Freshwater Diatomflora of the Panhalgarh Hillfort in the Kolhapur district

by

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SYNOPSIS

This is an account on the freshwater Diatomflora of the Panhalgarh hills in the Kolhapur district based on collections and studies made during different seasons of the years 1953—56. Besides the taxonomical studies, it is also endeavoured here to present notes on ecology, occurrence and distribution of these diatoms. A suggestion also has been made, wherever possible, regarding their form-change occurring during their reproduction or otherwise under the influence of varying climatic conditions —.

INTRODUCTION

The author's main interest in describing the Diatomflora of Panhalgarh hills is firstly that this area never before has been explored. Secondly, the collections and studies that could be made from season to season for a continuous period of about three-and-half years tended to throw some light on periodicity, occurrence, distribution of the diatoms and on growth phases of certain of them. Thirdly, the material collected from the region was found to be fairly rich in species and thus it made a worthwhile study. Lastly, the hill-flora, leaving the cosmopolitan elements, appeared to be distinct from that of the plains.

Panhalgarh is an ancient hill-fort on one of the spurs of the Western Ghats. It was probably built during the times of great, noble Maratha king — Chhatrapati Shivaji who made it his favourite place of dwelling. During a later period when the Maratha kingdom was distintegrated — it came in possession of Mohammedan rulers —

and again it changed hands ultimately to remain in possession of descendants of the Maratha Dynasty untill lately. This hill-fort had a glorious history that dates back to 17th century A. D. It had a continuous high wall which has crumbled down and what remains today is in delapidated condition.

The hill-fort is situated at latitude 16° 50' N. and Longitude 75° 10' E., at about 12 miles west of Kolhapur, to which it is connected by a tarred higway.It has an elevation varying between 2850 to 3177 feet above sea-level. The average rainfall is more than 100 inches, because of the direct influence of the S.-West moisture laden monsoon winds from the Arabian Sea. About 90 % of the precipitation occurs from June to September. The climate is fairly cool throughout the hot season.

The area has some hill-streams and several water-veins seeping out from hilly inclines. Besides these, there are 2—3 artificial tanks at a lower altitude with perennial water-supply, half-a-dozen old out-of-use cisterns which receive some water supply throughout the year, a couple of wells on hill tops which during the wet season overflow and several miscellaneous pools and puddles that are so commonly formed during the wet season. From all these wet situations the material for the present study was collected during different seasons for the period 1953—56. The place was chosen, it being a convenient and profitable ground for botanical excursions since it harboured a rich Angiosperm-flora more or less representative of any region of the Western Ghats. The frequent botanical excursions were solely conducted by the author who was in charge of teaching Systematic Botany — and it was a welcome thing.

The collections that were made during the period were examined soon after, both in fresh and preserved (5 % formalin used) condition at the Rajaram College, Kolhapur, and the necessary notes were then written down. During the years 1958—59, the prepared slides of the material were once again examined but at the Gujarat College, Ahmedabad, despite of several handicaps, and later at the M. N. College, Visnagar. Of all these studies and observations, I present the following account.

From the examination of the material, it appeared that the Diatom flora is fairly rich and quite interesting. The genera *Eunotia* and *Pinnularia* are predominating. The genus *Frustulia* appeared to be characteristic of hilly situations. Again, the collections and study made for a period of about three-and-half years, it had become possible to record a range of variation occurring, at least in certain species of diatoms, in the natural habitat. Of such species mention may be made of *Eunotia pectinalis* v. *gibbulosus* VENKAT., *E. rostellata* HUST., *E. tumida* sp. nov., *Neidium oblique-striatum* A. S. v. *rostrata*

SKV., *Stauroneis phoenicenteron* EHR. f. *producta* GANDHI, *Pinnularia braunii* (GRUN.) CL., *P. pusilla* sp. nov., *P. panhalgarhensis* sp. nov., *P. major* (KÜTZ.) CL. v. *linearis* CL. and *Surirella subsalsa* W. SM. Another interesting feature noted was that most of these species possessed weakly silicified walls and markings, in some it was difficult to decipher very fine and delicate markings, especially in species of *Frustulia* and *Anomoeoneis exilis* (KÜTZ.) CL., but Leitz's phase-contrast microscope to a certain degree helped in determination of such fine markings.

On account of several factors I could not make many ecological studies of the periodic collections. But whatever little facility that was available and the study that could be made is indicated in the form of notes under individual species. These notes mostly refer to the occurrence, distribution, seasonal variation and frequency.

On the whole, the Diatom flora of this part was found to be worth the study in as much as that, 1) sixty-eight diatoms are recorded from the area of which twenty-three make new records for India and 2) eight species, five varieties and one form, tentatively, are considered to be new for Science. In this account illustrations and descriptions are avoided of such diatoms that are well known in the Indian Literature.

1. *Melosira dickiei* (THW.) KÜTZ. (Figs. 1—3).

VAN HEURCK, Treat. Diat., 1896, 444, pl. 19, f. 623; HUSTEDT, Bacil., 1930, 86, f. 42; SCHMIDT, A., Atlas Diat., 1874—1944, t. 182, f. 48—50 (= *Orthosira Dickieyii* THW.): — Cells 12. 8—19 μ in diameter and 10.5—11 μ high semi-cells, in short chains, cylindrical. Cells connected by small cushions. Sulcus absent. Inner rim thickened and gradually widening, often different in any two valves. Striae 15—16 in 10 μ, finely punctate in straight rows, often indistinct. Valves in top view circular with fine punctae probably arranged in radial rows, middle punctae scattered.

This species was first collected in 1955 and was continuously seen thereafter. It was found to inhabit springs and water veins seeping out from hilly inclines, appearing therein in the form of pale brown scum mostly after the rains. It usually occurred in good number till February, but during the hot seasons it was stray. A fairly distributed form but not abundant.

2. *Synedra ulna* (NITZ.) EHR.

HUSTEDT, Bacil., 1930, 151, f. 158—9: — Length 70—150 μ, breadth 5.5—6.8 μ and striae 8—10 in 10 μ.

This species was found in all seasons in smaller or larger numbers in all wet situations. It was very prolific in tanks with living and dead

vegetable matter. It was found to attain peak values from November to January.

3. *Synedra ulna* f. *staurodestituta* PANT. (Fig. 4).

CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 61, f. 382 b—c: — Valves 110—143 μ long and 6—6.6 μ broad, sublinear with ends abruptly narrowed and long-rostrate. Pseudoraphe narrow, linear. Central area not formed. Striae 9—10 in 10 μ, coarse.

4. *Eunotia praerupta* EHR. v. *bidens* GRUN. (Fig. 5).

VAN HEURCK, Treat. Diat., 1896, 302, pl. 9, f. 379; HUSTEDT, Bacil., 1930, 174, f. 213; BERG, A., genus Eunotia, 1939, 457 (=*E. praerupta bidens* (GRUN.) A. BERG); Diat. Sophia-Exped., 1945, 9, t. 2, f. 70; CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 127, f. 466 a—c (= *E. praebidens* (Å. BERG) A. CL. v. *genuina* A. CL.): — Valves 37.5—42 μ long and 10—12 μ broad, arcuate, dorsal side convex with a distinct concavity in the middle, ventral side uniformly but slightly concave; ends constricted on the dorsal side, capitate, somewhat obliquely subtruncate. Polar nodules small with a small part of raphe visible. Striae 10—12 in the middle and 13—14 in 10 μ at the ends, somewhat coarse.

BERG in 1939 regarded this species as *E. praerupta-bidens* and CLEVE-EULER, evidently basing her observations according to BERG, regarded it as *E. praebidens* v. *genuina*. The present author does not know of any explanation being offered by these scientists while departing from the normal course. Under this condition, it is felt here that the species be retained as such rather than building up nomenclatural difficulties.

This diatom was found as a stray form in most of the collections made from the region. It was usually found in pools, old-cisterns and in marginal slime of tanks, during August to February. In other months, it was seldom collected. A rare or stray form in the region.

5. *Eunotia pectinalis* (KÜTZ.) RABH. v. *curta* V. H. (Fig. 6).

CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 84, f. 409 b—d: — Length 21—24 μ, breadth 5.2 μ and striae 13—14 in 10 μ.

This diatom was found in a small number of pools and a cistern on Teen-darwaja side. It occurred as a stray form in pale brownish scum or encrustations formed by some Myxophyta. A rare form in the locality. From the collections nothing can be said regarding its periodicity.

6. *Eunotia pectinalis* v. *ventralis* (EHR.) HUST. (Fig. 7)

HUSTEDT, Algenfl. Bremen — IV, 1911, 276, t. 3, f. 26—27; Bacil.,

1930, 182, f. 241?; BERG, A., Genus Eunotia, 1939, 426, f. 1:25; CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 85, f. 409 k-l; VAN HEURCK, Treat. Diat., 1896, 301, pl. 9, f. 372 (= *E. pectinalis* v. *ventricosa* GRUN.): — Valves 70—76 μ long and 7—7.6 μ broad, slightly arcuate, dorsal side convex but straight in the middle, ventral side slightly concave, parallel with the dorsal side having a gibbosity in the middle; ends constricted on the dorsal side, well produced and weakly capitate or subcapitate. Polar nodules small. Striae 8—11 in 10 μ, irregularly disposed, coarse and slightly closely set towards the ends.

The illustration available of this diatom in the literature cited above shows a good deal of variations with regard to its apices which range from purely produced to slightly capitate, the ventral side having a slight bulge to a prominent gibbosity in the middle and in some cases slight inflations on ventral side terminations. However, the present form agrees well with CLEVE-EULER'S „f. 409 k" and HUSTEDT'S "t. 3, f. 27".

This diatom was collected in a small number from several large and small bodies of water around the hills. It was recorded during all seasons but rarely during the hot period. It was often found in pale brown films with decaying vegetable matter lying on borders of the wet situations, rarely epiphytic. Not quite common in the locality.

7. *Eunotia pectinalis* v. *gibbulosus* VENKAT. (Fig. 8)

VENKATARAMAN, G., S. I. Diat., 1939, 309, f. 22; GANDHI, H. P., Diat. Radhanagari, 1957, 47, pl. 13, f. 2: — Length 60—80 μ, breadth 6.6—7 μ and striae 9—13 in 10 μ.

