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The Fresh-water Diatom-Flora from Mugad, Dharwar District with some Ecological Notes

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(With 4 Plates)

In this paper is given a systematic account of all the Diatomaceae, except the genus *Pinnularia* Ehr., collected from the Mugad region in the District of Dharwar—Mysore State. From the account it appears that there are several new Diatoms available—and there exists yet a possibility of a greater number being found provided a larger area is explored and many collections made over years. The present account is based on comparatively few collections made mostly from small bodies of water in fields and on road-sides, during a brief period of a month. However, the collections show a good harvest. Besides systematic treatment, some notes on their ecology, occurrence and distribution are also given.

The author in his earlier paper (1957) has described the Diatom genus *Pinnularia* Ehr. 1843 from Mugad, besides which no other account of Diatomaceae from this area is available. Here, therefore, an attempt is made to describe all the Diatoms investigated from this region with some notes on their ecology, occurrence and distribution.

The collections were chiefly made from various ditches and pools on road-sides as well as in paddy and millet fields, during the rainy season of 1949 in the months of July-August. However, these collections could not be made extensive or comprehensive due to the author's unfortunate transfer from Karnatak College, Dharwar, after a very brief stay. It is quite likely that the area might have yielded a greater wealth of Diatom-flora, than is presented here, had a more extensive area been surveyed and the collection work extended over some years. Here, therefore, the author's chief aim remains to point out that even such a small area explored and meagre collections made could represent the richness of the Diatom-flora in this region. It suggests a further need for such work.

Indicative of the richness of the Diatom-flora of this area, the author has already shown in his earlier paper that out of 17 *Pinnularia* 6 are new to Science making 35.3 % of the local types. In the present account out of 58 species 10—11 are probably new, i.e. 17.24—19 % as local types ; totalling all the specimens found, they make 21.33—22.67 % of local types.

Surveying further, the genera *Hantzschia*, *Neidium* and *Stauroneis* respectively are richly represented, besides the *Pinnularia* which has already been described. These four genera were mostly abundant with regard to their species in the rain-inundated fields. Perhaps this richness could be correlated with the greater quantity of mineral nutritive

salts available to them from these fields, for most of these fields were well manured. Other genera appear to be sparsely represented, as indicated in several instances either by a single or a few species.

The flora of this part shows quite an affinity with that found in the more Northern region (Bombay-Salsette, Gujarat (unpublished work)), as this area is also a part of the Deccan Trap, i.e. governed by probably the same geological conditions. However, this topic will be dealt with fully at some future date when more data becomes available with extensive surveys made over years. Presently, the data is very meagre, and therefore reference to geological affinity in such an event is only a precocious hint.

In the present account illustrations and detailed descriptions are given for only those Diatoms which are either new records for India or altogether new forms. However, some forms are re-illustrated where such a need was felt.

The classification and identification is done according to Hustedt's (1930) and Cleve-Euler's (1951-55) monographs. Besides these, Van Heurck's Treatise on the Diatomaceae is referred to along with several other monographs and papers. The dimensions given for the individual forms are those actually recorded from the material. All the slides and material in connection with this paper lie with the author in his personal herbarium.

1. *Melosira granulata* (Ehr.) Ralfs.

Hustedt, Bacil., 87, f. 44 :— Length 9-15 μ, diam. 7-9 μ and striae 8-10 in 10 μ.

This diatom was mostly collected from slimy, pale-brown matter lying in either slowly flowing water or on margin of pools and some ditches along with decaying vegetable matter. Apparently widely distributed though not abundant anywhere in the locality. Its position in the Halobion system according to Petersen . . . . Indifferent.

2. *Melosira granulata* v. *angustissima* O. Müll.

Hustedt, Bacil., 88, f. 45 :— Length 35-40 μ, diam. 4-5 μ and striae 10-12 in 10 μ.

This diatom was particularly observed from larger pools and ponds, often along with the type but as a stray form. Distribution is limited. Its position in the Halobion system according to Foged . . . Indifferent.

3. *Melosira granulata* v. *muzzanensis*, Meister.

Hustedt, Bacil., 88, f. 47 :— Length 10-12 μ, diam. 16-20 μ and striae 11-12 in 10 μ.

This specimen was found in standing water of ponds and pools, appearing as a pale brown slime often along with the type. Again the distribution is limited, but more abundant than the above type. Its position in the Halobion system . . . . . ?

4. *Cyclotella meneghiniana*, Kütz.

Hustedt, Bacil., 100, f. 67 :— Diam. 10-26 μ and striae 8-9 in 10 μ.

It is a very common diatom found throughout the region is slimy matter of pools, ponds, ditches and in water courses with vegetable debris. However, it was never seen in abundance. It seemed to prefer water of a higher organic content as seen by its occurrence in larger numbers in such habitats. Its position in the Halobion system according to Hustedt, Petersen, Foged and Iyengar and Venkataraman . . . Halophilous.

5. *Cyclotella glomerata*, Bachman

Hustedt, Bacil., 105, f. 81 :— Diam. 4-7 μ and striae 12-13 in 10 μ.

It is a small diatom particularly noted from slowly flowing water courses in fields, often appearing in light brown soil matrix building up local colonies. However, it was not widely distributed in the region. It seemed to prefer open sunny situations where it was found in good numbers. Its position in the Halobion system ..... ?

6. *Synedra ulna*, (Nitz.) Ehr.

Hustedt, Bacil., 151, f. 158-9 :— Length 80-150 μ, breadth 6-7 μ, and striae 9-10 in 10 μ.

It is one of the commonest diatoms found in the locality. It appeared to be more abundant particularly in larger bodies of water, sometimes gregarious, forming chains or ribbons of pale brown colour. It occurred as stray specimens in some ditches and some small water holes in fields. Its position in the Halobion system according to Hustedt, Petersen, Foged and Iyengar and Venkataraman ..... Indifferent.

7. *Synedra ulna* v. *amphirhynchus* (Ehr.) Grun.

Hustedt, Bacil., 154, f. 167 :— Length 150-200 μ, breadth 5-7 μ, and striae 10 in 10 μ.

This diatom occurred very sparingly in certain pools and ditches along with the type. It was very poorly distributed in the locality. Its place in the Halobion system according to Hustedt ..... ?

8. *Synedra ulna* v. *danica* (Kütz.) Grun.

Hustedt, Bacil., 154, f. 168 :— Length 135-195 μ, breadth 5-5.5 μ, striae 9-10 in 10 μ.

This type also was seen as a stray form in some puddles and water holes. Poorly distributed in the area. In larger bodies of water it was present in greater numbers. Its place in the Halobion system according to Petersen, Foged and Iyengar and Venkataraman ..... Indifferent.

9. *Eunotia major* (W. Sm.) Rabh. v. *indica* (Grun.) Å. Berg. (Fig. 18).

Berg, Å., *Some new Eunotia*, 452 ; Cleve-Euler, A., Diat. Schwed Finn.—II, 120, f. 456 r :— Length 53-60 μ, breadth 8-8.5 μ and striae 10-16 in 10 μ.

This species was particularly collected from pools and ditches as an isolated or stray form and only a few samples contained it. Its position in the Halobion system ..... ?

10. *Cocconeis placentula* Ehr. v. *euglypta* (Ehr.) Cl.

Hustedt, Bacil., 190, f. 261 :— Length 19-30 μ, breadth 13-16 μ and striae 24—26 in 10 μ.

This is also one of the commonest diatoms found in the locality, particularly inhabiting brownish or pale brown slimy matrix on the wet soils and on submerged rotting vegetable stuff in standing water, occasionally gregarious. In samples from fields it occurred rather sparingly. Its place in the Halobion system according to Hustedt, Petersen and Foged ..... Indifferent.

11. *Gyrosigma spencerii* (W. Sm.) Cl. (Fig. 1).

Hustedt, Bacil., 225, f. 336 ; Cleve-Euler, A., Diat. Schwed. Finn.—V, 14, f. 1344 a-b (=*G. spencerii* v. *smithii* (Grun.) A. Cl.) ; Van Heurck, Treat. Diat., 257, t. 7, f. 276 (=*Pleurosigma spencerii* W. Sm. v. *smithii* Grun.) :— Valves 72-75 μ long and 12.5 μ broad, sigmoid, linear-lanceolate with broadly rounded ends. Raphe central, sigmoid. Central area very slightly elliptical. Striae transverse 16-20 and longitudinal ones 20-22 in 10 μ.

This diatom was found as a casual or rare specimen in samples collected from a pool. A single sample from a paddy field also contained it as a very rare form. Its place in the Halobion system according to Hustedt and Foged ..... Mesohalobous.

12. *Caloneis pulchra* Messikommer v. *interrupta* v. nov (Fig. 2).

Valvae 53-56 μ longae atque 8 μ latae, lineares, gibbosae in medio ac in utroque apice late rotundatis. Raphe tenuis et recta. Area axialis ampla, linearis-lanceolatae ; area centralis amplissima, ad margines perveniens. Striae 18-20 in 10 μ, radiales ; tenui sed distincte longitudinali linea ad margines interruptae.

