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A CONTRIBUTION TO OUR KNOWLEDGE OF THE DIATOM GENUS *PINNULARIA*

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(*With twenty-one figures*)

INTRODUCTION

The material for the present paper was collected during the rainy season of 1949, from many millet and paddy fields and road-side pools at Mugad, a place some 9-10 miles away from Dharwar (Mysore State). It was then preserved in 5-6% of commercial formalin. On the author's transfer to the Ismail Yusuf College, Jogeswari, Bombay, the said material was examined in part and the remaining at the Rajaram College, Kolhapur, during 1951-56

On examination, the collection was found to be very rich in diatoms as can be seen from the number of forms (over sixty) found, in proportion to the area explored. Among these forms, the genera *Pinnularia* and *Hantzschia* appeared to be significant in species. Here the author restricts his paper to describing Pinnularias only, as they occurred in a good number.

For the classification and identification of these forms, Cleve-Euler's (1951-55) monograph is chiefly followed in consultation with Hustedt's (1930) monograph. Here, the preference is given to the former since it has many sections remodelled and a few newly added, besides having a large number of forms described and rearranged. However, the epithets like, 'v. *genuina*; v. *typica*; f. *typica* etc. etc.', which refer to the species or variety proper are dropped, being out of vogue.

In all seventeen forms are described in this paper of which two species and four varieties are considered to be new to science and nine, new records for this country.

The dimensions given under each form are those actually recorded.

Genus **Pinnularia** Ehrenberg 1843

Section NODOSAE A. Cl.

1. **Pinnularia acrosphaeria** (Bréb.) W. Sm. f. **undulata** Cleve; Hustedt, *Bacil.*, p. 330. (Fig. 1).

P. acrosphaeria (Bréb) W. Sm. v. *genuina* Cl. f *undulata* Cl. Cleve-Euler A., *Diat. Schwed. Finn.*—IV, p. 25, fig. 1022 c.

Valves 72-80 μ long and 10-12 μ broad, linear with prominent inflation in the middle and at the broadly rounded ends. Axial area with irregular punctae. Striae 11-12 in 10 μ, thick, very feebly radial in the middle and convergent at the ends.

Distribution in India: Dharwar (Gandhi, 1956): paddy fields and road-side pools.

2. **Pinnularia acrosphaeria** (Bréb.) W. Sm v. **minor** Cl.; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 25, fig. 1022 d (Fig 2.).

Valves 41-54 μ long and 8-9 μ broad, linear, small, very slightly swollen in the middle and at the broadly rounded ends. Striae 12-13 in 10 μ, feebly radial in the middle and parallel or slightly convergent at the ends.

Distribution in India: Dharwar (Gandhi, 1956); Bombay; Jog-Falls; Kolhapur; road-side pools and puddles at Mugad.

Section LUNULAE A. Cl.

3. **Pinnularia stomatophoroides** Mayer v. **ornata** A. Cl. f. **erlangensis** Mayer: Cleve-Euler, A., *Diat, Schwed. Finn.*—IV, p. 41, fig. 1053 a, c. (Figs. 3, 13).

Valves 53-77 μ long and 10-12 μ broad, linear or sub-linear with feebly triundulate sides and broadly rounded produced or feebly capitate ends. Raphe thick, subcomplex with unilaterally bent central pores and bayonet-shaped terminal fissures. Axial area 1/4-1/3 the breadth of the valve, sublinear; central area large, reaching the sides with arcuate row of coarse punctae on either side of the central nodule. Striae 11-13 in 10 μ, thick strongly radial in the middle and convergent at the ends.

Distribution in India: paddy and millet fields at Mugad

4. **Pinnularia karnatica** sp. nov. (Fig. 4).

[Valvae 62-68 μ longae atque 16-16.5 μ latae, subellipticae, apicibus late-rotundatis. Raphe crassa atque subcomplexa, ornata poris centralibus paulum unilateraliter inclinatis ac fissuris terminalibus crassis et magnis ac falciformibus. Area axialis angusta, linearis; area centralis ampla usque ad margines perveniens, punctisque crassis ac circa nodulum centralem ordine curvatis, ad aream axialem versus porrecta. Striae 8-9 in 10 μ, crassae, paulum radiales in medio ac convergentes ad apices.]