Some of the specimens showed the dorsal side less gibbous in the middle part than in others, both from this as well as from other localities. From the observations of the species collected here, it seems that the margin of difference between this and *E. pectinalis* v. *ventralis* described above tends to be small. It may be that larger valves of length more than 70—80 μ, having distinct median gibbosity on the dorsal side with lateral elevations towards the apices, tend to lose them into a more or less straight wall in small specimens to appear like *E. pectinalis* v. *ventralis*. In the diatom illustrated presently it seems to find some emphasis of this kind, that the dorsal side has a feeble gibbosity in the middle and towards the ends the sides less elevated than in specimens recorded previously by different workers as well as some here also. However, the point whether *E. pectinalis* v. *gibbulosus* gives rise to *E. pectinalis* v. *ventralis* could not be ascertained for want of suitable material. This doubt needs varification by clone culture. It may be indicated that range of dimensions recorded by different workers, for *E. pectinalis* v. *gibbulosus* and *E.* v. — *ventralis*, are as follows: —

a) *Eunotia pectinalis* v. *gibbulosus*

Author		Length	Breadth	Striae in 10μ	
VENKATARAMAN	(1939)	42-120μ	5-8μ	7-11	
HUSTEDT	(1930)	?	?	?	(v. *ventralis*?)
BERG	(1939)	85-115μ	5-6μ	8-10	(f. *gibbosa*)
CLEVE-EULER	(1953)	80-160μ	5-7μ	7-10	(v. *gibbosa*)
GONZALVES & GANDHI	(1951)	125-134.5μ	8-9μ	8-11	
GANDHI	(1957)	96-111μ	8.5-9μ	8-11	
— (unpublished)	(1959)	98-120μ	8.8-9μ	10-12	

b) *Eunotia pectinalis* v. *ventralis*

Author	Length		Breadth	Striae in 10μ
BERG	(1939)	35-75μ	6-8 μ	12
CLEVE-EULER	(1953)	40-70μ	7 μ	8-11
in the present case		70-76μ	7-7.6μ	8-11

From the observation of these two tables, it becomes evident that *E. pectinalis* v. *gibbulosus* are larger forms than *E. pectinalis* v. *ventralis* and the range of dimensions recorded by VENKATARAMAN appears to be certainly not in keeping with those recorded by other workers, especially the lower range.

This diatom was also found in good number throughout the seasons and in several bodies of water during the years 1945—56. It often occurred in masses of dead vegetable matter forming pale brown matrix. It also was noted once or twice in a few samples collected from old cisterns. Fairly distributed in the locality.

8. *Eunotia pectinalis* v. *neglecta* GANDHI (Fig. 9)

GANDHI, H. P., Diat. Radhanagari. 1957, 47, pl. 13, f. 3—5 :— Length 43—53 μ, breadth 6.7—7 μ and striae 11—13 in 10 μ.

This diatom was found sparsely distributed in the area, often represented by stray specimens. However, it was noted as an all-season form mostly occurring in stagnant waters in cisterns and pools with rotting vegetable matter.

9. *Eunotia rostellata* HUSTEDT (Figs. 10—16).

SCHMIDT, A., Atlas Diat., 1874—1944, t. 289, f. 3—4; BERG, A., Diat. Sophia-Exped., 1945, 7, t. 2, f. 46; CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 87, f. 410 :— Valves 16—57 μ long and 6.6—7.5 μ broad, arcuate, linear, somewhat parallel in the middle

with ends constricted on the dorsal side, broadly produced and rounded but not at all capitate. Polar nodules small but distinct. Striae 12—16 in 10 μ, fine but distinct.

A table of typical dimensions noted for the species.

		Length	Breadth	Striae in 10μ
		16 μ	6.6μ	14—15
		23 μ	6.6μ	16
		26.2μ	7.2μ	14—16
		30 μ	7 μ	14
		47.6μ	7—7.5μ	13—14
		57μ	7.5μ	12—13
BERG	(1945)	19—35μ	5 μ	15—17
CLEVE-EULER	(1953)	13—45μ	5—6.5μ	15—17

Of this species several specimens were observed with a typical latitude of dimensions indicated in the above table and also those recorded by BERG and CLEVE-EULER, for the comparison. Again, several figures are given of the same depicting different sizes. All these illustrations seem to resemble very closely with three different species, viz. 1) *E. septentrionalis* ØSTRUP (HUSTEDT, Bacil., 1930, 179, f. 232), 2) *E. rostellata* HUST. and 3) *E. grunowii* Å. BERG v. *uplandica* A. CL. (CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 97, f. 421 j-r; BERG, Å., genus Eunotia, 1939, 437, f. 5 : 190), in the outline, typically narrowed, produced rounded ends with smaller polar nodules. These three species do not show much difference either in their outline, apices or the arrangement of striae though the striae number varies. Considering my examined material and setting to compare that with these three species, I, therefore, experience a certain amount of hardship. However, I place *E. septentrionalis*, out of consideration on the basis of length to breadth proportions and density of striae, although in larger forms L. : Br. proportions tend to be approximate. The dimensions given for *E. septentrionalis* are according to HUSTEDT (1930) 11—36 x 3.5—6 μ, striae 16—20 in 10 μ; CLEVE-EULER, A. (1953) 18—25 x 4—5 μ, str. 16—19 in 10 μ. While considering the above table it appears that the breadth in present forms does not much diminish with the diminishing length. Moreover, the larger forms have less number of striae per 10 μ.

The difficulty which arises now is that whether all the forms examined and referred to in the table be considered as a single, polymorphic species *E. rostellata* HUST., or two species as *E. rostellata* having denser striae and *E. grunowii* v. *uplandica* A. CL. (= f. *uplandica* according to Å. BERG) with less denser striae. The range of

dimensions given for *E. rostellata* more or less agrees as also the number of striae per 10 μ, with forms collected here of length 16—30 μ, shown in the table. And what that minor difference exists, may be taken for ecological variation. Now the forms of length range 47—57μ, that remain have less number of striae than the others, create hesitation. If these forms are considered with *E. grunowii* v. *uplandica*, they quite fit-in with CLEVE-EULER'S records which have striae range 10—13 in 10 μ. According to BERG, *E. grunowii* v. *uplandica*, has only 9—10.5 striae per 10 μ. In this event CLEVE-EULER'S and specimens recorded here admittedly deviate.

While looking to the given table again, the striae number seems to be diminishing in specimens of larger lengths, and in the case of *E. grunowii* v. *upplandica*, CLEVE-EULER and BERG giving different ranges of striae. I am not sure to what extent I would be right if I say that there seems to be an opening for solution of the present dilemma. If, *E. grunowii* v. *uplandica* be reviewed to *E. rostellata*, the latter being a polymorphic type exhibiting denser and denser striae in its smaller derivatives without having much change in form, then the difficulty seems to find a solution. I, therefore, adopt this view resting on my observations of forms of medium to smaller lengths. In this event — naturally — *E. grunowii* v. *uplandica* (= f. *uplandica* according to BERG) becomes *E. rostellata* HUST., which would have now the range of dimensions 13—140 μ x 5—10 μ, and striae 9—17 in 10 μ (9—13 in larger forms and 14—17 in smaller forms per 10 μ).

This species was collected from practically all wet situations in the area, in smaller or larger numbers during different seasons. It was found particularly in pale brown films formed on dead leafy matter, wet soils, rocks along the slowly flowing water veins and as encrustations in cisterns. A very common type in the locality. It was usaully more abundant from November to January.

10. *Eunotia veneris* (KÜTZ.) O. MÜLL. (Fig. 17)

HUSTEDT, Bacil., 1930, 182, f. 245 -— Length 11.5—16 μ, breadth 3.8 μ and striae 13—14 in 10 μ.

This species consisting of small forms was represented in association of *E. lunaris* (EHR.) GRUN., *E. alpina* (NAEG.) HUST. and others. It mostly occurred in brownish masses of matter lying loosely in slowly moving water veins and courses. In some cisterns also it was represented but rather uncertainly. Sparsely distributed in the locality. Not recorded during hot and rainy seasons.

11. *Eunotia lunaris* (EHR.) GRUN. (Fig. 18)

HUSTEDT, Bacil., 1930, 183, f. 249 :— Length 30—63 μ, breadth 3—3.3 μ and striae 14—15 in 10 μ.

This species occurred in all wet situations but in good number in stagnant waters of pools and cisterns. It was seen during all seasons but more during December to early February. Well distributed in the region.

12. *Eunotia alpina* (NAEG.) HUST. (Fig. 19)

HUSTEDT, Bacil., 1930, 185, f. 252 :— Length 42—45 μ, breadth 2.8 μ and striae 16—18 in 10 μ.

This species also occurred in several wet situations but rather sparingly. It was specially recorded from slowly flowing water courses around hills. It was rarely prolific in certain pools and cisterns. Not known during the hot season. A frequent form in the locality, except for the season indicated.

13. *Eunotia pseudoparallela* Å. BERG v. *densestriata* A. CL. (Fig. 20)

BERG, Å., genus Eunotia, 1939, 438, f. 2:84 (= *E. pseudoparallela* v. β); CLEVE-EULER, A., Diat. Schwed. Finn. — II, 1953, 89, f. 424 c: — Valves 14—16 μ long and 2.8 μ broad, arcuate, linear with parallel sides and obtusely rounded ends, ventral side with two notches one towards each end away from the polar nodules. Striae 18 in 10 μ, fine but clearly seen.

This diatom was found usually with *E. lunaris*, *E. alpina* and others in a small number. It was somewhat frequent during November to January, but stray or rare for rest of the year. It was mostly collected from smaller bodies of water occurring there with pale decaying vegetable matter. Not quite common in the locality.

14. *Eunotia hebridica* Å. BERG v. *bergii* v. nov. (Fig. 21)

Valvae 61—65 μ longae atque 10 μ latae, arcuatae, lineares, apicibus ad dorsum constrictis, productis ac subcapitato-rotundatis. Noduli polares distinctae. Striae 8—11 in 10 μ, distincte ac proxime positae in utroque apice.

Valves 61—65 μ long and 10 μ broad, arcuate, linear with ends constricted on the dorsal side, produced and subcapitate-rounded. Polar nodules distinct. Striae 8—11 in 10 μ, distinct and closely set towards the ends.

This diatom resembles well with the form *E. hebridica* v. β described and illustrated by BERG (BERG, Å., genus Eunotia, 1939, 457, f. 4 : 164), but for want of varietal name it has been so treated and named in honour of my esteemed friend.

This diatom was found in a small number from a over-flowing well situated on the hill top, sometimes from September to October, 1954. But from other parts of locality, it was found fairly frequently in pools and cisterns cluttered with dead vegetable matter. On one oc-

cassion during 1955, it was also collected from clusters of some liverworts growing around a continuously moistened rock on the hill-side near Waghdarwaja. Not quite common. Type slide Pan 1:136.

15. *Eunotia tumida* sp. nov. (Fig.s 22—25)

Frustula parva, late rectangularis is aspectu zonale. Valvae 13.3—14 μ longae atque 6.6—7.6 μ latae, minutae, margine dorsale valde tumida ventrale recta vel paululum concava, apicibus ad dorsum aliquantum depressis, productis ac rotundatis. Noduli polares minuti sed distincti. Striae 11—14 in 10 μ, tenues sed distinctae.

Frustules small, broadly rectangular in girdle view. Valves 13.3—14 μ long and 6.6—7.6 μ broad, small, dorsal side strongly tumid and ventral side straight or very slightly concave with ends feebly depressed on the dorsal side, produced and rounded. Polar nodules small but distinct. Striae 11—14 in 10 μ, fine but distinct.

This species does not correspond well to any of the similar looking types noted in the literature, hence it is tentatively considered to be a new species.

This species was collected in a good number from many wet situations of Panhalgarh hills, during practically all seasons of the years 1953—56. It was sometimes gregarious in some pools or slowly flowing water courses soon after the rains. However, during the hot season it was somewhat casual or stray. It was either found in pale brown films deposited on stones along the water courses or on continuously wet soils of pools, ditches or cisterns. A fairly common form. This species is also known to occur at several places on the Western Ghats, in similar situations. Type slide Pan 2:137.