Valves 53-56 μ long and 8 μ broad, linear, gibbous in the middle with broadly rounded ends. Raphe thin and straight. Axial area fairly wide, linear-lanceolate ; central area very large, reaching the sides. Striae 18-20 in 10 μ radial ; fine but clear longitudinal line interrupts them near the margins.

This diatom agrees well with *Caloneis pulchra* Messik. (Hustedt, Bacil., 235, f. 357 ; Cleve-Euler, A., Diat. Schwed. Finn.—IV, 106, f. 1152 a-b (—v. *genuina* A. Cl.)), in all respects except that it has a very wide central area reaching the sides. It is, therefore, regarded as a new variety.

This species was found in a few samples collected from millet or paddy fields. It was found forming a pale brown film on a half-submerged stone in a pool. Not common in the area. Its place in the Halobion system ..... ?

13. *Caloneis bacillum* (Grun.) Meresch.

Hustedt, Bacil., 236, f. 360 :— Length 23.4-28 μ, breadth 6.6-7 μ and striae 22-24 in 10 μ

This species was observed in good number in many samples both from road-side ditches and millet—paddy fields. However, it was not seen forming any local colonies. It was found in brownish matrix deposited on the margins of pools and other bodies of water. Its place in the Halobion system according to Hustedt, Petersen and Foged ..... Indifferent.

14. *Caloneis silicula* (Ehr.) Cl.

Hustedt, Bacil., 236, f. 362 :— Length 41-50 μ, breadth 7-7.5 μ and striae 18-22 in 10 μ.

This diatom occurred in most of the samples collected from the locality. It was specially frequent in paddy and millet fields and in certain of the larger bodies of water. It was found mixed with decaying vegetable matter or forming incrustations on partially submerged stones. A fairly common form. Its place in the Halobion system according to Hustedt, Petersen and Foged ..... Indifferent.

15. *Neidium bisulcatum* (Lagst.) Cl.

Hustedt, Bacil., 242, f. 374 :— Length 35-40 μ, breadth 7-7.5 μ and striae 26-28 in 10 μ.

This diatom appeared only in a few samples from the paddy fields in pale brown scum along with decaying vegetable matter. It occurred as a stray form. Its position in the Halobion system ..... ?

16. *Neidium bisulcatum* f. *undulata* O. Müll.

Hustedt, Bacil., 242, f. 375 :— Length 49-52 μ, breadth 8.8 μ and striae 26-30 in 10 μ.

This diatom appeared in many samples collected from millet and paddy fields, as well as from road-side pools and ditches, in the latter case often encrusting submerged stones or mixed with decaying vegetable matter. However, it was not very common. Its place in the Halobion system ? ? ? ? ?

17. *Neidium iridis* (Ehr.) Cl. (Fig. 11).

Hustedt, Bacil., 245, f. 379 ; Cleve-Euler, A., Diat. Schwed. Finn.—IV, 119, f. 1174 a-b (=*N. iridis* v. *genuina* Mayer f. *minor* A. Cl.) :— Valves 53-58 μ long and 13 μ broad, linear-elliptical with slightly convex sides and broadly rounded ends. Raphe thin and straight with central pores bent in opposite directions and terminal fissures bifurcated. Axial area narrow, central area rounded or transversely elliptical. Striae 19-22 in 10 μ, fine but distinctly punctate, somewhat obliquely disposed in the middle, parallel or radial and slightly convergent at the ends ; some longitudinal hyaline furrows cross them near the margins.

This species was particularly frequent in samples collected from paddy and millet fields, occurring in brownish matrix. Fairly common but not wide spread. Its place in the Halobion system according to Hustedt ? ? Indifferent, but according to Petersen ? ? ? Halophobous.

18. *Neidium iridis* (Ehr.) Cl. v. *indica* v nov. (Fig 12).

Valvae 42-52 μ longae atque 10-13.2 μ latae, linearis-lanceolatae cum margines fere parallelis ; apicibus subcuneatis rotundatis. Raphe ut in typo. Area axialis angusta, aliquantum dilatata in partem mediam ; area centralis ampla, aliquantum oblique-elliptica. Striae 18-20 in 10 μ, clare punctatae, aliquantum oblique ornata ac papallalae in partem mediam atque convergentes ad apicem, pauci longitudinali hyalina fissuris decussatae ad margines.

Valves 42-52 μ long and 10-13.2 μ broad, linear-lanceolate with fairly parallel sides and subcuneate rounded ends. Raphe as in the type. Axial area narrow, slightly widened in the middle part ; central area fairly large, slightly obliquely elliptical. Striae 18-20 in 10 μ, clearly punctate, slightly obliquely disposed and parallel in the middle part and convergent at the ends ; a few longitudinal hyaline furrows cross them near the margins

This diatom resembles *N. iridis* v *robusta* McCall (McCall, *Fossil Diat.*, 242, f. 7), in outline, but differs in the striae which are very coarse and fewer in number, i.e. 10 in 10 μ., It also resembles *N. amphigomphus* (Ehr.) Pfitzer (Tiffany and Britton, Alg. Illinois, 263, t. 70 f. 818), in outline but here the dimensions greatly differ besides the organisation of the striae. This form also bears a resemblance to *N. bisulcatum* (Lagst.) Cl. v. *nipponica* Skv. (Skvortzow, *Diat. Kizaki Lake*, 29, t. 3, f. 1 ; t. 4, f. 8) and particularly to fig 1 on t. 3, in the linear outline and cuneate rounded ends as also in dimensions. However, the striae are represented to be fine, 20-30 in 10 μ, which is not the case here, ; hence it is difficult to refer to Skvortzow's species. The oblique orientation of striae in the middle region is a typical feature of *N. iridis*, which is so in the present specimen ; hence it is referred to it and considered to be its new variety.

This diatom species was collected in association with the type and was more frequently seen. It formed a pale brown scum with the decaying vegetable matter in the fields. Its position in the Halobion system . . . . . ?

19 *Neidium dubium* (Ehr.) Cl. v. *peisone* (Grun.) Mayer (Fig. 3).

Cleve-Euler, A., Diat. Schwed. Finn.—IV, 117, f. 1170 p-s :— Valves 25-35 μ long and 6.3-11 μ broad, small linear with parallel sides and broadly cuneate ends. Raphe thin and straight with central pores small, bent in opposite directions and terminal fissures shortly bifurcated. Axial area very narrow, linear ; central area small, roundish. Striae 20-24 in 10 μ, radial, finely punctate, crossed by clear longitudinal hyaline lines near the margin.

This form compares well with the type described and illustrated by Cleve-Euler, except that some smaller forms with somewhat closer striae were also noted. It also resembles *N. dubium* v. *cuneatum* Fontell (Cleve-Euler, A., *op. cit.*, 117, f. 1170 i-l) in outline but differs in being proportionately more slender and with very closely set striae.

This species was collected from road-side pools and puddles. A single sample from a paddy field also showed it as a stray form. It is not at all well distributed in the area. Its place in the Halobion system . . . . . ?

20. *Neidium hustedtii*, sp. nov. (Fig. 4).

Valvae 44.6-72 μ longae atque 11-17.5 μ latae, lineares, marginibus indistinte triundulatis atque apicibus cuneato-rotundatis. Raphe tenuis et recta, ornata poris centralibus inclinata in directiones contrarias ac fissuris terminalibus bifurcatis. Area axialis angusta, linearis cum paulum dilatata ad partem mediam : area centralis ampla ac rotundata. Striae 22-26 in 10 μ, subtile punctatae, paululum radiales in medio atque indistincte convergentes in utroque apice ; sulcis hyalina longitudinali decussatae ad margines.

Valves 44.6-72 μ long and 11-17.5 μ broad, linear with indistinctly triundulate walls and cuneate rounded ends. Raphe thin and straight with central pores bent in contrary directions and terminal fissures bifurcated. Axial area narrow, linear, slightly widened in the middle part ; central area fairly wide and rounded. Striae 22-26 in 10 μ, finely punctate, very slightly radial in the middle and indistinctly convergent at the ends, crossed by longitudinal furrows near the margins.

This diatom does not resemble any of the known types; hence it is considered to be a new species. This species is named in honour of Dr Hustedt of Bremen for his eminent contributions in this field.

This species occurred in a few samples collected from the fields and was very scarce in samples taken from road-side pools. It therefore seems to have a limited distribution in the area. It was found particularly in brownish scum of vegetable debris. Its place in the Halobion system . . . . . ?

21. *Diploneis puella* (Schum.) Cl (Fig. 5).

Hustedt, Bacil., 250, f. 394 :— Length 13-16 μ, breadth 7.2 μ and costae 14-16 in 10 μ.

This diatom was mostly collected from the paddy fields in standing water. Samples from other places showed it mostly as a stray form. It occurred in pale brown slimy stuff formed on the soil surface in exposed places. Its place in the Halobion system according to Petersen . . . . . ? and according to Foged . . . . . Indifferent.

22. *Stauroneis phoenicenteron* Ehr. (Fig. 6).

Hustedt, Bacil., 255, f. 404 :— Length 83-94 μ, breadth 16-17 μ, striae 18-20 in 10 μ.

