiles, media vero striae valde abbreviata. Typus lectus a H. P. Gandhi ad Borivli in rivulis die 10-8-1946, et positus in herbario proprio auctoris sub numero BOM-BOR.—107.

Valves 30-37.5  $\mu$  long and 6.4-7.4  $\mu$  broad, clavate-lanceolate with acutely cuneate apex and gradually attenuated broadly rounded base, base sometimes produced to produced-subcapitate. Raphe thin and straight. Axial area very narrow; central area large, unilaterally dilated with an isolated stigma on the opposite side. Striae 13-15 in 10  $\mu$ , radial, quite fine and one middle striae much abbreviated.

*Habitat* : Fresh water. Collected from streams at Borivli, Kanheri caves, Powai lake, in a good number mixed up in vegetable dead matter. It was also collected from Kolhapur-Katyani hill streams, and some pools along roadsides.

This species does not agree with any of the known types of similar shape; hence it is considered to be a new species.

106. **Gomphonema moniliforme** sp. nov. (Fig. 99)

Valvae 56-52  $\mu$  longae atque 19-20  $\mu$  latae, late clavatae, apice constricto, producto-subtruncato, basi aliquantum concava ad latera ac attenuata. Raphe crassa et recta, parte centrali unilateraliter inclinata

in nodulo centrali, fissuris terminalibus distinctis. Area axialis angusta, linearis; area centralis angusta, unilateraliter dilatata, stigmatе unico in latere opposito. Striae 7.5-8 in 10  $\mu$ , aliquantum radiales, crasse punctatae, punctis circiter 11-13 in 10  $\mu$ . Typus lectus a H. P. Gandhi in lacu Powai die 6-3-1945, et positus in herbario proprio auctoris sub numero BOM-POW.—110.

Valves 56-62  $\mu$  long and 19-20  $\mu$  broad, broadly-clavate, apex constricted, produced-subtruncate; base with slightly concave sides and attenuated. Raphe thick with part in the central nodule unilaterally bent and terminal fissures distinct. Axial area narrow, linear; central area narrow unilaterally dilated with an isolated stigma on the opposite side. Striae 7.5-8 in 10  $\mu$ , slightly radial, coarsely punctate and puncta about 11-13 in 10  $\mu$ .

*Habitat*: Fresh water. Collected from Powai lake in a small number.

This diatom is quite distinctive and does not agree with any other type, hence it is considered to be a new species.

107. *Gomphonema olivaceum* (Lyngb.) Kütz

*Habitat*: Fresh water. Collected from streams at Borivli, Powai, Vihar, and Tansa lakes, and several other large bodies of water in region. A common form.

108. *Gomphonema lingulatum* Hust. (Fig. 119)

Hustedt, 1927, *Arch. Hydrobiol.* 18 : 166, t. 5, f. 5; Skvortzow, B. W., 1937, *Philipp. J. Sci.* 61 : 52, pl. 13, f. 6-7; 1937b, *ibid.* 61 : 285, pl. 3, f. 13; Hustedt, 1938, *Arch. Hydrobiol., Suppl.* 15 : 443, t. 27, f. 1.

Valves 30-42  $\mu$  long and 10-12  $\mu$  broad, clavate with shortly apiculate apex and gradually attenuated base. Raphe thin and straight. Axial area very broad; central area not defined. Stigma absent. Striae 14-15 in 10  $\mu$ , radial, short and marginal.

*Habitat*: Fresh water. Collected from Powai and Vihar lakes in a small number.

#### SUMMARY

This paper deals with the diatom genera *Pinnularia*, *Amphiprora*, *Amphora*, *Cymbella*, and *Gomphonema*, collected from the year 1945 to 1958, from the region of Bombay and Salsette. Here, in all 108 diatoms are recorded of which 53 are new records for India and eight species, twelve varieties, and three forms are considered to be new to science.



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