16. *Frustulia saxonica* RABH. (Figs. 26—27)

CLEVE—EULER, A., Diat. Schwed. Finn. — V, 1952, 8, f. 1327 a—b :— Length 32.5—40 μ, breadth 8.4—10 μ and striae about 30 in 10 μ.

This is one of the very wide spread species in the area being found frequently in all collections made during different seasons of years 1953—56. Its favourite haunts were pools, cisterns, slowly flowing water courses and hill streams, but never noted in tanks, except once in 1955. It often occurred in pale brown films deposited on dead submerged leaves and in encrustations of cisterns as also on continuously moistened soils around the hills. Its prolific growth was noted usually during November to January, otherwise seen as a common form. It is also known from several hilly situations all along the Western Ghats.

17. *Frustulia saxonica* v. *linearis* A. CL. f. *minor* GANDHI

GANDHI, H. P., Diat. Radhanagari, 1957, 52, pl. 13, f. 16 :— Length 36.5—38 μ, breadth 10 μ and striae over 30 in 10 μ.

This diatom was found along with the above type but somewhat less frequently. At one time during 1954, it was found to be gregarious in a certain reservoir and around an overflowing well on the hill top. Fairly well distributed in the locality as well as at several places on the Western Ghats. Its peak period probably was November or little earlier.

18. *Frustulia vulgaris* THW. v. *subcapitata* v. nov. (Figs. 28—29)

Valvae 32—34 μ longae atque 7.5—8 μ latae, lineares-ellipticae, apicibus constrictis ac late-subcapitatis. Raphe inter siliceas costas inclusa cum cornibus in nodulo centrale dilatatis. Area centralis elliptica. Striae 24—25 tenus 30 in 10 μ in utroque apice. Striae in medio radiales ac distinctae, indistincte punctatae.

Valves 32—34 μ long and 7.5—8 μ broad, linear-elliptical with constricted, broad subcapitate ends. Raphe between the siliceous ribs, horns in the central nodule widened. Central area elliptical. Striae 24—25 in the middle upto 30 in 10 μ towards the ends. Middle striae radial and distinct, indistinctly punctate.

This diatom agrees well with *F. vulgaris* THW. and its variety v. *capitata* KRASSKE (HUSTEDT, Bacil., 1930, 221, f. 327—8), in the general outline, radial striae, central and polar nodules. However, several specimens collected of this diatom from year to year showed less capitate ends. It is therefore felt here to name these under a new varietal status.

This diatom was represented well in the locality occurring in pale brown films lying either in stagnant water or slowly flowing water courses around the hills. It was well noted during the wet and cool seasons but sparsely during the summers. Type slide Pan 3:138.

19. *Frustulia indica* sp. nov. (Figs. 30—31)

Valvae 45—60 μ longae atque 7.8—8.6 μ latae, lineares, paulum triundulatae, apicibus constrictis, cuneatis ac plus minus producto rotundatis. Raphe inter siliceas costas inclusa, costae aliquantum curvatae, atque ad partem mediam dilatatae. Area centralis aliquantum dilatata ac elliptica. Noduli polares elongati. Striae circiter 35 in 10 μ, tenuissime punctate, punctae fere indistinctae.

Valves 45—60 μ long and 7.8—8.6 μ broad, linear, slightly triundulate, ends constricted, cuneate and more or less produced-rounded. Raphe between the siliceous ribs, ribs slightly bent and at the middle part widened. Central area slightly widened and elliptical. Polar nodules elongated. Striae about 35 in 10 μ, finely punctate, punctae almost indistinct.

This diatom does not correspond to any of the known species, hence it is tentatively considered to be a new species. A very common diatom richly represented from November to February. Type slide Pan 4:139

20. *Neidium amphigomphus* (EHR.) CL. v. *obtusum* A. CL. (Fig. 32)

CLEVE-EULER, A., Diat. Schwed. Finn. — IV, 1955, 115, f. 1168 d :— Valves 40.8—50 μ long and 11.5—13 μ broad, elliptical-lanceolate with feebly constricted or not, subcuneate rounded ends. Raphe thin and straight with central pores bent in opposite directions and terminal fissures shortly bifurcated. Axial area very narrow; central area slightly obliquely elliptical, fairly large. Striae 20—23 in 10 μ fine but clearly punctate, slightly obliquely set in the middle and convergent at the ends, crossed by a few longitudinal furrows near the margins.

This diatom was represented in only a few samples made during 1954, usually in small numbers. These samples were obtained from some pools and cisterns around the hills. During later years it was irregularly observed as a sort of deposition on dead vegetable matter, loosely lying in some pools only. Not properly known in the locality.

21. *Neidium obliquestriatum* A. S. v. *rostrata* SKV. (Fig.s 34—36)

SKVORTZOW, B. W., Diat. Kizaki-lake, 1937, 30, pl. 4, f. 16: :— Valves 47.6—57 μ long and 10.5—11 μ broad, linear-elliptical to lanceolate-elliptical with constricted, broadly produced, cuneate to subcuneate ends. Raphe thin and straight with central pores conspicuously bent in opposite directions and terminal fissures bifurcated. Axial area narrow, linear; central area large, obliquely rectangular. Striae 22—26 in 10 μ, lineate or lineolate and obliquely disposed throughout, crossed by 1—3 hyaline longitudinal furrows near the margins.

Of this diatom several specimens were examined during different seasons and years. All these showed some difference in their form and also in their dimensions and structure. All these differences are indicated in the illustrations. Regarding dimensions that were typically noted, the following table may be referred to:—

Length:	Breadth:	Striae in 10 μ
41 μ	11.5μ	22—23
47.6μ	10.5μ	24—26
48 μ	11 μ	—do—
57 μ	10.5μ	22—24
61 μ	15 μ	24 according to SKVORTZOW

This species was recorded all the year round in the area from several bodies of water in smaller or larger numbers. It was often found mixed up in brownish decaying vegetable matter and some My-

xophyta. A certain water course in a garden near Wagh-darwaja yielded it in good number. Its period of good growth was noted to vary from September to November. A fairly common form in the locality.

22. *Neidium panhalgarhensis* sp. nov. (Fig. 33)

Valvae 47—50 μ longae atque 8.5—8.7 μ latae, lineares, paululum tumidae in medio, apicibus obtuso-cuneatis. Raphe tenuis et recta, poris centralibus inclinatis in directione contraria, fissuris terminalibus bifurcatis. Area axialis angustissima; area centralis ampla, elliptica vel circularis. Striae 28—30 in 10 μ, tenuissime punctatae, fere indistinctae, paululum oblique evolutae in medio atque convergentes ad apicem, sulcis paucibus longitudinalibus interruptis ad margines.

Valves 47—50 μ long and 8.5—8.7 μ broad, linear, feebly tumid in the middle with obtusely-cuneate ends. Raphe thin and straight with central pores bent in opposite directions and terminal fissures bifurcated. Axial area very narrow; central area fairly large, elliptical to circular. Striae 28—30 in 10 μ, very finely punctate almost indistinct, feebly oblique in the middle and somewhat convergent at the ends, crossed by a few longitudinal furrows near the margins.

This species does not agree with any of the known types, hence it is regarded as a new species. Noted as rare. Type slide Pan 3:138.

23. *Stauroneis phoenicenteron* EHR.

HUSTEDT, Bacil., 1930, 255, f. 404 :— Length 80—110 μ, breadth 18—22 μ and striae 14—16 in 10 μ.

This species occurred as a stray form in a number of samples collected during different seasons. In certain larger pools and tanks it occurred fairly in marginal scum. A constant but stray form.

24. *Stauroneis phoenicenteron* f. *gracilis* DIPPEL (Fig. 37)

HUSTEDT, Bacil., 1930, 255; SKVORTZOW, B. W., Diat. Vladivostok, 1938, 254, pl. 1, f. 36; CLEVE-EULER, A., Diat. Schwed. Finn. — III, 1953, 210, f. 944 g? (= v. *gracilis* (EHR.) DIP.) :— Valves 110—120 μ long and 18—20 μ broad, narrowly rhombic-lanceolate with produced rounded ends. Raphe thick with central pores conspicuous and terminal fissures curved. Axial area narrow, linear; central area a stauros, somewhat more widened near the margins. Striae about 20—22 in 10 μ, becoming strongly radial towards the ends, fine but clearly punctate.

This diatom was seen mostly in very small number from September to February, otherwise very rarely seen. It was collected from some pools and cisterns near Wagh-darwaja. Rather rarely seen in the area.

25. *Stauroneis phoenicenteron* f. *producta* GANDHI (Figs. 38—40)

GANDHI, H. P., Diat. Hirebhasgar, 1958, 252, f. 7 :— Length 58—90 μ, breadth 12.6—16 μ and striae 22 in 10 μ.

Of this diatom some illustrations are given to suggest the form change that was found to occur. Here the deviations are noted regarding the outline and the apices.

This diatom was found very frequently throught the region and during all seasons. It was particularly found to be prolific during January-February, otherwise fairly noted. In certain cisterns it was more abundantly formed in decaying vegetable matter. A common form. Also recorded from other places on the Western Ghats. Type slide Pan 5:140.

26. *Stauroneis anceps* EHR.

HUSTEDT, Bacil., 1930, 256, f. 405 :— Length 50—70 μ, breadth 9—13 μ and striae 22—24 in 10 μ.

This diatom was found in a few samples but in good number every year from 1954—56. It was usually found in cisterns, tanks and larger pools around the hills. An all-season form but sparingly seen during the hot and monsoon seasons.

27. *Stauroneis anceps* v. *linearis* (KÜTZ.) V. H. (Fig. 41)

VAN HEURCK, Treat. Diat., 1896, 160, pl. 1, f. 56; HUSTEDT, Bacil., 1930, 256, 407? (= f. *linearis* (EHR.) CL.); CLEVE-EULER, A., Diat. Schwed. Finn. — III, 1953, 208, f. 943 f (= v. *linearis* GRUN.); BERG, Å., Diat. Sophia-Exped., 1945, 12, pl. 3, f. 115 (= v. *hyalina* BR. & PERAG.) :— Valves 36—48 μ long and 8.2—10 μ broad, linear-elliptical with somewhat abruptly narrowed, rostrate rounded ends. Raphe thin and straight. Axial area very narrow; central area a somewhat linear stauros. Striae 26—28 in 10 μ, radial and finely punctate.

While going through the available literature, I find that forms of the present features have been named differently but wherever the similar varietal epithets appear the illustrations tend to show diverse features, e.g. VAN HEURCK, HUSTEDT and CLEVE-EULER give three different illustrations for *S.* — v./f. *linearis* indicating different authors. Whereas, VAN HEURCK and BERG illustrate similar forms under different names. I, therefore, experience much difficulty regarding the correct identity of the present specimens. However, I regard present specimens according to VAN HEURCK'S since they agree very closely.

This diatom was found frequently in pools, puddles, cisterns, streams and some water courses in the area. It was more abundantly noted from November to January than during the rest of the seasons.

It occurred mostly in brownish masses of matter but sometimes in encrustations also. A common diatom in the area.