This form very closely agrees with Hustedt's illustration in having smoothly narrowed apices i.e. without irregular constrictions as indicated in my previous papers as also by Van Heurck (Van Heurck, *Treat. Diat.*, 159, t. 1, f. 50) and others.

This is one of the commonest diatoms found in the locality, seen in practically all the collections. In a certain field it was gregarious, forming a pale brown slimy substance in a water hole. It was also fairly well represented in larger bodies of water, particularly in the marginal slime. It appears that standing water favours its growth. Its place in the Halobion system according to Hustedt, Petersen and Foged . . . . . Indifferent.

23. *Stauroneis anceps* Ehr. (Fig. 13).

Hustedt, Bacil., 256, f. 405 :— Length 37-61 μ, breadth 9-16 μ and striae 20-22 in 10 μ.

This form shows a resemblance to *S. anceps* v. *amphicephala* Kütz. (Å. Berg, *Diat. Sophia-Exped.*, 12, t. 3, f. 116), and particularly agrees in the outline, apices and all other details except in the proportion of Length : Breadth (48-60 $\times$ 9-10). Whereas the breadth observed here is upto 16 μ, Van Heurck has indicated no breadth for his *S.*— v. *amphicephala* (V. H. Treat. Diat., 161, t. 1, 57) and the outline given is linear with rather abruptly narrowed, produced capitate ends—whereas here the outline is lanceolate to lanceolate-elliptical. Van Heurck's illustration appears like that of Hustedt's *S. anceps* f. *linearis* (Ehr.) Cl. (Hustedt, *op. cit.*, 256, f. 407), whereas Van Heurck's v. *linearis* V. H. (V. H., *op. cit.*, 160, t. 1, f. 56) has only abruptly rostrate apices. The present form also bears a resemblance to *S. anceps* v. *hyalina* Brun. and Perag. of Å. Berg (*op. cit.*, 12, t. 3, f. 115) in outline and the abruptly produced ends which are not so in Hustedt's form (Hust., 256, f. 408), but are shown to be progressively attenuated.

Taking the general survey of the literature, the present diatom more or less fits well with descriptions and illustrations given by Van Heurck, Hustedt, Cleve-Euler and others for *S. anceps*, except that the outline here is more lanceolate than indicated by Cleve-Euler. However, I regard my specimens as *S. anceps* only.

This is also one of the common diatoms seen in the collections particularly made from the fields. It occurred in light brown matrix contaminated with decaying vegetable matter and slime algae. It also occurred rather sparingly in samples collected from road-sides. Its place in the Halobion system according to Hustedt, Petersen and Foged. . . . . Indifferent.

24. *Stauroneis anceps* f. *indica* f. nov. (Fig. 25).

Valvae 54-58 μ longae atque 14.4 μ latae, late-lanceolatae, apicibus constrictis, breviter-rotundato-capitatis. Raphe aliquantum crassa et recta, ornata poris centralibus distincte ac fissuris terminalibus paulum curvatis. Area axialis angusta, linearis ; area centralis late staurodea, dialtata ad latera. Striae 18-20 in 10 μ, fortiter radiales atque punctatae.

Valves 54-58 μ long and 14.4 μ broad, broadly lanceolate with constricted, shortly capitate rounded ends. Raphe slightly coarse and straight with central pores distinct and terminal fissures shortly curved. Axial area narrow, linear ; central area a wide stauros widening near the margins. Striae 18-20 in 10 μ, strongly radial and punctate.

This form differs from the type in being broadly lanceolate with shortly rounded capitate ends. Stauros is also comparatively wider than in the type, hence it is considered as a new form.

Only a few specimens were recorded from a sample collected from a paddy field. It was found associated with the type proper. Its position in the Halobion system . . . . . ?

25. *Stauroneis anceps* v. *leiostauron* A. Cl. (Fig. 14-15).

Cleve-Euler, A., Diat. Schwed. Finn.—III, 208, f. 943 k :— Valves 53-67 μ long and 15-17 μ broad, somewhat lanceolate to elliptical-lanceolate with constricted, produced or produced-subcapitate ends. Raphe thin or slightly thick and straight, central pores conspicuous and terminal fissures slightly curved. Axial area narrow, linear ; central area very wide but not reaching the sides, linear. Striae 17-18 in 10 μ, radial and distinctly punctate.

This diatom agrees well with the type described by Cleve-Euler. However, it represents a slight variation with regard to its outline and apices : in some forms the outline was found to be apparently lanceolate with produced subcapitate ends, whereas in others it was lanceolate-elliptical with either subcapitate or simply produced ends.

It occurred in samples from paddy and millet fields in good numbers, while from other bodies of water it appeared casually or as a stray form and some samples were entirely barren of this diatom. From the observation it appears that this species prefers open localities. Its distribution is limited in the locality. Its place in the Halobion system . . . . . ?

26. *Stauroneis acuta* W. Sm. (Fig. 19).

Hustedt, Bacil., 259, f. 415 a-b :— Valves 70-114 μ long and 15-19 μ broad, rhombic-lanceolate with polar septa. Striae 14-16 in 10 μ, punctate, punctae 22-24 in 10 μ. This diatom is re-illustrated to show a more rhombic-lanceolate outline as found in specimens collected from the locality.

This species was found to be wide-spread in the area. It occurred particularly in fields, ponds and pools rather frequently, often forming small ribbons embedded in slimy matrix with decomposing vegetable matter imparting a golden yellow hue. It seemed to have very favourable growth in situations having more organic matter as evidenced from its gregarious presence at such places in the fields. It also occurred as a stray form in certain pools and puddles on road-sides. Its place in the Halobion system according to Hustedt and Petersen . . . . . Indifferent.

27. *Anomoeoneis sculpta* (Ehr.) Cl. (Fig. 7).

Van Heurck, Treat. Diat., 216, t. 4, f. 194 ; Cleve-Euler, A., Diat. Schwed. Finn.—III, 202, f. 927 a-b (= *A. sculpta* v. *genuina* A. Cl.) ; Hendey, N. I., *Diat. Chichester Harbour*, 56, t. 17, f. 16 ; Venkataraman, G., *S. I. Diat.*, 324, f. 70, 80 (= *A. sphaerophora* (Kütz.) Pfitzer v. *sculpta* (Ehr.) Müll. f. *indica* Venkat.) ; Hustedt, Bacil., 262, f. 423 (= *A. sphaerophora* v. *sculpta* (Ehr.) Müll.) ; Donkin A. S., *Brit. Fresh-water Diat.*, 15, t. 2, f. 9 (= *Navicula rostrata* Ehr.). :— Valves 70-90 μ long and 23-27.5 μ broad, robust, broadly lanceolate with constricted rostrate ends. Raphe thin and straight with central pores unilaterally bent and terminal fissures slightly curved. Axial area narrow, linear ; central area large, unilaterally expanded with very fine, indistinct punctae irregularly disposed. Striae 16-18

in 10 μ, radial, corasely punctate, crossed by many hyaline longitudinal irregular spaces due to which punctae in the axial region appear to be irregularly scattered.

This diatom mostly occurred as a stray form in collections from the fields as well as from road side pools, puddles and ditches. It appeared in a sort of yellowish brown matter in rotting hay. Its place in the Halobion system . . . . . ?

28. *Navicula cuspidata* Kütz. (Fig. 20).

Hustedt, Bacil., 268, f. 433 :— Length 77.5-97 μ, breadth 17-22 μ and striae trans. 14-16 and long. 20-24 in 10 μ. The illustration is of a mature specimen without craticular plates.

It is one of the common diatoms collected from the area. Practically all samples contained it in a smaller or larger number, hence it is widely distributed. However, it was never gregarious. Craticular stages were also recorded as illustrated by Gonzalves and Gandhi (1954). It was found mostly in slimy matter formed by decomposing vegetable matter and occasionally as an isolated, free floating form in some bodies of water. Its place in the Halobion system . . . . . according to Hustedt, Petersen and Foged . . . . . Indifferent.

29. *Navicula cuspidata* v. *ambigua* (Ehr.) Cl.

Hustedt, Bacil., 268, f. 434 :— Length 64-68 μ, breadth 18-19 μ and trans. striae 16-18, long striae 24-26 in 10 μ.

This diatom was found to be very frequent in the locality, appearing in all collections. It was also collected from wet soils but as stray form. Craticular stages were seen rather rarely. It was, however, not gregarious anywhere in the area. Its place in the Halobion system according to Hustedt and Petersen . . . . . Indifferent.

30. *Navicula cuspidata* v. *conspicua* Venkat.

Venkataraman, G., *S. I. Diat.*, 325, f. 83, 88 :—Valves 100-155 μ long and 30-38.5 μ broad, quite identical with Venkataraman's illustration. Striae trans. 15-16 and long. 8-12 in 10 μ.

The forms recorded from this area, while agreeing in all respects, show both smaller and larger dimensions; thus here the range dimensions are extended.

This diatom was particularly common in certain water holes in fields, suggesting its greater nutritional needs. Occasional specimens also appeared in samples collected from ponds and pools on road-sides. It is a very conspicuous diatom due to its coarse longitudinal striae and robust walls. Its distribution in the area is somewhat restricted. It often occurred with the type in the slimy matrix formed by decaying vegetable stuff. Its place in the Halobion system . . . . . ?