Valves 62-68 μ long and 16-16.5 μ broad, subelliptical with broadly rounded ends. Raphe thick and subcomplex with central pores slightly unilaterally bent and terminal fissures, thick, large homma-shaped. Axial area narrowly linear: central area large reaching the sides with a curved row of coarse puncta on either side of the central nodule extending towards the axial area. Striae 8-9 in 10 μ, thick, slightly radial in the middle and convergent at the ends.

Distribution in India: paddy fields at Mugad

This form appears like *P. divergens* W. Sm, as illustrated by McCall (McCall, D., *Diat Tay Dist.* p. 259, fig. 21 a), in the outline and group of puncta in the central area. However, it differs from it in having puncta in the central area rather well arranged in a curved row and extending towards the axial area. Moreover, the raphe here is thick and subcomplex with broadly curved terminal fissures. It is, therefore, unlike that of *Pinnularia divergens*. Further, with regard to arrangement of puncta in the central and axial areas it resembles *P. stomatophoroides* Mayer and its varieties (Cleve-Euler, op. cit., p. 41, fig. 1053 a-d) and *P. stomatophora* (Grun.) Cl. v. *bergii* A. Cl. (Cleve-Euler, op. cit, p. 42, fig. 1054 e g), but the present form differs from the said types in the outline, terminal fissures of the raphe and the number of striae. It therefore does not agree with any other known types, hence it is considered to be a new species.

Section DIVERGENTES Cleve

5. **Pinnularia legumen** Ehr. v. **florentina** (Grun.) Cl.; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 51, fig. 1070 c-d (Figs. 5-6, 14).

Valves 55-85 μ long and 12-16 μ broad, linear-lanceolate with triundulate sides and constricted, slightly produced capitate ends. Raphe thin, somewhat undulated with distinct unilaterally bent central pores and broadly curved terminal fissures. Axial area fairly wide, linear; central area large, reaching the sides. Striae 8-11 in 10 μ thick, strongly radial in the middle and convergent at the ends.

Distribution in India: paddy and millet fields at Mugad.

6. **Pinnularia brébissonii** (Kütz.) Cl. v. **producta** A. Cl.; Cleve-Euler A., *Diat. Schwed. Finn.*—IV, p. 54, fig. 1072 k. (Fig. 15).

Valves 43-54 μ long and 9.8-11 μ broad, narrowly lanceolate with constricted, produced, broadly cuneate or subtruncate ends. Raphe thin with slight undulations, terminal fissures curved. Axial area moderately wide, linear-lanceolate; central area large, reaching the sides. Striae 10-12 in 10 μ thick, closely set, radial in the middle and convergent at the ends.

Distribution in India: paddy and millet fields and road-side pools at Mugad.

7. **Pinnularia brébissonii** (Kütz.) Cl. v. **producta** A. Cl. f **biundulata** (O. Müll.) A. Cl.; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 54, fig. 1072 l, m, o, (Fig. 7).

Pinnularia microstauron (Ehr.) Cl. f. *biundulata* O. Müll.; Hustedt, *Bacil.*, p. 320, fig. 583.

Valves 40-45 μ long and 9-9.5 μ broad, linear-lanceolate, slightly concave in the middle with constricted, broadly produced rounded ends. Raphe thin and slightly undulated with central pores unilaterally bent and terminal fissures curved. Axial area and central area as in the above type. Striae 9-11 in 10 μ, thick, closely set, strongly radial in the middle and convergent at the ends.

Distribution in India: Bombay; paddy and millet fields and road-side pools at Mugad.

8. **Pinnularia microstauron** (Ehr.) Cl. v. **ambigua** Meister; Hustedt *Bacil.*, p. 320; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 55, fig. 1073 e-f. (Fig. 8).

Valves 46-50 μ long and 7.7-8 μ broad, linear or sublinear with triundulate sides and constricted, broadly produced rounded ends. Raphe thin, slightly undulated with unilaterally bent central pores and only slightly curved terminal fissures. Axial area narrow, linear; central area very wide, reaching the sides. Striae coarse, 12-13 in 10 μ, strongly radial in the middle and convergent at the ends.

Distribution in India: paddy and millet fields at Mugad.