28. *Anomoeoneis exilis* (KÜTZ.) CL. (Figs. 42—43)

HUSTEDT, Bacil., 1930, 264, f. 429 :— Valves 15—22 μ long and 3.8—4.5 μ broad, lanceolate with capitate rounded ends. Raphe thin and straight. Axial area very narrow; central area small, rounded or elliptical. Striae about 30 in 10 μ, radial, finely punctate, crossed by several longitudinal hyaline ribs 12—13 in 10 μ, irregularly formed. On the whole the structure was very fine and was difficult to observe.

This species was collected from an overflowing well on the hill top, some pools and cisterns. It occurred in pale brownish scum or slime lying on soil, dead vegetable matter etc. It was well represented during winter and spring seasons but otherwise sparingly seen. A water course in a garden near Wagh-darwaja also yielded it usually in good numbers. A moderately distributed species.

29. *Navicula cuspidata* KÜTZ.

HUSTEDT, Bacil., 1930, 268, f. 433 :— Length 60—100 μ, breadth 19—21 μ and striae: longitudinal 24—26 and transverse 14—16 in 10 μ.

This species occurred rather rarely in the locality. Each time during each year usually a few specimens were observed. These specimens sometimes with craticular plates also were seen.

30. *Navicula cuspidata* v. *ambigua* (EHR.) CL.

HUSTEDT, Bacil., 1930, 268, f. 434 :— Length 70—73 μ, breadth 20—22 μ and striae: longitudinal 26 and transverse 16—18 in 10 μ.

This diatom was with or without the company of the above species, was seen rather more frequently in the area. Practically every algal sample contained it in usually smaller number with or without craticular stages. A frequent form in the area.

31. *Navicula mutica* KÜTZ. (Figs. 44—45)

HUSTEDT, Bacil., 1930, 274, f. 453 a; LUND, J. W. G., Brit. Soil Alg. 1946, 71, f. 6 A-I :— Length 11—14 μ, breadth 5—5.2 μ, and striae 18—20 in 10 μ.

Of this species two illustrations are given to show the form change that was noted in a collection.

The collections made from this region indicate that this species is wide spread, occurring during all seasons in smaller or larger numbers. It was noted also from wet soils and clusters of mosses and liverworts. However, it was rarely gregarious.

32. *Navicula viriduloides* sp. nov. (Fig. 46)

Valvae 30—38 μ longae atque 8—8.5 μ latae, lineares-ellipticae, apicibus aliquantum abrupte constrictis, producto-rostratis vel subcapitatis. Raphe tenuis et recta, poris centralibus distinctis et unilateraliter inclinatis, fissuris terminalibus curvatis. Area axialis linearis cum hyalino; area centralis magna item hyalina, paulum unilateraliter evoluta. Striae 14—16 in 10 μ, lineatae, radiales in medio atque convergentes in utroque apice.

Valves 30—38 μ long and 8—8.5 μ broad, linear-elliptical with somewhat abruptly narrowed, produced rostrate to subcapitate ends. Raphe thin and straight with central pores distinct and unilaterally inclined and terminal fissures curved. Axial area linear and hyaline; central area large and likewise hyaline, slightly unilaterally formed. Striae 14—16 in 10 μ, lineate, radial in the middle and convergent at the ends.

This species resembles *N. viridula* KÜTZ. v. *capitata* MAYER (CLEVE-EULER, A., Diat. Schwed. Finn. — III, 1953, 151, f. 805 e-g), in the outline, apices and arrangement of striae. However, it differs from it in having denser striae and their equidistant setting. The more characteristic feature is the presence of a hyaline zone surrounding the raphe besides the central pores unilaterally bent and conspicuous within a clear space. It is therefore considered as a new species.

This species was found as a common form throughout the region and was collected all the year round from several bodies of water both large and small. However, it was more frequent during January to February. It usually occurred in pale masses of matter along with other species. Type slide Pan 5:140—140 b

33. *Navicula viriduloides* v. *lanceolata* sp. et v. nov. (Fig. 47)

Valvae 30—36 μ longae atque 8.4—8.8 μ latae, late-lanceolatae, apicibus constrictis, productis ac subcapitatis. Striae 14—16 in 10 μ. In ceteris ut typus.

Valves 30—36 μ long and 8.4—8.8 μ broad, broadly lanceolate with constricted, produced and subcapitate ends. Striae 14—16 in 10 μ. In all other characters like the above type.

This diatom was found usually along with the type but less commonly. Again a wide spread form. Type slide Pan 6:141.

34. *Navicula zanoni* HUSTEDT (Fig. 48)

HUSTEDT, Diat. Albert nat.-park, 1949, 92, t. 5, f. 1—5 :— Valves 28—36 μ long and 6.6—8 μ broad, narrowly lanceolate with narrowed, constricted, produced acutely rounded ends. Raphe thin and straight. Axial area narrow; central area circular or subquadrate. Striae 13—14 in 10 μ, lineate, radial in the middle and convergent at the ends.

This species occurred fairly in several collections made over years (1953—56). It was common in certain cisterns near Teen-darwaja and some pools but in other similar habitats it occurred casually. In other bodies of water and streams it was usually found in smalller number or absent. Fairly distributed in the area. A constant and all season form.

35. *Navicula venezuelensis* HUST. (Figs. 49—50)

HUSTEDT, Diat. Lago de Maracaibo, 1956, 115, f. 33—36 :— Valves 30—36 μ long and 5—6 μ broad, linear-lanceolate with cuneate ends. Raphe thin and straight with curved terminal fissures. Axial area quite narrow; central area small roundish or subquadrate. Striae 12—13 rarely 14 in 10 μ, coarsely but not very distinctly lineate, radial in the middle and convergent and somewhat closely set at the ends.

I here offer my grateful thanks to Dr. HUSTEDT, for while studying this species I was very much in difficulty regarding its determination and at that juncture the unexpected arrival of the above quoted paper from him rescued me.

This species was collected from some cisterns, a spring on the side of Teen-darwaja and an over-flowing well atop the hill. It was found in brownish matter lying on the soil or with some vegetable matter. Many other samples casually represented it. Not quite common in the locality. It was first observed in November 1954 and thereafter it continued to be known from similar situations.

36. *Navicula panhalgarhensis* sp. nov. (Fig. 51)

Valvae 38—46 μ longae atque 6.2—6.5 μ latae, lineares, apicibus aliquantum abrupte constrictis, elongato-rostratis. Raphe tenuis et recta, fissuris terminalibus curvatis. Area axialis angustissima; area centralis ampla, rotundata. Striae 12—13 in 10 μ, lineatae, valde radiales in medio atque convergentes in utroque apice, 1—2 mediae striae breviter cum distantiis evolutae.

Valves 38—46 μ long and 6.2—6.5 μ broad, linear with somewhat abruptly constricted and long rostrate ends. Raphe thin and straight with terminal fissures curved. Axial area very narrow; central area large and circular. Striae 12—13 in 10 μ, lineate, strongly radial in the middle and convergent at the ends, 1—2 middle striae short and distantly formed.

This species resembles *N. cari* EHR. v. *linearis* (ØST.) A. CL. (CLEVE-EULER, A., Diat. Schwed. Finn. — III, 1953, 153, f. 810 c), in the outline and produced ends. However, it differs in dimensions and the feature of the middle striae which appear to be characteristic. It is, therefore, considered to be a new species.

This species was collected in a small number usually from pools, some cisterns and certain of the water veins seeping out from hilly inclines. A few specimens also were noted in a collection from a garden pool near Teen-darwaja. It did not appear as a constant form. Type slide Pan 7:142.

37. *Navicula radiosa* KÜTZ. v. *minutissima* (GRUN). CL. (Fig. 52)

CLEVE-EULER, A., Diat. Schwed. Finn. — III, 1953, 156, f. 816 o :— Valves 20—22 μ long and 4—4.5 μ broad, lanceolate with somewhat produced acutely rounded ends. Raphe thin and straight. Axial area very narrow; central area small, elliptical, rounded or subquadrate. Striae 14—18 in 10 μ, indistinctly lineate, rather faint, radial in the middle and convergent at the ends and somewhat closely set.

This diatom was found in a number of small bodies of water as well as in cisterns. It usually occurred in smaller numbers in brownish masses of matter. It was first observed during February 1954 and then was usually collected during all seasons though sparingly. An infrequent form.

38. *Pinnularia braunii* (GRUN.) CL. (Figs. 53—56)

HUSTEDT, Bacil., Sarek., 1924, 566, t. 19, f. 15; Bacil., 1930, 319, f. 577; CLEVE-EULER, A., Diat. Schwed. Finn. — IV, 1955, 24, f. 1020 a-c (c= HUSTEDT'S form); SCHMIDT, A. Atlas Diat., 1874—1944, t. 45, f. 77—78 (= *Navicula brauniana* GRUN.); VAN HEURCK, Treat. Diat., 1896, 173, pl. 2, f. 95 (= *Nav. braunii* GRUN.) :— Valves 35—43 μ long and 6.6—7.6 μ broad, narrowly elliptical-lanceolate with produced, narrowly capitate ends. Raphe thin and straight with central pores unilaterally bent and closely set, terminal fissures distinctly curved. Axial area narrow to broadly lanceolate; central area widely rhombic and reaching the sides. Striae 10—13 in 10 μ, coarse, gradually shortened in the middle and radial, at ends convergent and closely set.

A table of typical dimensions noted for the species

Author:		Length:	Breadth:	Striae in 10μ
		35μ	7 μ	12—13
		38μ	7.6μ	10—12
		38μ	7.6μ	11—13
		43μ	7.6μ	10—13
		44μ	7.5μ	12—13
VAN HEURCK		40μ	—	10—11
HUSTEDT	(1930)	30—60μ	8—12μ	11—12
CLEVE-EULER	(1955)	30—50μ	7.5—12μ	11—12

This species was collected usually in good number from practically all wet situations in the area during different parts of years 1953—56. It occurred as a common species and perhaps more abundantly during December to January. The local specimens represented some amount of variations in their outline and structure as represented in illustrations 53—56. However, all the specimens collected here agree well with VAN HEURCK's *Navicula (Pinnularia) braunii* GRUN. and SCHMIDT's (Atlas) *Nav. brauniana* GRUN., which have length to breadth proportions 5.8 : 1, whereas the local ones have L. : Br. = 5—5.8 : 1. While comparing these with those described by HUSTEDT and CLEVE-EULER which have L. : Br. = 4—5 : 1, then specimens of this place are distinctly slimmer. With the exception of this feature, no other departures from *P. braunii* (GRUN.) CL., are found.

Further, CLEVE-EULER's attempt to distinguish HUSTEDT's *P.braunii* as *P. braunii* v. *marginata* (HUST.) A. CL., however could in no event be supported here, since local specimens from year to year collections evidently showed striations varying in their length which tended to connect CLEVE-EULER's *P.*—v. *genuina* A. CL. with *P.*—v. *marginata*. This point is being clearly indicated in figures 53—56. HUSTEDT already has stated that the striae often are shortened, and I should think he has illustrated such forms alone in works referred to above. In the light of above considerations, the local specimens could not be assigned to any new taxa on the mere basis of length to breadth proportions which on the other hand approximate with those given by VAN HEURCK and others.

39. *Pinnularia conica* GANDHI (Figs. 57—58)

GANDHI, H. P., genus Pinnularia, 1957, 847, f. 9—10 : — Length 58—63 μ, breadth 9—10.5 μ and striae 9—11 in 10 μ.