31. *Navicula cryptocephala* Kütz.

Hustedt, Bacil, 295, f. 496 :— Length 38-42 μ, breadth 7.2-7.5 μ and striae 13-16 in 10 μ.

This is also a widely distributed diatom observed in smaller or larger numbers practically in all samples. It was sometimes gregarious in certain water holes in paddy fields. From

road-side pools and puddles it was collected in fair number. Its higher numbers in fields suggests that mineral salts favour its growth and cause it to be gregarious. Its place in the Halobion system according to Hustedt, Petersen and Foged . . . . . Indifferent.

32. *Navicula rhynchocephala* Kütz. v. *amphiceros* V. H. (Fig. 8)

Van Heurck, Treat. Diat., 181, t. 3, f. 120; Cleve-Euler, A., Diat. Schwed. - III, 157, f. 817 h-k :— Valves 34-36 μ long and 8.5 μ broad, broadly lanceolate with constricted, produced feebly capitate ends. Raphe thin and straight. Axial area very narrow; central area moderately wide, elliptical. Striae 8-13 in 10 μ, lineate, coarse, radial in the middle and convergent at the ends, and somewhat closely set.

This diatom was particularly noted in collections from pools and puddles on road-sides. It occurred mostly as a stray form in many samples. Its place in the Halobion system . . . ?

33. *Navicula mugadensis* sp. nov.

Valvae 100-150 μ longae atque 18-23 μ latae, rhombio-lanceolatae, apicibus rotundatis. Raphe tenuis et recta, ornata poris centralibus distincte ac fissuris terminalibus curvatis. Area axialis angusta, linearis ; area centralis paulum dilatata ac elliptica. Striae 8-13 in 10 μ, ubique radiales, distincte lineatae, ad apice aliquantum proxime positae.

Valves 100-150 μ long and 18-23 μ broad, rhombic-lanceolate with rounded ends Raphe thin and straight with central pores distinct and terminal fissures curved. Axial area narrow, linear ; central area slightly dilated and elliptical. Striae 8-13 in 10 u, radial throughout, distinctly lineate and somewhat closely set at the ends.

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

This species was collected from a paddy field where it occurred in brownish scum. In all 2-3 samples represented it, that too as a stray form. It was, however, conspicuous by its larger dimensions. Its place in the Halobion system . . . . . ?

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

Hustedt, Bacil., 358, f. 660 :— Length 35-45 μ, breadth 9-11 μ and striae 8-10 in 10 μ.

This diatom was observed in practically every sample. It was found as a frequent form but never gregarious. It occurred in brownish or pale brown films either on moist soil bordering pools and puddles or as deposition on submerged, half-rotten vegetable matter. It is a common diatom in the area. Its place in the Halobion system according to Hustedt and Foged . . . . . Indifferent

35. *Cymbella spicula* Hustedt. (Fig 9)

Hustedt, *Diat. Java Bali u. Sumatra*, 422, t. 25, f. 14 ; Voigt, M., *Genre Cymbella*, 30, t. 2, f. 7-8 ; Fukushima, H., *Diat. Oze*, 613, t. 6, f. 1. :— Valves 55-67.5 μ long and 9-11 μ broad, subsymmetrical, semi-lanceolate with slightly more convex dorsal side than the ventral one with acutely rounded ends. Raphe thick with dorsally directed terminal fissures. Axial area quite wide, about $\frac{1}{3}$ the breadth of the valves, lanceolate ; central area indistinct but with an isolated stigma on the dorsal side. Striae 12-16 in 10 μ, coarse, indistinctly punctate, radial and more widely set in the middle and somewhat perpendicular and closer towards the extreme ends.

This diatom agrees well with the type in all details, except that here somewhat broader forms were recorded. It also resembles *C. frigida* A. Cl. (Cleve-Euler, A. Diat. Schwed. Finn. IV, 136, f. 1195 a-b) in outline, striae and other details, but differs in having a very wide axial area and an isolated stigma.

This species occurred in a few samples collected from a paddy field. It was seen fairly frequently in association with other diatoms in the slimy stuff of decomposing vegetable matter. Stray specimens were also recorded from certain small pools and ditches on road-sides. Its place in the Halobion system ..... ?

36. *Gomphonema augur* Ehr.

Hustedt, Bacil., 372, f. 688 :— Length 25-32 μ, breadth 8-9.5 μ and striae 12-14 in 10 μ.

This species occurred only as a stray form in a few samples from paddy fields and a small pond on the road-side. Its distribution is very restricted in the locality. Its position in the Halobion system according to Hustedt and Foged .... Indifferent.

37. *Gomphonema parvulum* Kütz.

Hustedt, Bacil., 372, f. 713 a :— Length 18-27 μ, breadth 5-7 μ and striae 14-15 in 10 μ.

This species was seen as a common diatom in the locality, as it appeared in most of the samples. A few samples from road-side pools and puddles showed it in good numbers. It occurred in brownish slimy depositions on the soil or on partially submerged rotting vegetable matter. In one case it was epiphytic on *Pithophora*. Its place in the Halobion system according to Hustedt, Petersen and Foged ..... Indifferent.

38. *Gomphonema gracilis* Ehr. (Fig. 21).

Hustedt, Bacil., 376, f. 702 :— Length 61-68 μ, breadth 10-11 μ and striae 6-14 in 10 μ

This diatom was seen only in a few samples collected from the fields. It occurred as a stray form in association with other diatoms. Its place in the Halobion system according to Hustedt and Foged ..... Indifferent.

39. *Rhopalodia gibba* (Ehr.) Müll. v. *ventricosa* (Ehr.)Grun.

Hustedt, Bacil., 391, f. 741 :— Frustules 60-86 μ long and 23-26 μ broad in girdle view, costae 5-6 in 10 μ, rows of areoles 11-12 in 10 μ.

This species was found in many samples collected from fields as well as from roadside pools, puddles and ditches. It occurred either in the marginal slime of the body of water or attached to some species of *Chara* or other plants. It was never seen to be gregarious. Its position in the Halobion system according to Hustedt and Petersen ..... Indifferent.

40. *Hantzschia amphioxys* (Ehr.) Grun. v. *mugadensis* v. nov. (Fig. 26-27).

Valvae 62-84 μ longae atque 10 μ latae, lineares, arcuatae, margine dorsali convexo ac ventrali concavo ; apicibus cuneatis, constrictis atque breviter capitatis. Carina ex-centro cum punctis carinae parvis 7-10 in 10 μ. Striae 16-19 in 10 μ, tenues sed distincte punctatae.

Valves 62-84 μ long and 10 μ broad, linear, arcuate with dorsal margin convex and ventral side concave with wedge-shaped, constricted, shortly capitate ends. Keel excentric with short keel punctae 7-10 in 10 μ. Striae 16-19 in 10 μ, fine but distinctly punctate.

This form resembles very closely *H. amphioxys* (Ehr.) Grun. v. *leptocephala* Ostrup (Cleve-Euler, A., Diat. Schwed. Finn.—V, p. 48, f. 1419 j-k), in outline, the capitate ends and the curvature. However, it differs in respect of closely set striae and keel punctae. Moreover, it differs in dimensions and shortly capitate ends. Hence, it is tentatively considered as new variety of *H. amphioxys*, rather than as a new form of v. *leptocephala* Ostrup.

This diatom occurred in collections made from paddy fields. It was found mixed with pale brown vegetable debris in certain water holes. Its place in the Halobion system . . . . . ?

41. *Hantzschia dubravicensis* (Grun.) A. Cl. (Fig. 28).

Ostrup, E., *Diat. Iceland*, 46, t. 5, f. 68 ; Cleve-Euler, A., Diat. Schwed. Finn.—V, 51, f. 1420 n-p :— Valves 65-120 μ long and 9.5-11 μ broad, almost linear with convex dorsal side and only slightly concave ventral side, ends narrowed, slightly constricted, subcapitate and rounded. Keel excentric with very coarse or thick keel punctae 6-7 in 10 μ. Striae 15-16 in 10 μ, indistinctly punctate.

This form agrees well with the type described by Ostrup and Cleve-Euler, except that the ventral side here is only lightly concave.

This diatom was found only in a few samples collected from some water holes or ditches in paddy—millet fields. It occurred as an isolated form mixed with decaying vegetable matter. It was, however, conspicuous by its somewhat robust structure and very coarse keel punctae. Its position in the Halobion system . . . . . ?

42. *Hantzschia linearis* (O. Müll.) A. Cl. v. *capitata* v. nov. (Fig. 29).

Valvae 74-93 μ longae atque 11-12 μ latae, arcuatae, lineari-lanceolatae, margine dorsali convexo, ventrali concavo, in utroque apice constricto, producto, anguste capitato. Carina ex-centro, punctis carinae 6-8 in 10 μ, crassae, impariter positae cum punctis in medio distante evoluta. Striae 16-18 in 10 μ, distincte lineatae.

Valves 74-93 μ long and 11-12 μ broad, arcuate, linear-lanceolate, dorsal side convex and ventral side concave with constricted, produced, narrowly capitate ends. Keel excentric with keel punctae 6-8 in 10 μ, coarse, irregularly disposed and the middle punctae widely set. Striae 16-18 in 10 μ, distinctly lineate.