9. **Pinnularia conica** sp. nov. (Figs 9-10)

[Valvae 40-63 μ longae atque 7-11 μ latae, lineari-lanceolatae; apicibus constrictis productis, aliquantum capitatis-cuneatis. Raphe tenuis et recta, ornata poris centralibus distincte atque fissuris terminalibus curvatis. Area axialis angusta 1/5-1/4 latitudinis valvae, linearis; area centralis

ampla usque ad margines perveniens Striae 9-12 in 10 μ, crassae, valde radiales in medio atque in utroque apice convergentes.]

Valves 40-63 μ long and 7-11 μ broad, linear-lanceolate with constricted, produced, slightly capitate-cuneate ends. Raphe thin and straight with distinct central pores and curved terminal fissures. Axial area narrow 1/5-1/4 the breadth of the valve, linear ; central area very large reaching the sides. Striae 9–12 in 10 μ, coarse, strongly radial in the middle and convergent at the ends.

Distribution in India : paddy and millet fields and road-side pools at Mugad. Also collected from Bombay ; Kolhapur ; Dharwar; Jog-Falls ; Sagar; Hirebhasgar-dam side and other places.

This form in the first place, resembles *P. braunii* (Grun.) Cl. v. *amphicephala* (A. Mayer) Hust. f. *conica* Venkat., as illustrated by Venkataraman (Venkataraman, *S. I. Diat.*, p. 337, fig. 113), in the outline and produced, slightly capitate-wedge-shaped ends. However, it differs from the said form in the number of striae, greater breadth and dimensions But the dimensions given for *P. braunii* v. *amphicephala* by Hustedt (Hustedt, *Bacil.*, p. 319, fig. 578), agree well here. Venkataraman, in his remarks on the form states, 'the form resembles in all respects the figure *P. interrupta* f. *braunii* Fritsch (Fritsch, *Ann. S. Afr. Museum*, IX, pt. VII, 1918, p. 592, fig. 40 *a-b*),' but makes no statement as to in what respect his form differs from Fritsch's that led him to create it as a new form of *P. braunii* v. *amphicephala*. He, in his subsequent paper ' ... Diat. S. India (Government Press, Madras) 1956, p. 9, fig. 25', gives a figure of the same form which to my mind is very much like *P. braunii* in the outline and agreeing more or less in the dimensions also (Hustedt, op. cit., p. 319, fig. 577 ; Cleve-Euler, A., op. cit., p. 24, fig. 1020 a-c, inclusive of the variety *marginata* A. Cl.). However, the striae indicated in his latter form are rather more robust and the area in the centre unilaterally extended. He, in his remarks to this latter form states, 'this form agrees with the type (*Pinnularia braunii* v. *amphicephala* f. *subconica* Venkat.), except for the striae being present on one side in the middle region. This is also broader and shorter than the type. In some specimens striae are continuous while in some others they are *interrupted in one valve* and *not so on one side in the other valve*. These variations also exist in the form described already'. This account given by the author is radically different from what he gave for his original form ; neither does he state that he has completely established the identity of the latter specimens with that of his original one by comparison. If this is true that both of his forms are one and the same with indicated range of variations, then my specimens are different. The specimens collected by me from several different localities and areas in Bombay State, do not lend to such variations except for the dimensions, which are within the limits given above.

Further, the present form resembles *P. nodosa* Ehr. v. *pseudogracillima* (Mayer) A. Cl., as illustrated by Cleve-Euler (Cleve-Euler, A., op. cit. p. 26, fig. 1024 k, l) and particularly with 'l', in all respects except for the axial area which in the present specimens is narrow. But the description does not fully accord with the illustration given by the author; nor is it clear if *P. nodosa* v. *pseudogracillima* has or has not scattered punctae in the axial field, characteristic of the main type, but I presume them to be present. In the line following the description of the form, the author