This species occurred in many collections in smaller or larger number during different seasons inhabiting brownish masses of matter or decaying vegetable matter. It was noted to be more frequent during September to November than otherwise. A common species in the region.

40. *Pinnularia pusilla* sp. nov. (Figs. 59—62)

Valvae 18—37.5 μ longae atque 3.8—5.6 μ latae, lineares, plus minus marginibus cum lineis aeque distantibus, apicibus aliquantum abrupte constrictis atque producto-rotundatis vel leniter subcapitatis. Raphe tenuis et recta, poris centralibus unilateraliter inclinatis paulum proximis; fissuris terminalibus curvatis. Area axialis late lanceolata; area centralis amplissime rhomboidea ad latera perveniens. Striae 10—15 in 10 μ, valde radiales in medio ac convergentes in utroque apice, striae in parte media gradatim abbreviatae.

Valves 18—37.5 μ long and 3.8—5.6 μ broad, linear, more or less with parallel sides and ends somewhat abruptly constricted, produced rounded or feebly subcapitate. Raphe thin and straight with central pores unilaterally bent and somewhat closely set, terminal fissures curved. Axial area broadly lanceolate; central area widely rhomboid and reaching the sides. Striae 10—15 in 10 μ, strongly radial in the middle and convergent at the ends, middle striae gradually abbreviated.

This species appeared to be very variable and seemed to show probably different phases from season to season or year to year as understood from collections made from the same and similar habitats in the area. The different phases observed are given in figures 59—62 and the typical dimensions recorded are indicated in the following table:

A table of typical dimensions noted

Length:	Breadth:	Striae in 10 μ
18 μ	3.8 μ	11—12
20 μ	5.3 μ	10—13
23 μ	4.2 μ	11—12
23.5 μ	4.5 μ	14—15
26.5 μ	4.7 μ	11—12
28 μ	4.6 μ	10—12—13
37.5 μ	5.6 μ	10—12

Further, the species to which present set of specimens more or less agree, are the following:

1. *Pinnularia interrupta* f. *minor* B. PET. (PETERSEN, Aërial Alg., 1928, 405, f. 25, dimensions 22—30 x 4.8—6 μ, str. 14/10 μ = *P.*—v. *minor* (B. PET.) A. CL. (CLEVE-EULER, Diat. Schwed. Finn.—IV, 1955, 63, f. 1088 k—n, dimensions 22—45 x 5—7.5 μ, str. 14—16/10 μ), in the later case ends are shown to be more strongly capitate.

2. *P. subcapitata* GREG. v. *subrobusta* A. CL. (CLEVE-EULER, ibid., 65, f. 1090 h. dimensions 40—60 x 5.7 μ, str. 11—13) this form with produced ends corresponds with some of the present ones.

3. *P. stauroptera* (RABH.) CL. v. *minuta* MAYER (CLEVE-EULER, ibid., 68, f. 1091 o—p, dimensions 35—75 x 7—9.5 μ, str. 10—11) it has the same features as in the above case no. 2.

4. *P. stauroptera* v. *minuta* f. *medioconstricta* A. CL. (CLEVE-EULER, ibid., f. 1091 r—s), here the sides are slightly concave a feature also is known in some of the present specimens.

5. *P. lapponica* HUST. (HUSTEDT, Diat. Abisko, 1942, 122, f. 43—45, dimensions 19—33 x 4.5 μ str. 14—16/10 μ) in this form ends are more capitate and the central area does not reach the sides.

6. *P. subcapitata* GREG. (SCHMIDT, Atlas Diat., 1874—1944, t. 44, f. 56) this species fig. 56 appears like some of the forms observed here with rostrate apices, but fig. 55 is very different as compared to the other.

However, the present set of specimens differ from all the above named species in respect of axial area being very large-lanceolate and central area widely rhomboid due to gradual abbreviation of striae in the middle zone. Again, the specimens of present set show two kinds of apices, viz. in some, clearly rostrate rounded and in others weakly subcapitate or subcapitate. The set with rostrate apices agrees with nos. 2, 3, 4, 6 in the outline and more or less in the number of striae/10 μ, whereas the other set with feebly capitate apices somewhat compares with nos. 1, 5. But then differences are such that no satisfactory all out comparision could be made with any one type. Moreover, certain of the specimens noted here have much narrower valves. Hence it is understood here that present specimens are a new species of poly-phasic nature, at least I consider it to be so provisionally.

This species was collected in smaller or larger numbers from variety of wet situations, throughout the region during all seasons. However, collections made during November to February period showed it more frequently. This species was found to inhabit brownish masses of matter lying on wet soils, dead leafy matter, submerged stones or other objects and occassionally the encrustations of some cisterns. A common type in the region. Type slide Pan 8 : 143.

41. *Pinnularia interrupta* W. SM. f. *minor* B. PET. (Fig. 63)

PETERSEN, J. B., Aërial Alg., 1928, 405, f. 25 :—Valves 28—29.5 μ long and 6.5—6.7 μ broad, linear with somewhat abruptly narrowed produced subcapitate ends. Raphe thin and straight. Axial area narrow, linear-lanceolate; central area large, rhomboid and reaching the sides. Striae 13—14 in 10 μ, radial in the middle and convergent at the ends.

A few specimens were usually collected from tufts of wet mosses and brownish matter formed on sides of water veins seeping out from hilly inclines. A sample from an over-flowing well collected in 1944 also contained it but very sparingly. Uncommon in the area.

42. *Pinnularia panhalgarhensis* sp. nov. (Figs. 64—66)

Valvae 67—96.4 μ longae atque 12.3—12.8 μ latae, lineare-lanceolatae, marginibus paulum triundulatis, apicibus constrictis, productis, subcapitatis vel capitatis rotundatis. Raphe paulum undulata vel subcomplexa, ornata poris centralibus aliquantum unilateraliter inclinatis, fissuris terminalibus crassis, semi-circularibus oblique evo-

lutis. Area axialis ampla, 1/5—1/4 latitudinis valvae, lineare-lanceolata; area centralis plus minus dilatata, rhomboidea, tenuis versus ad latera perveniens, unilateraliter dilatata vel unilateraliter perveniens ad latera. Striae 8.5—11 in 10 μ, crassae, radiales in medio ac convergentes in utroque apice.

Valves 67—96.4 μ long and 12.3—12.8 μ broad, linear-lanceolate with sides feebly triundulate and ends constricted, produced subcapitate to capitate rounded. Raphe slightly undulate to subcomplex with central pores slightly unilaterally bent and terminal fissures semicircular, coarse and oblique. Axial area fairly wide, 1/5—1/4 the width of the valve, linear-lanceolate; central area more or less widened rhomboid, narrow while reaching the sides or unilaterally dilated to unilaterally reaching the side. Striae 8.5—11 in 10 μ, coarse, radial in the middle and convergent at the ends.

This species seems to be related to *P. graciloides* HUST., *P. microstauron* (EHR.) CL., *P. divergens* W. SM. and other members of the Divergentes group, in feature of striae, axial and central areas, but it does not agree satisfactorily with any one type. It is therefore considered to be a new species and put under the Divergentes group.

Within the cycle of this species, quite a degree of variation seemed to exist intergrading the individual specimens. The illustrations given show some of the typical representatives of the series. Here, it was also known that the smaller specimens seemed to possess a few more striae per 10 μ, and the central area more uniformly developed — reaching the sides.

This species was collected in varying number from several such bodies of water which had perennial supply. It was usually found to inhabit brownish masses of dead vegetable matter or occasionally the films of Myxophyta encrusting the cisterns. A more or less all season form but was seen more in number usually in November to December. Type slide Pan 9 : 144.

43. *Pinnularia panhalgarhensis* v. *lanceolata* sp. et v. nov. (Fig. 67)

Valvae 70—78 μ longae atque 12.3—12.5 μ latae, sublanceolatae, marginibus paulum triundulatis, apicibus leviter constrictis, late-producte rotundatis. Raphe, area centralis ut in typo. Area centralis ampla, ad latera dissimiliter perveniens. Striae 9—10 in 10 μ. In ceteris ut typus.

Valves 70—78 μ long and 12.3—12.5 μ broad, sublanceolate, margins feebly triundulate with slightly constricted, broadly produced rounded ends. Raphe and axial area as in the above type. Central area large, dissimilar while reaching the sides. Striae 9—10 in 10 μ. In all other characters like the type.

This diatom was found usually in smaller number than the type

from the same habitats. Not common in the area. Type slide Pan 10 : 145.

44. *Pinnularia legumen* EHR. v. *interrupta* v. nov. (Fig. 68)

Valvae 75—82 μ longae atque 12.3—12.5 μ latae, lineares, marginibus distincte triundulatis, apicibus valde producto-rotundatis. Raphe crassa et subcomplexa, poris centralibus paulum unilateraliter inclinatis ac fissuris terminalibus crassis et paulum curvatis. Area axialis modice lata, linearis; area centralis ampla, rhomboidea, ad latera perveniens. Striae 12—13 in 10 μ, crassae, valde radiales in medio ac convergentes in utroque apice.

Valves 75—82 μ long and 12.3—12.5 μ broad, linear with distinctly triundulate sides and strongly produced rounded ends. Raphe thick and subcomplex with central pores slightly unilaterally bent and terminal fissures coarse and slightly curved. Axial area fairly broad, linear; central area wide, rhomboid and reaching the sides. Striae 12—13 in 10 μ, coarse, strongly radial in the middle and convergent at the ends.

This diatom agrees very closely *P. legumen* v. *cuneata* HUST. (SCHMIDT, A., Atlas Diat., t. 392, f. 11), in the outline, axial and central area and the setting of the striae. However, the present specimen differs in having central area extending the sides and somewhat closer striae. It is therefore considered to be a new variety.

This diatom was collected in a small number or as a stray form from some pools and cisterns. It occurred among the masses of dead vegetable matter. Not regularly collected during different seasons or years. A rare diatom in the area. Type slide Pan 11 : 146.

45. *Pinnularia esox* EHR. v. *capitata* GANDHI (Fig. 68)

GANDHI, H. P., genus Pinnularia, 1957, 849, f. 17:—Length 70.8—80 μ, breadth 12.3—12.7 μ and striae 10 in 10 μ.

This diatom was collected from some pools and water veins seeping out from hilly inclines near Teen-darwaja. A casual diatom in the area.

46. *Pinnularia major* (KÜTZ.) CL. v. *linearis* CL. (Fig. 70—72)

CLEVE-EULER, A., Diat. Schwed. Finn.—IV, 1955, 70, f. 1094 c—e:—Valves 103—106 μ long and 19—23 μ broad, linear with more or less broadly rounded ends, in some cases middle part obscurely dilated. Raphe thick, simple with central pores slightly unilaterally bent and terminal fissures thick, somewhat obliquely semi-circular. Axial area linear about 1/4 the width of the valve; central area somewhat unilaterally widened but small. Striae 7—7.5 rarely upto 8 in 10 μ, thick, radial in the middle and convergent at the ends with narrow longitudinal band.

This diatom was found fairly frequently in the region. It occurred in tanks, pools and perennially wet situations around the hills. Stray specimens also were collected from certain water courses. It was collected during different seasons but more in number during February to March. A fairly distributed, probably an all season form, in the area.