This form resembles *H. linearis* (O. Müll.) A. Cl., as described by Cleve-Euler (Cleve-Euler, Diat. Schwed. Finn.—V, 51, f. 1421 a-d), in outline and the parallel sides, but differs from it in having produced, narrowly capitate ends. Moreover, the striae are uniformly set and the dimensions are comparatively smaller. It is therefore tentatively regarded as a new variety.

This species was collected from puddles and ditches in paddy and millet fields and a certain road-side pool. It occurred in pale brown matrix forming a film on the wet soil or rotting vegetable matter. It was observed fairly frequently but not throughout the locality. Its place in the Halobion system . . . . . ?

43. *Hantzschia virgata* (Roper) Grun. (Fig. 22).

Van Heurck, Treat. Diat., 381, t. 15, f. 488 b ; Hustedt, Bacil., 395, f. 752 ; Cleve-Euler, A., Diat. Schwed. Finn.—V, 52, f. 1422 a-c (= *H. virgata* v. *genuina* A. Cl.) :— Valves

107-117.5 μ long and 13-14 μ broad, arcuate, linear-lanceolate with convex dorsal side and concave ventral side deeply depressed in the middle ; ends constricted, narrowly produced and rounded. Keel strongly excentric, concave with large keel punctae, 5-7 in 10 μ, thick and irregularly disposed, two of the middle punctae widely set. Striae 9-14 in 10 μ, clearly and coarsely punctate, somewhat closely set at the ends.

Of this diatom only a few specimens were observed in a couple of collections from fields. It occurred with decaying vegetable matter. However, it was quite conspicuous by its sturdy walls, strong keel punctae and the striations. Its place in the Halobion system according to Hustedt . . . . . Mesohalobous.

44. *Hantzschia virgata* v. *rostrata* v. nov (Fig. 30).

Frustula robusta, rectangularia in aspectu zonali Valvae 71-80 μ longae atque 11-12 μ latae, lineari-semi-lanceolatae, margine dorsali convexo cum rectae in medio, ventrali concavo ; apicibus constrictis, productis, subcapitato-truncatis. Carina ex-centro, magnis carinae punctae 6-7 in 10 μ, impariter positae, in partem medio distante. Striae 11-12 in 10 μ punctatae.

Frustules robust, rectangular in girdle view. Valves 71-80 μ long and 11-12 μ broad, linear-semilanceolate with dorsal side convex and straight in the middle, ventral side concave ; ends constricted, produced and subcapitate-truncate. Keel excentric, with large keel punctae 6-7 in 10 μ, irregularly set and middle punctae wider apart. Striae 11-12 in 10 μ, punctate.

This form differs from the above type in having almost straight dorsal sides in the middle part and produced, rostrate-subcapitate-truncate ends. It also differs from *H. virgata* v. *capitellata* Hust. (Hustedt, Bacil., 395, f. 753), in respect of the rostrate-subcapitate-truncate ends, though it agrees in all other details. It is thus a distinctive form, and as it agrees in many details with *H. virgata* and its variety *capitellata* it is considered to be its new variety.

This diatom was collected from the same places as the type proper. It also occurred in association with other *Hantzschia* and was recorded as a stray form. Its place in the Halobion system . . . . . ?

45. *Hantzschia voigtii* sp. nov. (Fig. 31).

Valvae 80-114 μ longae atque 10-13.3 μ latae, lineares, arcuatae, margine dorsali aliquantum convexo ac ventrali concavo plus aliquantum incideri in medio ; apicibus tenuiore productis, dorsali inclinatis atque rotundatis. Carina ex-centro, carinae punctae 5-7 in 10 μ, crassae cum pariter positae. Striae 14-15 in 10 μ, tenues punctatae.

Valves 80-114 μ long and 10-13.3 μ broad, linear, arcuate, dorsal side slightly convex and ventral side concave with a notch in the middle, ends constricted, dorsally inclined, narrowly produced and rounded. Keel excentric with keel punctae 5-7 in 10 μ, coarse and uniformly disposed. Striae 14-15 in 10 μ, finely punctate.

This form appears to be a distinctive species since it does not agree with any of the known *Hantzschia*. It is therefore considered to be a new species. I have named this species in honour of my friend Mr Manfred Voigt who is a zealous Diatomologist.

This diatom was collected from puddles and ditches or slowly flowing water veins in paddy fields. It was seen thriving well in brownish films on wet soils and sometimes mixed with decaying vegetable stuff. However, it is not widely distributed in the locality, as it was found only in 18-20 % of the samples. Its place in the Halobion system.....?

46. *Hantzschia recta* sp. nov. (Fig. 32-33).

Valvae 112-141 μ longae atque 8-11 μ latae, robustae, lineari-lanceolatae, fere rectae, margine dorsali indistincte convexo, ventrali recto vel paululum concavo in medio ; utroque apice gradatim tenuiore, constricto, elongato-subcapitato. Raphe ad polis nodulum manifestas. Carina ex-centro, carinae punctis 7-10 in 10 μ, magnis atque pariter positae. Striae 18-20 in 10 μ, tenues punctatae.

Valves 112-141 μ long and 8-11 μ broad, robust, linear-lanceolate, fairly straight with dorsal side indistinctly convex and ventral side straight or slightly concave in the middle ; ends gradually narrowed, constricted, produced and subcapitate. Raphe apparent at the polar nodule. Keel excentric, with large keel punctae 7-10 in 10 μ, uniformly set. Striae 18-20 in 10 μ, finely punctate.

This diatom does not agree with any of the known *Hantzschia*, hence it is tentatively considered to be a new species.

This species was conspicuous in a very few samples collected from paddy fields. It occurred mostly as a stray form in certain water holes in fields. It has very limited distribution in the area. Its place in the Halobian system.....?

47. *Nitzschia jugata* Gandhi. (Fig. 10).

Gandhi, H. P., *Diat. Partabgarh*, 330, f. 38 :— Length 84-110 μ, breadth 13-14 μ, keel punctae 6-7 in 10 μ and striae 14-16 in 10 μ. This diatom is re-illustrated to show its paired nature on account of which it is named. The ends are slightly improved. Further, from this area some smaller forms are also noted.

This species was found frequently in collections made from paddy and millet fields. It occurred in brownish films covering wet soils or submerged vegetable matter. In certain pools it was also found in the marginal scum. It is a form fairly well represented in the locality. Its place in the Halobion system.....?

48. *Nitzschia sublinearis* Hustedt. (Fig. 23).

Hustedt, Bacil, 411, f. 786 :— Length 68-88 μ, breadth 5-6 μ, keel punctae 11-13 in 10 μ and striae about 33 in 10 μ. This form is re-illustrated to correct my previous diagram in which the keel is shown with a notch.

This species was fairly well represented in most of the collections made from fields, road-side pools and ditches. However, it was never abundant in the locality. It was found particularly in slimy films on the soil as well as on edges of bodies of water, contaminated with vegetable matter. Its place in the Halobion system.....?

49. *Nitzschia amphibia* Grun.

Hustedt, Bacil, 414, f. 793 :— Length 15-25 μ, breadth 3-4 μ, keel punctae 7-8 in 10 μ and striae 15-17 in 10 μ.

This is one of the commonest diatoms, occurring in all collections made from various bodies of water. In certain water holes in millet or paddy fields it was gregarious. It also occurred on wet soils forming brownish films with Myxophyceae. Its place in the Halobion system according to Hustedt and Petersen . . . . . Indifferent.

50. *Nitzschia palea* (Kütz.) W. Sm.

Hustedt, Bacil., 416, f. 801 :— Length 18-32 μ, breadth 2.8-4 μ, keel punctae 11-13 in 10 μ and striae over 32 in 10 μ.

This is again a very common diatom found in all collections made in the area. It was occasionally gregarious in certain fields forming pale brown films with some Myxophyta. It also occurred in wet soils. Its place in the Halobion system according to Hustedt, Petersen, Foged and Iyengar and Venkataraman . . . . Indifferent.

51. *Nitzschia gracilis*, Hantz. (Fig. 34).

Hustedt, Bacil., 416, f. 794 :— Length 99-110 μ, breadth 4-4.2 μ, keel punctae 13-15 in 10 μ and striae probably over 35 in 10 μ. Here an improved illustration is given over the one available in the Indian literature.

This diatom was fairly represented in the collection from fields. Isolated specimens were also found in samples from road-side pools and puddles. It occurred in the pale brown scum surrounding decaying vegetable matter. Its distribution is limited in the area. Its place in the Halobion system according to Hustedt, Petersen and Foged . . . . . Indifferent

52. *Nitzschia obtusa*, W. Sm. v. *scalpelliformis* Grun.

Hustedt, Baci ., 422, f. 817 b :— Length 81-106 μ, breadth 7.5-8 μ, keel punctae 8-9 in 10 μ and striae fine over 30 in 10 μ.

This species commonly occurred in somewhat larger bodies of water like pools and ponds, mostly forming a golden brown matter with rotting stuff. In certain fields with decomposing oil-cake pieces it appeared in large numbers; otherwise it was a stray form. Its place in the Halobion system according to Iyengar and Venkataraman . . . . . Mesohalobous, but I consider it to be at the most Halophilous since I have collected it even in fresh-water at many different places.