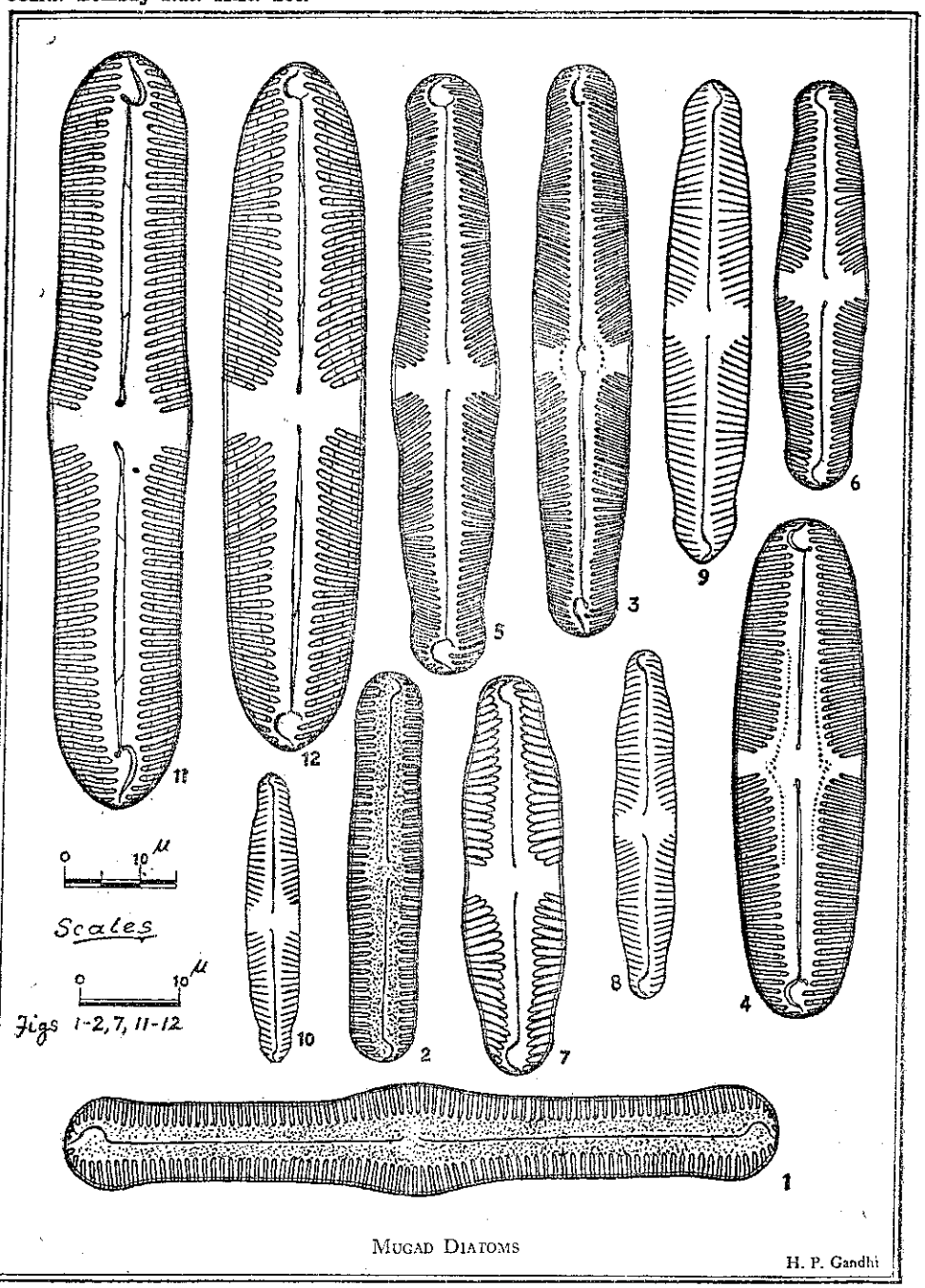

Fig. 1. *Pinnularia acrosphaeria* (Bréb.) W Sm. f. *undulata* Cl. 2. *Pinnularia acrosphaeria* (Bréb.) W. Sm. v. *minor* Cl. 3. *Pinnularia stomatophoroides* Mayer v. *ornata* A. Cl. f. *erlangensis* Mayer. 4 *Pinnularia karnatica* sp. nov. 5-6. *Pinnularia legumen* Ehr. v. *florentina* (Grun.) Cl. 7. *Pinnularia brébissonii* (Kütz.) Cl. v. *producta* A. Cl. f. *biundulata* (O. Müll.) A. Cl. 8. *Pinnularia microstauron* (Ehr.) Cl. v. *ambigua* Meister. 9-10. *Pinnularia conica* sp. nov. 11. *Pinnularia angustefasciata* A. Cl. 12 *Pinnularia aestuarii* Cl. v. *interrupta* (Hust.) A. Cl