47. *Pinnularia sudetica* HILSE v. *commutata* (GRUN.) CL. f. *obtusata* f. nov. (Figs. 73—74)

Valvae 52—59 μ longae atque 10—10.5 μ latae, lineares, marginibus cum lineis aeque distantibus, apicibus obtuso-rotundatis. Raphe crassa et complexa, ornata poris centralibus distincte ac paulum unilateraliter inclinatis, fissuris terminalibus semi-circularibus. Area axialis modice lata-linearis, circiter 1/4—1/3 latitudinis valvae; area centralis plus minus unilateraliter circularis. Striae 10—13 in 10 μ, crassae, leniter radiales in medio ac convergentes in utroque apice, vittae longitudinales tenues indistrincte evolutis.

Valves 52—59 μ long and 10—10.5 μ broad, linear, sides parallel and ends obtusely rounded. Raphe thick and complex with central pores distinct and slightly unilaterally bent, terminal fissures semi-circular. Axial area moderately broad, linear about 1/4—1/3 the width of valve; central area more or less unilaterally circular. Striae 10—13 in 10 μ, thick, slightly radial in the middle and convergent at the ends, longitudinal bands narrow and indistinctly formed.

This diatom agrees well with *P. sudetica* HILSE v. *commutata* (GRUN.) A. CL. (CLEVE-EULER, A., Diat. Schwed. Finn.—IV, 1955, 75, f. 1105 b—d), in the outline, organisation of striae, range of dimensions and other details. However, it differs in having strongly parallel sides and very obtusely rounded ends. It is therefore, considered as a new form.

This diatom was collected usually in good number from various bodies of water but particularly from more or less permanently wet places. It was found usually in brownish masses of dead vegetable matter but also in encrustations of cisterns. It was more numerous during September to November and during the summers it occurred rather sparingly. However, it was noted as an all season form in the area, a common type. Type slide Pan 12 : 147.

48. *Amphora veneta* KÜTZ.

HUSTEDT, Bacil., 1930, 345, f. 631:—Length 14—24 μ, breadth 7—9 μ and striae 18—20 in the middle and at the ends more denser in 10 μ.

This species was seen quite frequently in the area during all seasons in all wet situations. A very common form in the area.

49. *Cymbella pseudocuspidata* sp. nov. (Fig. 75)

Valvae 26.5—30 μ longae atque 8.5—8.7 μ latae, asymmetricae, subelliptico-lanceolatae, margine dorsale valde convexa, margine ventrale leniter convexa et in medio fere recta, apicibus plus minus abrupte constrictis ac rostratis. Raphe paulum excentrica, subcurvata, poris centralibus minutis, fissuris terminalibus versus marginem dorsalem flexis. Area axialis tenue-lanciolata; area centralis ampla, plus minus circularis et in parte media dilatata. Striae12—13 in 10 μ, regulariter positae, indistincte punctatae, ubique radiales ac 2—3 striae mediae ad marginem dorsalem abbreviatae.

Valves 26.5—30 μ long and 8.5—8.7 μ broad, asymmetrical, subelliptical-lanceolate, dorsal side strongly convex, ventral side slightly convex and somewhat straight in the middle, ends more or less abruptly constricted and rostrate. Raphe somewhat excentric, subarcuate with central pores small and terminal fissures directed towards the dorsal side. Axial area narrowly lanceolate; central area fairly large, more or less circular and dilated on the dorsal side. Striae 12—13 in 10 μ, regularly disposed, indistinctly punctate, radial throughout and 2—3 middle striae on the dorsal side abbreviated.

This species resembles *C. cuspidata* KÜTZ. (SCHMIDT, A., Atlas Diat., 1874—1944, t. 9, f. 50, 53—55; t. 374, f. 13—14; HUSTEDT, Bacil., 1930. 357, f. 650; VOIGT, genre Cymbella, 1943, 17, pl. 1, f. 15; CLEVE-EULER, A., Diat. Schwed. Finn.—IV, 1955, 146, f. 1217 a—d; FOGED, N., Diat. Pearyland, 1955, 64, pl. 10, f. 5), in the outline, rostrate apices and large central area. However, it differs from it in dimensions, uniformly set striae and 2—3 abbreviated mid-dorsal side striae. In its determination same amount of difficulties are experienced as by FOGED, yet it has not become possible here to come to any satisfactory conclusion. While considering *C. hybrida* GRUN. (SCHMIDT, op. cit., t. 377, f. 21—23; HUSTEDT, Bacil., 357, f. 652), the present form differs in having excentric raphe, more uniformly convex dorsal side, not very straight ventral side and different length to breadth proportions. The differences here are such that they do not permit satisfactory comparision and reference to any other similar looking species. It is, therefore, tentatively considered to be a new species.

This species was collected from various streams, water veins seeping out from hilly inclines and some cisterns, in smaller or larger numbers. It occurred more or less as a constant form in the locality but it was usually more frequent during November to December—January. A fairly distributed type. Type slide Pan. 13 : 148.

50. *Cymbella ventricosa* KÜTZ.

HUSTEDT, Bacil., 1930, 359, f. 661:—Length 24—28 μ, breadth 6.6 μ and striae 12—16 in 10μ.

This species occurred as a common form throughout the region but often in small numbers. A constant form for all seasons.

51. *Gomphonema sphaerophorum* EHR.

HUSTEDT, Bacil., 1930, 372, f. 695:—Length 26.5—32 μ, breadth 7.5—8 μ and striae 14—16 in 10 μ.

This species was seen during different seasons but usually in small numbers, inhabiting slimy or brownish masses of matter loosely lying in tanks, cisterns and pools. It was stray in samples collected from water coarses and streams. A common form in the region.

52. *Gomphonema parvulum* (KÜTZ.) GRUN. (Fig. 76 a—b)

SCHMIDT, A., Atlas Diat., 1874—1944, t. 234, f. 13—14 in particular; VAN HEURCK, Treat. Diat., 1896, 272, pl. 7, f. 306; SCHÖNFELDT, Bacil., 1913, 124, f. 270; VENKATARAMAN, G., S. I. Diat., 1939, 345, f. 126—128 (= *G. sphaerophorum* f. *subcapitata* f. nov. VENKAT.) :—Length 23.—30 μ, breadth 6.5—7.2 μ and striae 13—15 or —16 in 10 μ.

While determining this species, attention was drawn to VENKATARAMAN'S *G. sphaerophorum* f. *subcapitata* f. nov., and it therefore required reexamination of the material. From the careful observations, it appeared that VENKATARAMAN'S specimen fits well with *G. parvulum*, in all respects. The remarks set by the author while creating his form as a new form of *G. sphaerophorum*, appear hardly convincing. The figures 126—128, given by the author, indicate different phases of *G. parvulum* which are already known in the literature. From my many years of extensive collections and observations, I have observed this and other phases of *G. parvulum*, and I am convinced that VENKATARAMAN'S *G. sphaerophorum* f. *subcapitata* cannot be other than *G. parvulum* particularly when I refer to SCHMIDT'S Atlas and other references hitherto given. At the best I would consider VENKATARAMAN'S fig. no. 126 typical of *G. parvulum* and figs. 127—8 something approaching *G. parvulum* v. *lagenula* (GRUN.) HUST. (HUSTEDT, Diat. Albert Nat.-park, 1949, 119, t. 11, f. 8—10). Further, the figures given by the author do not show stigma in the unilaterally formed central area.

This species was collected from all kinds of wet situations in the region and during all seasons. It was a common form more abundantly formed in brownish masses of matter but also sometimes as an epiphyte on *Oedogonium* sp. and other larger aquatic plants. Its

period of prolific growth appeared to be September to November. A common type.

53. *Gomphonema parvulum* v. *exilissima* GRUN. (Fig. 77)

HUSTEDT, Bacil., 1930, 373; CLEVE-EULER, A., Diat. Schwed. Finn. —IV, 1955, 178, f. 1269 d—f (= v. *exilissimum*):—Valves 26—28 μ long and 6—6.2 μ broad, narrowly lanceolate-clavate with apex clearly constricted and produced beak-like. Striae 13—16 in 10 μ, radial. In all other features like the type.

This diatom was mostly found with the type usually in smaller numbers. It occurred particularly in pools and cisterns. Elsewhere in the locality rather seen as a stray form.

54. *Gomphonema lanceolatum* EHR.

HUSTEDT, Bacil., 1930, 376, f. 700:—Length 38—40 μ, breadth 7—7.5 μ and striae 12—13 in 10 μ.

This species was noted to be common in the region since it was found in all wet situations and during different parts of the year. However, it was never gregarious. Its period of prolific growth was noted from September to December.

55. *Gomphonema gracile* EHR.

HUSTEDT, Bacil., 1930, 376, f. 702:—Length 40—48.3 μ, breadth 7.6—8 μ and striae 8—14 in 10 μ.

This species was seen usually in very small numbers during different seasons. However, it appeared as a constant form in various pools, ditches and cisterns. In tanks it was more frequent. A fairly distributed and common type.

56. *Epithemia zebra* (EHR.) KÜTZ.

HUSTEDT, Bacil., 1930, 384, f. 729:—Length 32—40 μ, breadth 7—7.5 μ, costae 2—4 in 10 μ and rows of alveoli 12—13 in 10 μ.

This species occurred as a very stray form in the locality. It was found to inhabit brownish slimy matter in cisterns, pools and certain water courses. Not at all a constant form. Rare in the region.

57. *Rhopalodia gibba* (EHR.) O. MÜLL.

HUSTEDT, Bacil., 1930, 390, f. 740:—Length 60—80 μ, breadth in girdle view 22—24 μ, costae 6—8 in 10 μ and rows of alveoli 13—14 in 10 μ.

This species usually occurred in smaller numbers in tanks and some cisterns around the hills but was very irregularly collected from other bodies of water. It was found to inhabit masses of dead vegetable matter as well as known to be epiphytic on *Chara*, *Ceratophyllum* or *Hydrilla*. Not common in the locality.

58. *Rhopalodia gibba* v. *ventricosa* (EHR.) GRUN.

HUSTEDT, Bacil., 1930, 391, f. 741:—Length 38—40 μ, breadth in girdle view 18—19 μ, costae 6—7 in 10 μ and rows of alveoli 13—14 in 10 μ.

This diatom was also represented in small numbers during different seasons. It was particularly found to inhabit marginal slime of pools and ditches. In tanks fairly more common.

59. *Hantzschia amphioxys* (EHR.) GRUN. v. *compacta* HUST. (Fig. 78—79)

SCHMIDT, A., Atlas Diat., 1874—1944, t. 345, f. 11—12; CLEVE-EULER, A., Diat. Schwed. Finn.—V, 1952, 48, f. 1419 g:—Valves 50—60 μ long and 9—9.5 μ broad, linear, weakly arcuate with constricted, somewhat produced capitate-rounded ends. Keel excentric, keel punctae 7—8 in 10 μ, quite clear. Striae 18—20 in 10 μ.

This species was collected in small to good number, mostly from pools, cisterns and some slowly flowing water courses in the region. It was found to inhabit pale brownish matrix. A good number of specimens were also collected from an over-flowing well on the hill top. However, not well distributed.