53. *Nitzschia filiformis*, (W. Sm.) Hustedt

Hustedt, Bacil., 422, f. 818 a-c :— Length 22-30 μ, breadth 4-5 μ, keel punctae 8-10 in 10 μ and striae about 35 in 10 μ.

This species was represented quite well in the region, mostly occurring in association with *N. amphibia*, *N. palea* and some other diatoms It was primarily collected from paddy and millet fields and sparingly from road-side pools and ditches. Its place in the Halobion system according to Hustedt and Foged . . . . Mesohalobous.

54. *Nitzschia lorenziana*, Grun v. *subtilis*, Grun. (Fig. 35).

Hustedt, Bacil., 423, f. 820 ; Cleve-Euler, A., Diat. Schwed. Finn.—V, 93, f. 1510 :— Valves 75-106 μ long and 3.2-4.5 μ broad, sigmoid, linear-lanceolate with very slender, produced subcapitate ends Keel strongly excentric, sigmoid with small coarse punctae 7-8 in 10 μ. Striae 17-18 in 10 μ.

A similar form is described by Venkataraman (1956) as *N. lorenziana* Grun., of which I am doubtful. It is probably the same as the present one except that the illustration is not characteristic of it.

This diatom was seen only in a few samples collected from paddy fields and a pool on the road-side. It occurred rather sparingly or as a stray form. Its distribution in the locality is very restricted. Its place in the Halobion system according to Hustedt . . . . Mesohalobous.

55. *Cymatopleura solea* (Bréb.) W. Sm. v. *subconstricta* O. Müll. f. *minor* O. Müll. (Fig. 36).

Cleve-Euler, A., Diat. Schwed. Finn.—V, 97, f. 1619 n-p ; Berg, Å., *Diat. Sophia-Exped.*, 23, t. 8, 276 (= *C. albaregiensis* Pant. f. *reducta* A. Cl.) :— Valves 21-53 μ long and 10-12.2 μ broad at the broadest, isopolar, linear with slightly concave sides and broad, subcuneate, shortly rostrate-truncate ends. Pseudoraphe very narrow, linear. Transverse folds present. Costae 6-8 in 10 μ, rib-like, striae invisible.

This diatom was fairly well represented in the collections made from fields. It occurred in association with decaying vegetable matter forming a sort of brownish stuff. In road-side pools and ditches it was occasionally seen. Its distribution is moderate in the locality. Its place in the Halobion system . . . . . ?

56. *Stenopterobia intermedia*, (Lewis) Fricke. (Fig. 24).

Hustedt, Bacil., 428, f. 830 ; Cleve-Euler, A., Diat. Schwed. Finn—V, 100, f. 1522 a-d (= *S. intermedia* v. *genuina* A. Cl.) :— Valves 106.5-120 μ long and 4.5-5.5 μ broad, linear, sigmoid with attenuated ends. Pseudoraphe very narrow, linear-sigmoid. Flap projections very small 5.5-6 in 10 μ. Striae 18-20 in 10 μ.

This diatom was seen in a few collections made from paddy fields. It occurred in certain water holes with decaying hay. Not observed from other bodies of water. Distribution is very restricted in the area. Its place in the Halobion system . . . . ?

57. *Surirella splendida* (Ehr.) Kütz. (Fig. 17).

Hustedt, *Diat. Weser Bremen*, 361 (= *S. (plendida ?)splendida)* ; Bacil., 437, f. 851-2 (= *S. robusta* Ehr. v. *splendida* (Ehr.) V. H.) ; Cleve-Euler, A., *Diat. Schwed. Finn.*—V, 104, f. 1524 h (—*S. robusta* v. *splendida*) :— Valves 75-90 μ long and 26-29 μ broad, heteropolar, ovate or subovate. Costae 25-35 in 100 μ.

Dr Hustedt in one of his very recent papers has treated his original *S. robusta* v. *splendida* as *S. (plendida ?) splendida*, and I agree with him.

This diatom occurred as a stray form in a few collections from fields, and pools on the road-side. Its distribution in the area is very limited. Its place in the Halobion system according to Hustedt and Petersen . . . . Indifferent.

58. *Surirella tenera*, Greg.

Hustedt, Bacil., 438, f. 853 :— Length 105-115 μ, breadth 28-32 μ and costae 25-30 in 100 μ.

This species was recorded from a certain road-side pool as a stray form. It also occurred likewise in paddy and millet fields. Its place in the Halobion system according to Hustedt . . . . Indifferent.

ECOLOGICAL CONSIDERATION OF DIATOMS RECORDED IN THIS PAPER :—

From the available data of the Halobion rate of the said Diatoms, the following Halobion Spectrum can be represented :—

Mesohalobous forms		4	which	make	6.9 %
Oligohalobous	Halophilous	2	,,	,,	3.448 %
	Indifferent	25	,,	,,	43.100 %
	Halophobous	—	,,	,,	0.000 %
? i.e. undetermined forms		27	,,	,,	46.552 %
	Total	58	,,	,,	100.00 %

I. Of the 27 Diatoms with their undetermined Halobion rate, I assign *Melosira granulata* (Ehr.) Ralfs v. *muzzanensis* Meister, *Synedra ulna* (Nitz.) Ehr. v. *amphirhynchus* (Ehr.) Grun, *Stauroneis anceps* Ehr. f. *indica* f. nov., *S. anceps* v. *leiostauron* A. Cl. and *Navicula cuspidata* Kütz. v. *conspicua* Venkat. to the category of Indifferent. This I do in view of the fact that I have invariably seen them in smaller or larger number accompanying their respective species proper in my extensive collections made from the whole of the South-Western zone of Bombay State. And I consider them, therefore, to be governed by the same conditions as the species proper.

II. *Neidium iridis* (Ehr.) Cl., *N. iridis* v. *indica* v. nov., *Navicula rhynchocephala* Kütz v. *amphiceros* V. H., *Cymbella spicula* Hust., *Hantzschia amphioxys* (Ehr.) Grun. v. *mugadensis* v. nov., *H linearis* (O. Müll.) A. Cl. v. *capitata* v. nov., *Nitzschia sublinearis* Hust. and *Cymatopleura solea* (Brèb.) W. Sm. v. *subconstricta* O. Müll. f. *minor* O. Müll., I regard as Indifferent, being observed quite frequently in several bodies of water in the region. These forms often appeared in association with several other Indifferent species hence they are probably governed by similar conditions.

III. *Cyclotella glomerata* Bachman I place in the Halophobous category, since I found this form mostly in hilly streams so common all along the Western Ghats or in water veins in fields during the rainy season in the present locality. These waters are, I think, very pure.

IV. I further assign, of course provisionally, *Eunotia major* (W. Sm.) Rabh. v. *indica* (Grun.) A. Berg, *Neidium bisulcatum* Lagst. Cl., and *N. bisulcatum* f. *undulata* O. Müll. to the Halophobous category, since I found them in varying numbers in many pools, puddles and ditches formed during the rains. Waters of such habitats are either quite pure or fairly rich in organic matter depending upon their distance or proximity to human habitation. These forms may even be Indifferent.

V. *Anomoeoneis sculpta* (Ehr.) Cl., I regard to be at least Halophilous, since I found it in abundance in practically every large wet situation in Ahmedabad where the water is quite saltish, i e. NaCl-content ranging from 30-52 or more in parts per 100,000.

VI. *Nitzschia jugata* Gandhi, I place in between Indifferent and Halophilous, since it was seen in fair number in association with *Surirella ovata* Kütz. which according to Hustedt is an Indifferent form. It occurred there in incrustation on partially submerged rocks on the side of a polluted pool, where the mineral or organic content of the water

is likely to be high. In the present situation it was collected in large numbers, principally from well manured fields. Such situations are, therefore, bound to be rich in mineral or organic content.

VII. For the rest of the Diatoms, it is difficult to assign the Halobion rate, at least for the present on account of their being scarce or not well distributed in this region.

In the light of the above, the Halobion Spectrum becomes modified thus :—

Mesohalobous	4	which make		6.9 %
Oligohalobous — Halophilous	3	,,	,,	5.172 %
Oligohalobous — Indifferent	37	,,	,,	63.786 %
Oligohalobous — Halophobous	5	,,	,,	8.62 %
? i.e undetermined forms	9	,,	,,	15.52 %
	—			+ .002 %
Total	58	,,	,,	100.00 %

SUMMARY

In this paper Diatomaceae collected from the Mugad area are enumerated with full descriptions and illustrations of only those specimens which have been so far not recorded in the Indian literature. Certain of the forms are re-illustrated either to suggest an improvement or a new aspect is represented.

Under individual species, besides dimensions some ecological and distributional notes are also given.

It is suggested that the Diatom flora of the area is quite rich, considering the number of forms recorded in proportion to the area explored within a short period of a month ; and it is felt that there is further need for work of this nature.

In all fifty-eight additional Diatoms from this area are recorded in this paper representing twenty genera. Of these fifty-eight forms, twelve are new records for India and four species, five varieties and one form are considered to be new to Science.