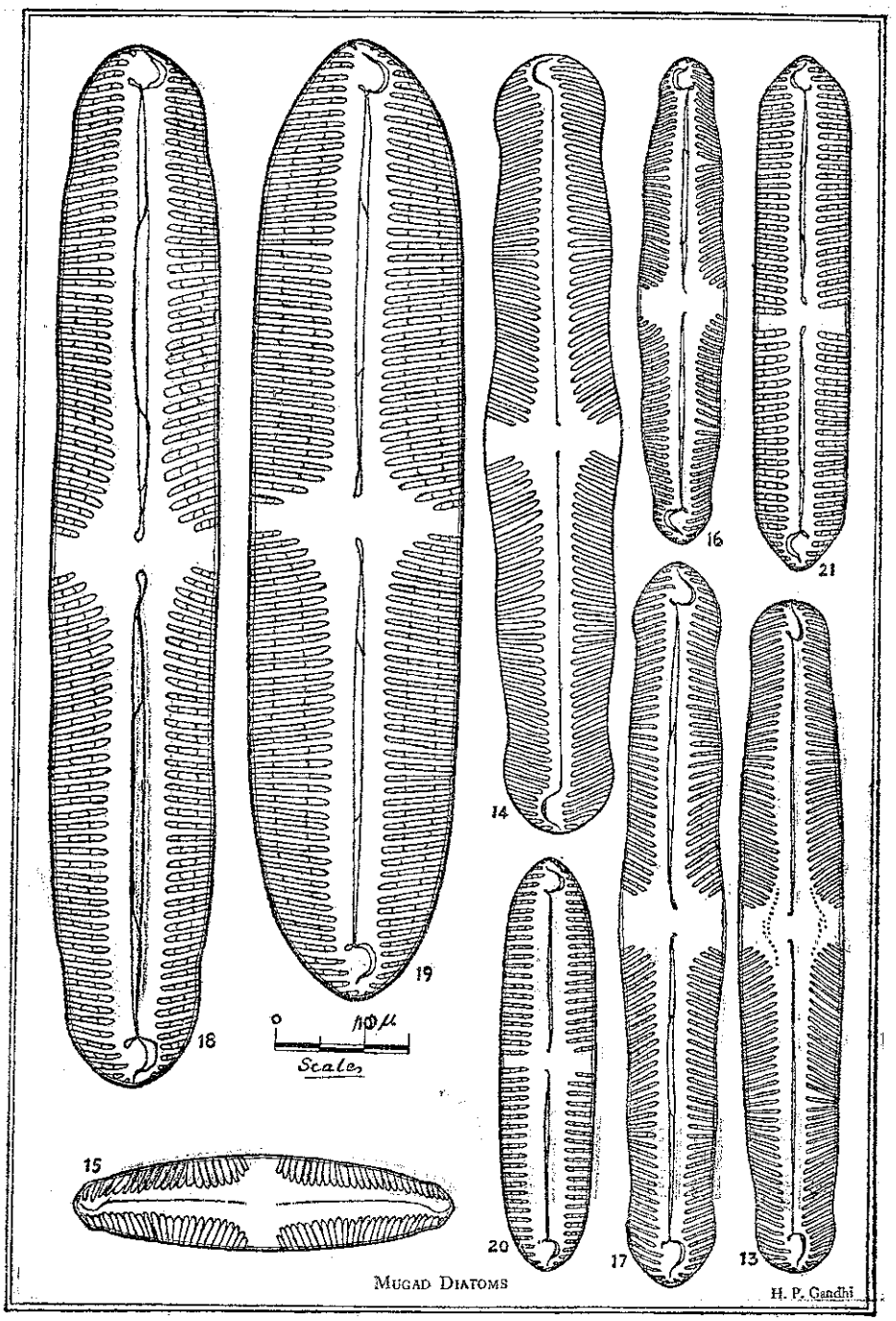

Fig. 13, *Pinnularia stomatophoroides* Mayer v. *ornata* A. Cl. f. *erlangensis* Mayer. 14. *Pinnularia legumen* Ehr. v. *florentina* (Grun.) Cl. 15. *Pinnularia brebissonii* (Kütz.) Cl. v. *producta* A. Cl. 16. *Pinnularia esox* Ehr. v. *fasciola* v. nov. 17. *Pinnularia esox* Ehr. v. *capitata* v. nov. 18. *Pinnularia neglecta* (Mayer) A. Berg v. *interrupta* v. nov. 19. *Pinnularia desluarii* Cl. v. *lata* v. nov. 20. *Pinnularia isostauron* (Ehr. ? Grun.) Cl. 21. *Pinnularia isostauron* (Ehr. ? Grun.) Cl. v. *conifera* Brun and Heribaud.

mentions that the walls are not undulate and fig. 1024, 1, is like v *recta* A. Cl.

Taking all these points into consideration, it seems clear that my specimens which do not have any puncta in the axial area, are distinctive. I therefore consider them to be a new species.

Section MAJORES Cleve

10. **Pinnularia esox** Ehr. v. **fasciata** v. nov (Fig. 16).

[Valvae 55-71 μ longae atque 10.5-11 μ latae, lineari-lanceolatae, marginibus triundulatae; apicibus constrictis, productis-cuneatis vel subcapitatis. Raphe semi-complexa, poris centralibus distinctis et fissuris terminalibus late curvatis. Area axialis ampla 1/4-1/3 latitudinis valvae, lineari-lanceolatae; area centralis amplissima usque ad margines perveniens. Striae 9-11 in 10 μ, crassae, valde radiales in medio ac in utroque apice convergentes, vittis longitudinalibus indistinctis.]

Valves 55-71 μ long and 10.5-11 μ broad, linear-lanceolate with triundulate margins and constricted, produced-cuneate to subcapitate ends. Raphe semi-complex with central pores distinct and terminal fissures broadly curved. Axial area wide 1/4-1/3 the breadth of the valve, linear-lanceolate; central area very large reaching the sides. Striae 9-11 in 10 μ, thick, strongly radial in the middle and convergent at the ends, longitudinal bands indistinct.

Distribution in India: paddy fields at Mugad.