60. *Hantzschia amphioxys* v. *densestriata* (FONT.) A. CL. (Fig. 80)

CLEVE-EULER, A., Diat. Schwed. Finn.—V, 1952, 49, f. 1419 n—p:—Length 43.7—50 μ, breadth 6—6.6 μ, keel punctae 9—11 in 10 μ very small and striae 20—24 in 10 μ, fine.

This diatom was represented as a stray specimen in some cisterns. It occurred in brownish matter formed by decaying vegetable stuff. Rather rare in the locality.

61. *Hantzschia amphioxys* v. *gracilis* HUST. (Fig. 81)

SCHMIDT, A., Atlas Diat., 1874—1944, t. 329, f. 6—8; CLEVE-EULER, A., Diat. Schwed. Finn.—V, 52, f. 1421 i (= *H. gracilis* HUST.):—Valves 115—130 μ long and 10.2—10.5 μ broad, linear with almost parallel sides, fairly arcuate with wedge-shaped, produced, subcapitate rounded ends. Raphe part apparent at the poles. Keel excentric with keel punctae coarse, 7—8 in 10 μ, middle punctae distantly set. Striae 16—18 in 10 μ, finely punctate.

This diatom was found in slowly flowing water courses, in an over-flowing well and some cisterns. It occurred usually in very small number during different times in the year. Not quite regularly collected. A sparsely distributed type in the area.

62. *Nitzschia tryblionella* HANTZ. v. *victoriae* GRUN.

HUSTEDT, Bacil., 1930, 399, f. 758:—Length 30—45 μ, breadth 15—20 μ, keel punctae 4—5—6 in 10 μ and striae 6—7 in 10 μ.

This diatom was found to be a widespread species in water courses, hill streams and water veins seeping out from hilly inclines. However, it was never found in any abundance. An all season form in the locality.

63. *Nitzschia palea* (KÜTZ) W. SM.

HUSTEDT, Bacil., 1930, 416, f. 801:—Length 20—35 μ, breadth 2.5—3.5 μ, keel punctae 10—12 in 10 μ and striae about 35 in 10 μ.

This species was found in all wet situations on and around the hills. It occurred in brownish masses of dead vegetable matter or forming thin films on moist soils, rocks and the like. It was sometimes gregarious on moist soils or in marginal slime of some pools. A very common type.

64. *Nitzschia pseudofonticola* HUST. (Fig. 82)

HUSTEDT, Diat.-fl. Weser, 1957, 353, f. 83—90:—Valves 28.5—32 μ long and 4—4.2 μ broad, lanceolate with constricted capitate ends. Keel excentric with keel punctae 10—11 in 10 μ, very small. Striae possibly 35 in 10 μ, quite indistinct.

This species was collected as a very stray form in some pools, ditches and cisterns but in clusters of wet mosses it occurred fairly. Not common.

65. *Nitzschia clausii* HANTZ. (Fig. 83)

HUSTEDT, Bacil., 1930, 421, f. 814:—Valves 27—31.5 μ long and 3.5—3.8 μ broad, linear, somewhat sigmoid at the ends which are constricted and obliquely wedge-shaped and capitate. Keel very excentric, sigmoid with keel punctae 12—13 in 10 μ, small and beaded. Striae over 30 in 10 μ, very fine and almost indistinct.

This species was collected mostly from cisterns and was found inhabiting the decaying vegetable stuff. It was also collected in small numbers from some pools and wet soils along with species of *Frustulia*. Not common. Probably an all season form.

66. *Surirella tenera* GREG.

HUSTEDT, Bacil., 1930, 438, f. 853:—Length 108.5—120 μ, breadth 30—33 μ and costae 18—20 in 100 μ.

This species was collected usually in small numbers from various water courses and streams in the region. It seldom occurred in standing water. An all-season form, but was seen to be more abundant during the period December to January. Not very common.

67. *Surirella subsalsa* W. SM. (Figs. 84—86)

CLEVE-EULER, A., Diat. Schwed Finn.—V, 1952, 105, f. 1526 a—d,

f :— Length 31.7—42.8 μ, breadth 8.7—13.8 μ and costae 40—50 in 100 μ.

This species was collected from several streams and water courses on and around the hills, but seldom in standing waters. It usually occurred in brownish masses of matter or tufts of wet mosses on sides of hills. A fairly common form in the locality. This form seems to be a variable one as it showed different phases during the same or different seasons in collections made from more or less same spots or other similar places. Of the variations noted, three different typical illustrations are given which were found to be inter-connected by several other intermediates. Some of these intermediates agreed with those accounted in my previous papers on the Jog-falls (1957) and Hirebhasgar (1958) diatoms.

68. *Surirella apiculata* W. SMITH (Figs. 87—88)

SCHMIDT, A., Atlas Diat., 1874—1944, t. 23, f. 34:—Valves 26.5—30 μ long and 7.5—8.5 μ broad, linear with or without slightly convex or concave sides, isopolar to indistinctly heteropolar with cuneate more or less constricted slightly to well marked produced or rostrate ends. Pseudoraphe very narrow. Flap margin very narrow with indistinct flap projections. Costae 6—8 in 10 μ, rib-like alternating with fine but clear striae, ribs do not reach the axial part. Striae 20—24 in 10 μ, fine but well marked.

While going through the literature, there appears to prevail quite an amount of uncertainty regarding the identity of this species. The two sets of illustrations in SCHMIDT's Atlas appear to differ from each other, but, „t. 23, f. 34", more or less agrees well here.

HUSTEDT makes mention of *S. apiculata* W. SM. (HUSTEDT, Algenfl. Bremen—IV, 1911, 310, t. 3, f. 23; Bacil. Sudeten, 1914, 190, citing in both cases SCHMIDT's Atlas, t. 23, f. 34—5, while in the latter case *S. lapponica* A. CL., being considered as synonym), in the first reference the given illustration does not correspond with the one given in SCHMIDT's Atlas in as much as that the apices are not shown to be constricted and more or less produced. In the latter reference, in addition, another form *S. lapponica* A. CL., is considered as synonym of *S. apiculata*. While, CLEVE-EULER in order to re-establish *S. lapponica* (CLEVE-EULER, A., Diat. Schwed. Finn.—V, 1952, 118, f. 1558 a—b), includes not only HUSTEDT's *S. apiculata* (as per citation) but also another species *S. gracilis* (W. SM.) GRUN. From the discussion that follows *S. lapponica* A. CL., it appears that the identity of W. SMITH's original form (SCHMIDT's Atlas, t. 23, f. 34) probably is not established. However, CLEVE-EULER seems to include probably SMITH's form also under *S. lapponica* by giving „f. 1558 d".

Further, VAN HEURCK gives *S. ovalis* BRÉB. v. *pinnata* (W. SM.) V. H. (VAN HEURCK, Treat. Diat., 1896, 373, pl. 13, f. 591) and describes, „Valve linear, narrow with cuneate apices, length 40—50 μ", and finally remarks, „all these forms, which connect with one another, cannot be specifically separated". This form has very close resemblance with the present specimens as well as with *S. apiculata* of SCHMIDT's Atlas.

Again, TIFFANY and BRITTON describe *S. apiculata* W. SM. (TIFFANY & BRITTON, Alg. Illinois, 1952, pl. 78, f. 913), by giving two figures and bring out in relief the costae short and long alternating—but this fact does not appear to be so in SCHMIDT's Atlas from which these authors seemed to have adopted the same. However, their statement, „an imperfectly known species", is valuable.

With these references before me and the present material of which I depict „figs. 87—88" showing the maximum divergence noted among specimens from the area collected during different seasons and years, from the same or similar habitats, I am at the best inclined to mark out my specimens for *S. apiculata* W. SM. (SCHMIDT's Atlas, t. 23, f. 34 only). And, I further propose to consider VAN HEURCK's *S. ovalis* BRÉB. v. *pinnata* (W. SM.) V. H. und CLEVE-EULER's *S. lapponica* v. *genuina* A. CL. „fig. 1558 b?, d," under *S. apiculata.*

This species was collected from several wet situations in the area in varying amounts. It was found to inhabit brownish masses of matter as well as encrustations formed by some Myxophyta in cisterns. A set of samples from an over-flowing well and a water course in a garden near Teen-darwaja yielded it in good numbers in 1954. This species was more frequently noted during October to December. A more or less constant and common type in the region.

SUMMARY

For the first time the Diatom flora of Panhalgarh-Hills in the District of Kolhapur was investigated of which an illustrated account is presented in these pages. In this account, an attempt also is made to give general notes on their occurrence, distribution in the region, seasonal variation and frequency. With certain diatoms some life-history features are also indicated.

In all sixty-eight diatoms are recorded from the area after a consistant collection work and study for a period of about three-and-half years. Of these, 23 are new records for India and eight species, five varieties and one form, tentatively, are considered to be new for Science.

The material in connection with the present study lies in the author's own herbarium. The type-slide numbers pertaining to new taxa are indicated in the text.

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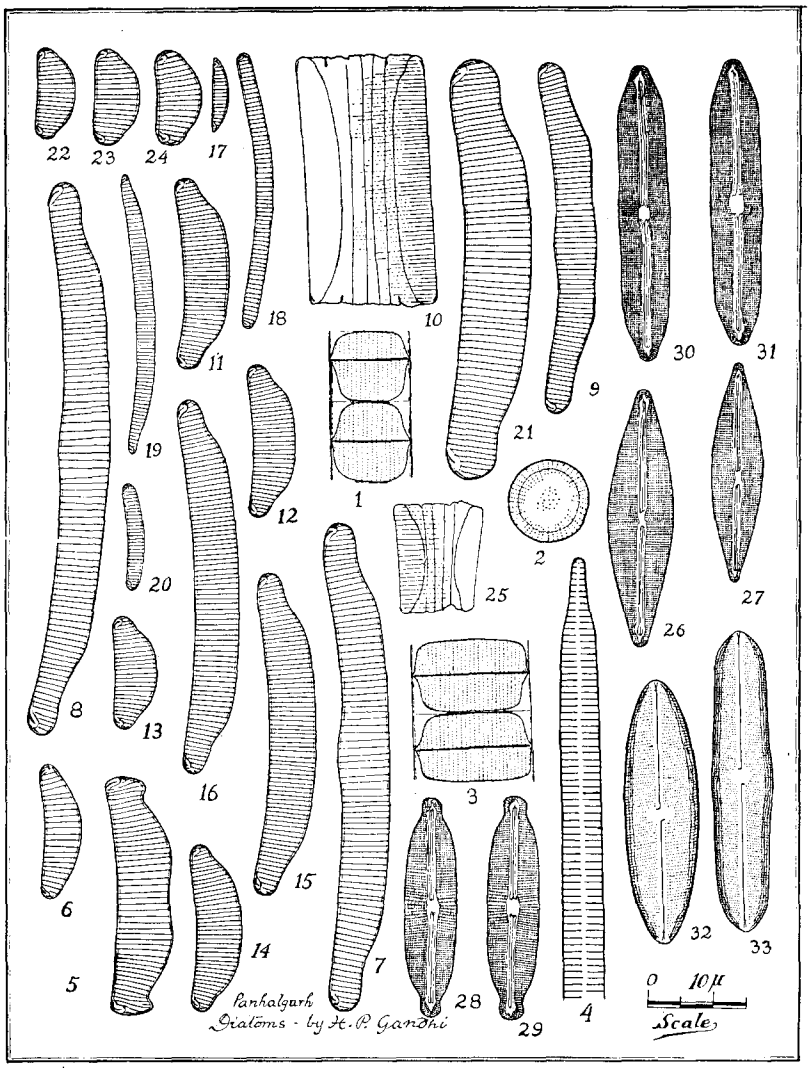