At the end of the paper Halobion Spectra are given on the basis of data available from the existing literature and local observations.

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DESCRIPTIONS OF FIGURES

FIGURES

1. *Gyrosigma spencerii* (W. Sm.) Cl.
2. *Caloneis pulchra*. Messikommer v. *interrupta* v. nov.
3. *Neidium dubium*, (Ehr.) Cl. v. *peisone* (Grun.) Mayer.
4. *Neidium hustedtii*, sp. nov.
5. *Diploneis puella*, (Schum.) Cl.
6. *Stauroneis phoenicenteron*, Ehr.
7. *Anomoeoneis sculpta*, (Ehr.) Cl.
8. *Navicula rhynchocephala*, Kutz. v. *amphiceros*, V. H.
9. *Cymbella spicula*. Hust.
10. *Nitzschia jugata*, Gandhi

FIGURES

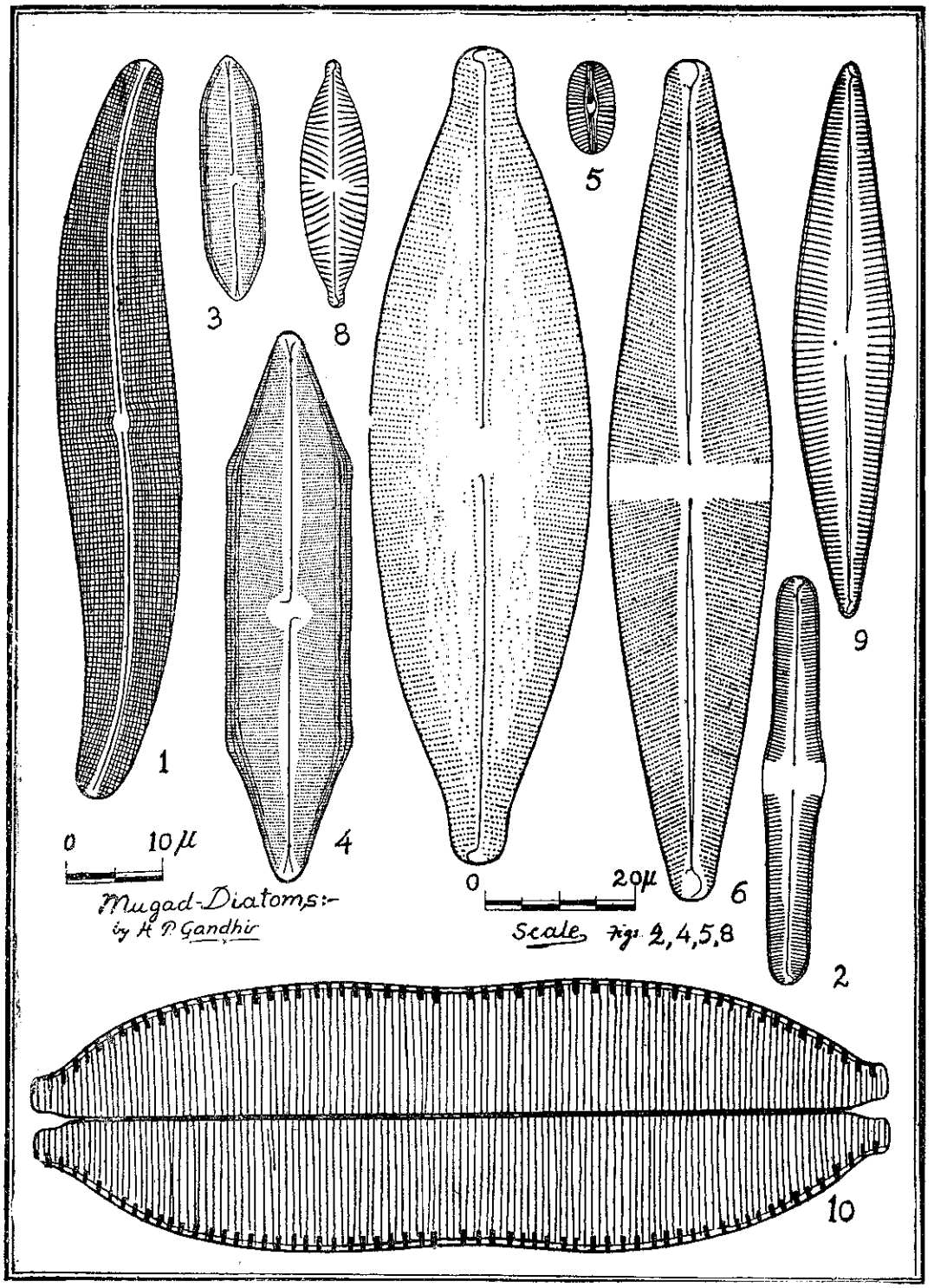
11. *Neidium iridis*. (Ehr.), Cl.
12. *Neidium iridis* v. *indica* v. nov.
13. *Stauroneis anceps*, Ehr.
14—15. *Stauroneis anceps* v. *letostauron*, A. Cl.
16. *Navicula mugadensis*, sp. nov.
17. *Surirella splendida*, (Ehr.) Kutz

FIGURES

18. *Eunotia major*, (W. Sm.) v. *indica* (Grun.) A. Berg
19. *Stauroneis acuta*, W. Smith
20. *Navicula cuspidata*, Kutz
21. *Gomphonema gracile*, Ehr.
22. *Hantzschia virgata*, (Roper) Grun.
23. *Nitzschia sublinearis*, Hustedyt.
24. *Stenopterobia intermedia*, (Lewis) Frickc

FIGURES

25. *Stauroneis anceps*, Ehr. f. *indica* f. nov.
26—27. *Hantzschia amphioxys*, (Ehr.) Grun. v. *mugadensis* v. nov.
28. *Hantzschia dubravicensis*, (Grun.) A. Cl.
29. *Hantzschia linearis*, (O. Mull.) A. Cl. v. *capitata* v. nov.
30. *Hantzschia virgata* (Roper) Grun. v. *rostrata* v. nov.
31. *Hantzschia voigtii*, sp. nov.
32—33. *Hantzschia recta*, sp. nov.
34. *Nitzschia gracilis*, Hantz.
35. *Nitzschia lorenzizna* Grun. v. *subtilis* Grun.
36. *Cymatopleura solea*. (Breb.) W. Sm. v. *subconstricta*, O. Mull. f. *minor*, O. Mull.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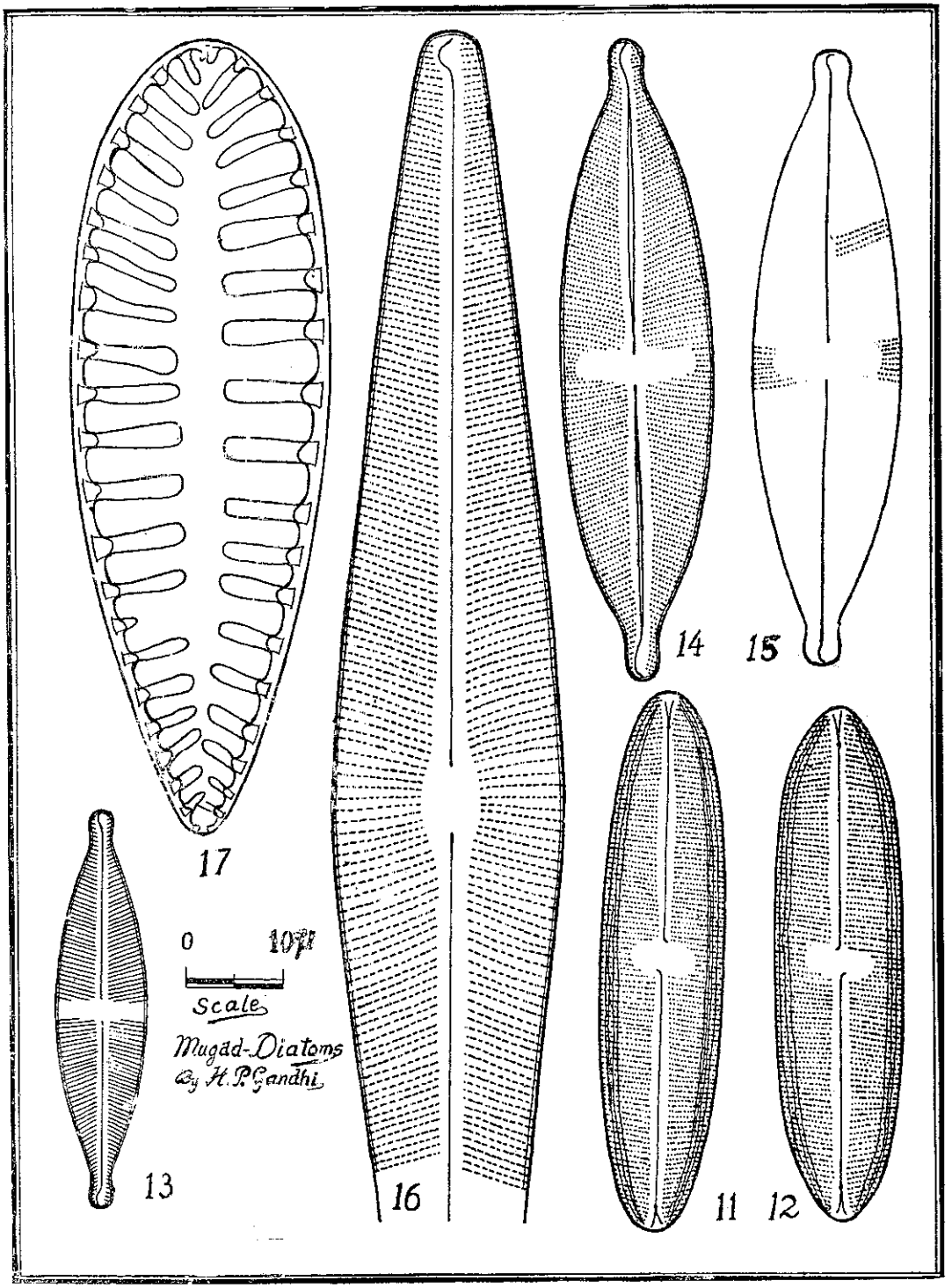
Mugad-Diatoms:-
by A. P. Gandhi
Scale figs. 2, 4, 5, 8