This form closely resembles *P. esox* Ehr., and its varieties as illustrated by Cleve-Euler, (Cleve-Euler, A., op. cit., p. 76, fig. 1107 a-g) and Hustedt (Hustedt, *Bacil.*, p. 334, fig. 616), in the triundulate sides, semi-complex raphe, narrow longitudinal bands etc. However, it differs from it in having broad central area reaching the sides, longitudinal bands somewhat indistinct, besides it is smaller in size. This form also differs from *P. stomatophoroides* Mayer v. *nuda* A. Cl. (Cleve-Euler, op. cit., p. 41, fig. 1053 e, f) and *P. staurоptera* (Rabh.) Cl. v. *longa* A. Cl. (Cleve-Euler, op. cit., p. 67, fig. 1091 g-i) in many respects except for the general outline. Since this form shows a greater affinity to *P. esox* than any other form, it is, therefore, regarded as a new variety of *P. esox*.

11. **Pinnularia esox** Ehr. v. **capitata** v. nov. (Fig. 17).

[Valvae 78-80 μ longae atque 12-13 μ latae, lineari-lanceolatae, marginibus triundulatae aliquantum dilatatae in medio; apicibus constrictis et capitato-cuneatis. Raphe crassa, semi-complexa, ornata poris centralibus unilateraliter inclinatis; fissuris terminalibus late curvatis. Area axialis 1/4 latitudinis valvae, linearis; area centralis amplissima usque ad margines perveniens. Striae 8-10 in 10 μ, crassae, valde radiales in medio et convergentes ad apices, vittis longitudinalibus indistinctis et angustissimis.]

Valves 78-80 μ long and 12-13 μ broad, linear-lanceolate with triundulate margins, somewhat dilated in the middle with constricted capitate-wedge-shaped ends. Raphe thick and semi-complex with unilaterally bent central pores and broadly curved terminal fissures. Axial area $\frac{1}{4}$ the breadth of the valve, linear; central area very large, reaching the sides. Striae thick, 8-10 in 10 μ, strongly radial in the middle and convergent at the ends, longitudinal bands indistinct and very narrow.

Distribution in India: paddy fields at Mugad.

This form resembles *P. esox* Ehr., as described and illustrated by Hustedt, (Hustedt, *Bacil.*, p. 334, fig. 616) and Cleve-Euler, A. (op. cit p. 76, fig. 1107 a–b, = *P. esox* v. *clevei* A. Cl.), in the outline, undulated margins, semi-complex raphe and other details. However, it differs from the said type in having distinctly capitate-wedge shaped ends and very large central area extending to the sides. It also differs from *P. polyonca* (Bréb.) O. Müll., described by Hustedt (Hustedt, op. cit, p. 319, fig. 576), and others, in many details except for the general outline and capitate ends. The present form further differs from *P. divergens* W. Sm. v. *capitata* A. Cl. (Cleve-Euler, op. cit., p. 53, fig. 1071 k), in not having the constriction in the middle as also the thickenings on the walls in the central region, but for the outline. Moreover, the raphe here is sub-complex. It, therefore, appears to be a distinctive form coming closer only to *P. esox*, hence it is considered to be its new variety.

Section COMPLEXAE Cleve

12. **Pinnularia angustefasciata** A. Cl ; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 78, fig. 1109 a-c. (Fig. 11).

Valves 52-87 μ long and 10-15 μ broad, linear with a median inflation and inconspicuously swollen broadly subcuneate ends. Raphe thick and complex with central pores unilaterally bent and terminal fissures somewhat bayonet-shaped. Axial area $\frac{1}{4}$ the breadth of the valve, linear ; central area moderately wide, reaching the sides. Striae 8-10 in 10μ thick, slightly radial in the middle and convergent at the ends, longitudinal bands present but indistinct.

Distribution in India: paddy and millet fields at Mugad.

This form agrees well with the type described by Cleve-Euler except that some smaller forms were also recorded from the area. The epithet 'v. *schmidtii* A. Cl.' (= *P. angustefasciata* v *schmidtii* A. Cl.), indicates the main type, hence avoided. This form resembles *P. regina* Mills (Mills, *Diat from Warri* p. 394, pl. III, fig. 33), in the outline, raphe, central and axial areas. However, the present form has no punctae either in the central area or in the polar nodules, hence it differs. It further differs from it in dimensions and number of striae

13. **Pinnularia neglecta** (Mayer) A. Berg v. **interrupta** v. nov (Fig. 18).

[Valvae 99-116 μ longae atque 17-19·3 μ latae. robustae, lineares, marginibus indistincte triundulatae ; apicibus late-productis, subcuneatis et rotundatis. Raphe crassa, valde complexa ; ornata poris centralibus crassis ac unilateraliter inclinatis ; fissuris terminalibus crassis et curvatis. Area axialis $\frac{1}{4}$-$\frac{1}{3}$ latitudinis valvae, linearis ; area centralis ampla usque ad margines perveniens. Striae 7-8 in 10 μ, crassae, radiales in medio ac in utroque apice convergentes, vittis longitudinalibus distinctis et angusta.]

Valves 99-116 μ long 17-19·3 μ broad, robust linear with indistinctly triundulate sides and broadly produced, subcuneate-rounded ends. Raphe thick, strongly complex with central pores thick and unilaterally bent and terminal fissures thick and curved. Axial area $\frac{1}{4}$-$\frac{1}{3}$ the breadth of the valve, linear ; central area large, reaching the sides. Striae

7-8 in 10 μ, thick, radial in the middle and convergent at the ends, longitudinal bands distinct but narrow.

Distribution in India: paddy and millet fields and a road-side pool at Mugad.

This form agrees well with the type described by Cleve-Euler (Cleve-Euler, A, op. cit., p. 80, fig. 1112 a-b), except that the central area reaches the sides due to interruption of the median striae. It is therefore regarded as a new variety.