17
0 10μ
Scale
Mugad-Diatoms
By H. P. Gandhi
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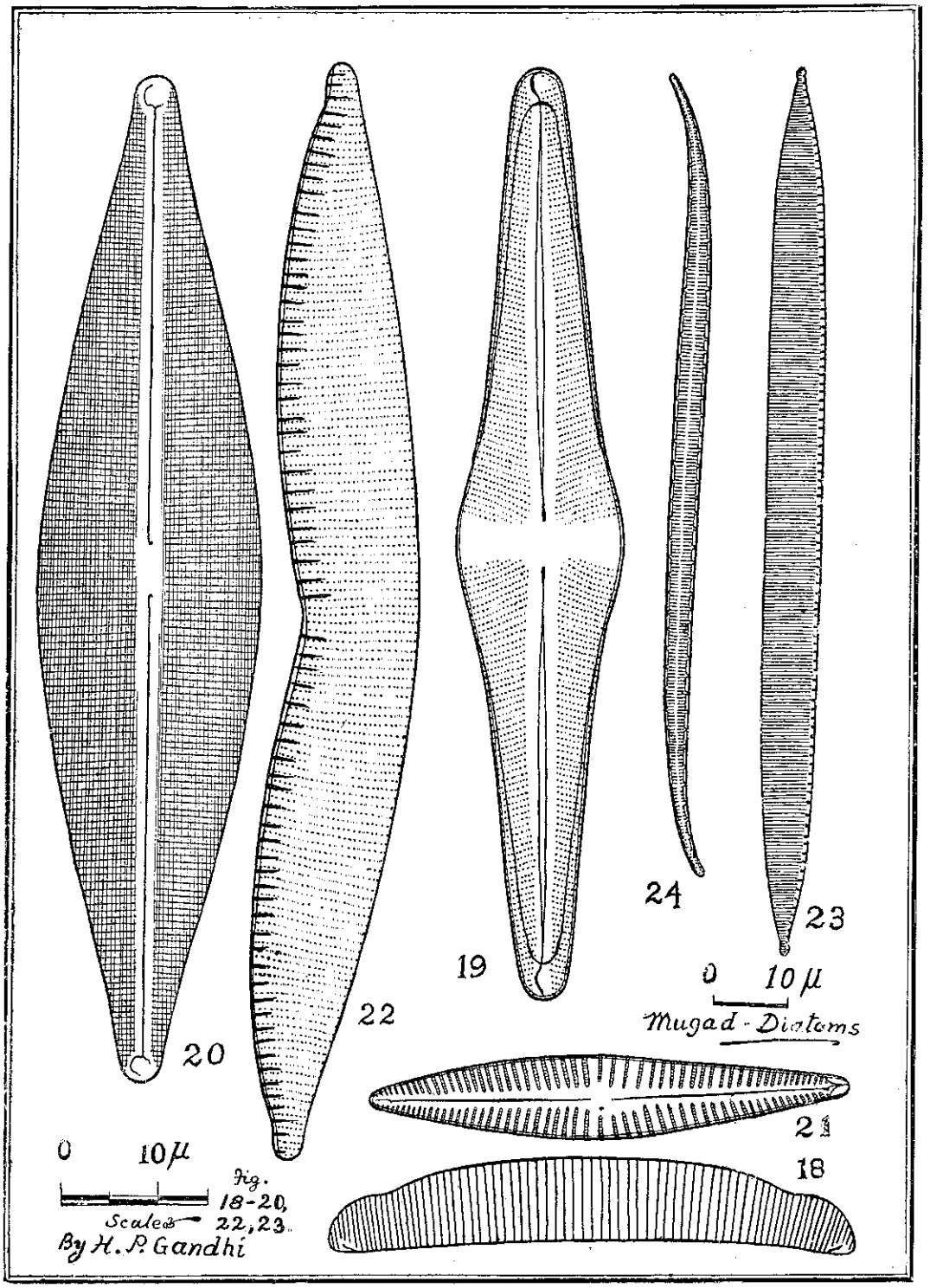
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Mugad - Diatoms
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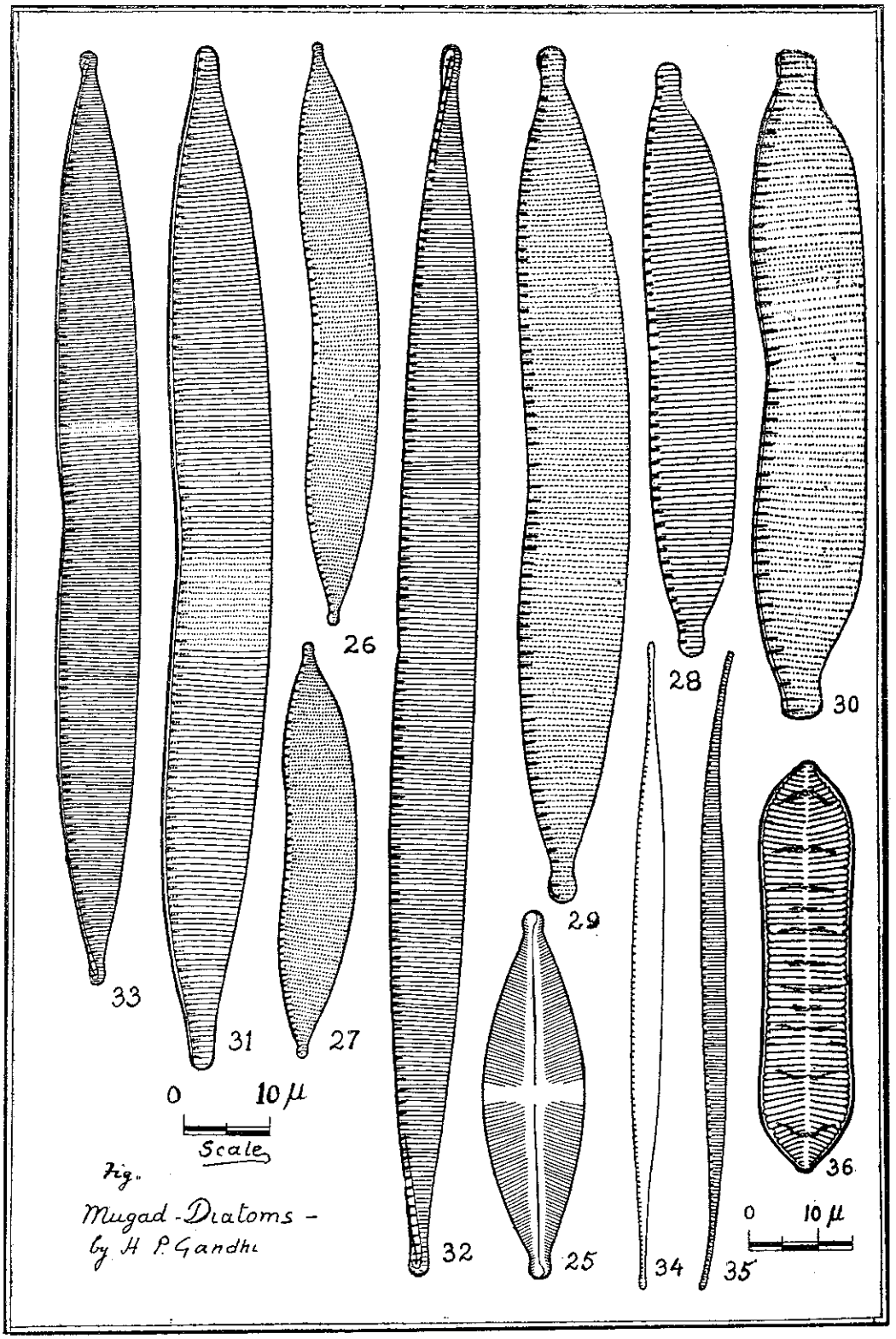
Fig. 18-20, Scales 22,23.
By H. P. Gandhi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Scale
Fig.
Mugad - Diatoms -
by H P Gandhi
0 10 μ