Section VIRIDATAE A. Berg

14. **Pinnularia aestuarii** Cl. v. **interrupta** (Hust.) A. Cl.; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 82, fig. 1115 b-c (Fig. 12)

Valves 67-87 μ long and 14-15 μ broad, linear with broadly sub-cuneate ends. Raphe thick, complex with large central pores unilaterally bent and semi-circular terminal fissures. Axial area $\frac{1}{4}$ the breadth of the valve, linear; central area fairly large, reaching the sides. Striae 8-9 in 10 μ, radial in the middle and convergent at the ends, fairly wide longitudinal shiny bands present.

Distribution in India: paddy and millet fields at Mugad.

This form agrees well with the type described by Cleve-Euler, except that it is slightly broader. It also resembles *P. westii* McCall (McCall, D., *Diat. Tay Dist*, p. 261, fig. 24), in the outline, dimensions and a few other details. However, the present form has complex raphe and the central pores not at all strongly unilaterally bent, hence it differs from *P. westii* McCall.

15. **Pinnularia aestuarii** Cl. v. **lata** v. nov. (Fig. 19).

[Frustula robusta atque in aspectu zonali late rectangularia. Valvae 87-106 μ longae atque 17-25 μ latae, late-lineares, apicibus subcuneatae rotundatae. Raphe crassa paullum complexa, ornata poris centralibus magnis atque unilateraliter inclinatis et fissuris terminalibus late curvatis. Area axialis angusta, linearis; area centralis angusta usque ad margines perveniens. Striae 7-8 in 10 μ, crassae, aliquantum parallelae, radiales in medio ac convergentes ad apices cum vittis longitudinalibus modico amplis et claris.]

Frustules robust and broadly rectangular in girdle view. Valves 87-106 μ long and 17-25 μ broad, broadly linear with subcuneate rounded ends. Raphe thick and slightly complex with central pores large and unilaterally bent and terminal fissures broadly curved. Axial area narrow, linear; central area narrow, reaching the sides. Striae 7-8 in 10 μ, thick, slightly parallel, radial in the middle and convergent at the ends with fairly broad and clear longitudinal bands.

Distribution in India: paddy and millet fields at Mugadi.

This form agrees well with the type *P. aestuarii* Cl. and its variety *interrupta* (Hust.) A. Cl., as described by Cleve-Euler (Cleve-Euler, op. cit., p. 82, fig. 1115 *a-c*), in all respects, except that it is proportionately very broad and the striae somewhat parallel, less radial and convergent than in the type. It does not agree with any other form so closely, hence it is regarded as a new variety of *P. aestuarii*.

16. **Pinnularia isostauron** (Ehr. ? Grun.) Cl.; Skvortzow, B. W., *Diat. from Kaolingtze—Manchoukuo*, p. 354 pl 1, fig. 19; pl. 2, fig. 15 (Fig. 20.).
P. isostauron v. *genuina* A. Cl.; Cleve-Euler, A., *Diat. Schwed. Finn.*—IV, p. 84, fig 1116 a-b.

Valves 41-46 μ long and 8·8·10 μ broad, linear with feebly convex sides and broadly subcuneate ends. Raphe thick, complex with distinct and somewhat closely set central pores and broadly curved terminal fissures Axial area $\frac{1}{5}$ the breadth of the valve, linear; central area reaching the sides and unilaterally wide Striae 9-10 in 10μ, slightly radial in the middle and convergent at the ends with well marked longitudinal bands

Distribution in India: paddy and millet fields at Mugad

17. **Pinnularia isostauron** (Ehr. ? Grun.) Cl. v. **conifera** Brun & Hér. Cleve-Euler, A, *Diat. Schwed Finn.* IV, p. 84, fig. 1116 c (Fig. 121)

Valves 52-56 μ long and 8-9 μ broad, linear with broadly cuneate rounded ends. Raphe thick, complex with unilaterally bent central pores and semi-circular terminal fissures Axial area $\frac{1}{4}$-$\frac{1}{5}$ the breadth of the valve, linear; central area reaching the sides but unilaterally wide. Striae 9-10 in 10 μ, thick, slightly radial in the middle and convergent at the ends, longitudinal bands present.

Distribution in India: paddy and millet fields at Mugad

Summary

In this paper the species of *Pinnularia* from Mugad (Dharwar) are described and illustrated. Many of these forms are interesting and beautiful, and make new records for India and a few for science.

Acknowledgement

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