PLATE I

Fig. 1—3. *Melosira dickiei* (THW.) KÜTZ. - 4. *Synedra ulna* (NITZ.) EHR. f. *staurodestituta* PANT. - 5. *Eunotia praerupta* EHR. v. *bidens* GRUN. - 6. *E. pectinalis* (KÜTZ.) RABH. v. *curta* V. H. - 7. *E.* - v. *ventralis* (EHR.) HUST. - 8. *E.* - v. *gibbulosus* VENKAT. - 9. *E.* - v. *neglecta* GANDHI. - 10—16. *E. rostellata* HUST. - 17. *E. veneris* (KÜTZ.) O. MÜLL. - 18. *E. lunaris* (EHR.) GRUN. - 19. *E. alpina* (NAEG.) HUST. - 20 *E. pseudoparallela* Å. BERG v. *densestriata* A. CL. - 21. *E. hebridica* Å. BERG v. *bergii* v. nov. - 22—25. *E. tumida* sp. nov. - 26—27. *Frustulia saxonica* RABH. - 28—29. *F. vulgaris* THW. v. *subcapitata* v. nov. - 30—31. *F. indica* sp. nov. - 32. *Neidium amphigomphus* (EHR.) CL. v. *obtusum* A. CL. - 33. *N. panhalgarhensis* sp. nov.

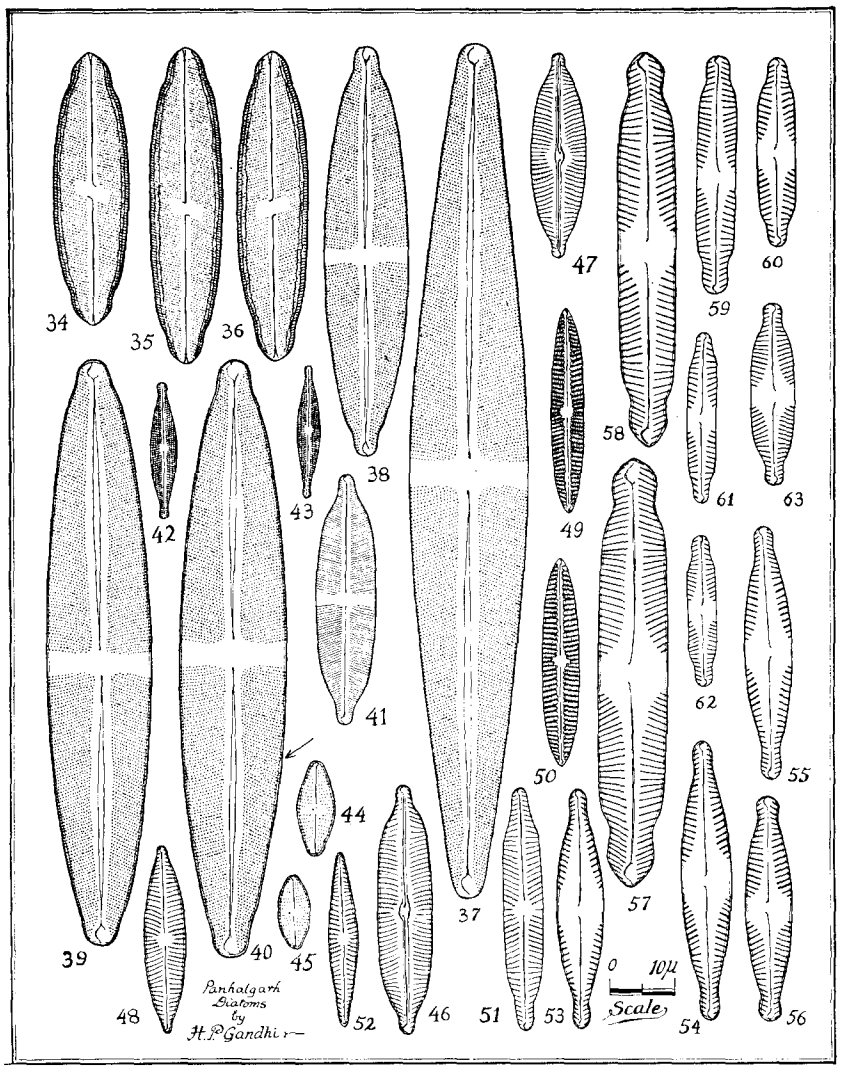

PLATE II

Fig. 34—36. *Neidium obliquestriatum* A. S. v. *rostrata* SKV. - 37. *Stauroneis phoenicenteron* EHR. f. *gracilis* DIP. - 38—40. *S.* - f. *producta* GANDHI (f. 40 - arrow shows defective structure) 41. *S. anceps* EHR. v. *linearis* (KÜTZ.) V. H. - 42—43. *Anomoeoneis exilis* (KÜTZ.) CL. - 44—45. *Navicula mutica* KÜTZ. - 46. *N. viriduloides* sp. nov. - 47. *N.* - v. *lanceolata* sp. et v. nov. - 48. *N. zanoni* HUST. - 49—50. *N. venezuelensis* HUST. - 51. *N. panhalgarhensis* sp. nov. - 52. *N. radiosa* KÜTZ. v. *minutissima* (GRUN.) CL. - 53—56. *Pinnularia braunii* (GRUN.) CL. - 57—58. *P. conica* GANDHI. - 59—62. *P. pusilla* sp. nov. - 63. *P. interrupta* W. SM. f. *minor* B. PET.

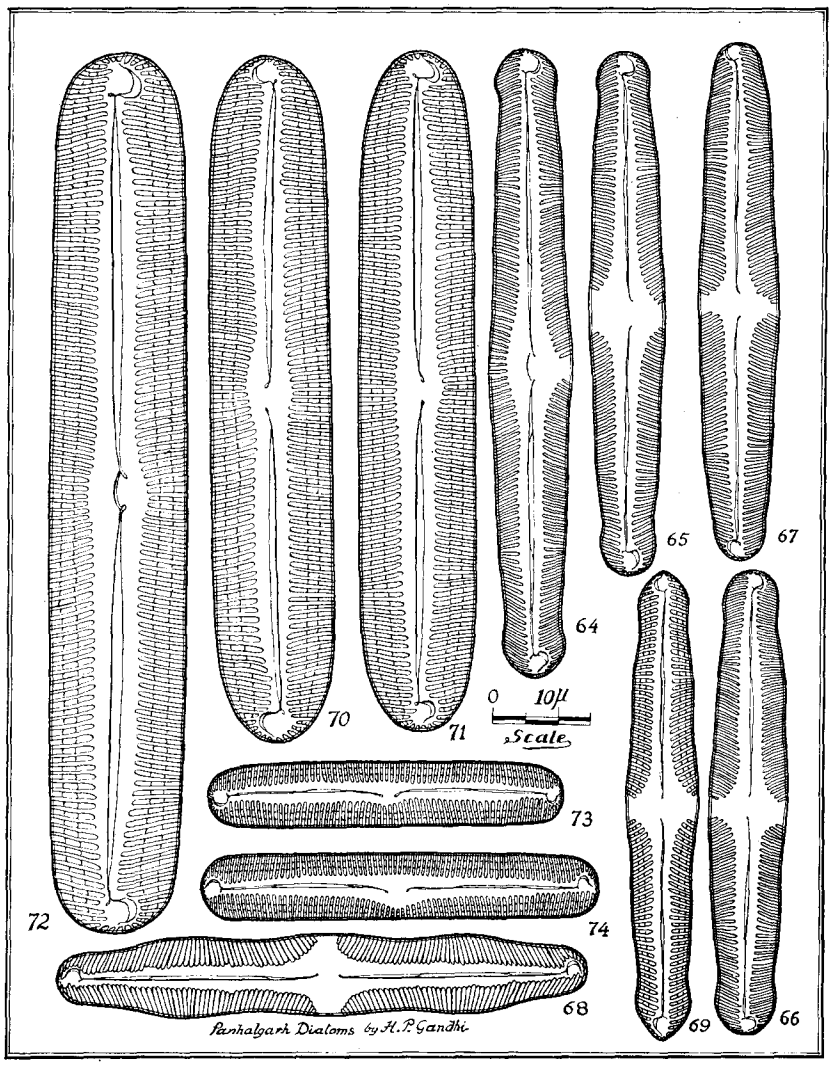

PLATE III

Fig. 64—66. *Pinnularia panhalgarhensis* sp. nov. - 67. *P.* - v. *lanceolata* sp. et v. nov. 68. *P. legumen* EHR. v. *interrupta* v. nov. 69. *P. esox* EHR. v. *capitata* GANDHI - 70—72. *P. major* (KÜTZ.) CL. v. *linearis* CL. - 73—74. *P. sudetica* HILSE v. *commutata* (GRUN.) CL. f. *obtusata* f. nov.

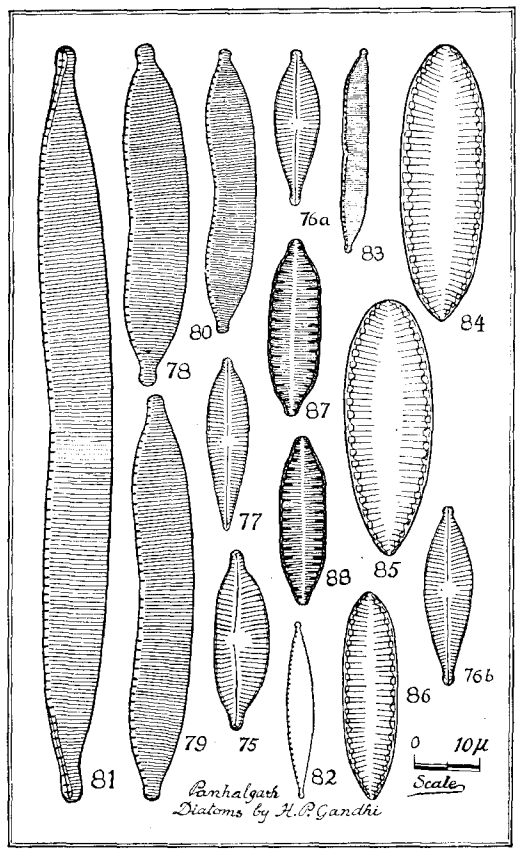

PLATE IV

Fig. 75. *Cymbella pseudocuspidata* sp. nov. - 76 a—b. *Gomphonema parvulum* (KÜTZ.) GRUN. - 77. *G.* - v. *exilissima* GRUN. - 78—79. *Hantzschia amphioxys* (EHR.) GRUN. v. *compacta* HUST. - 80. *H.* - v. *densestriata* (FONT.) A. CL. - 81. *H.* - v. *gracilis* HUST. - 82. *Nitzschia pseudofonticola* HUST. - 83. *N. clausii* HANTZ. - 84—86. *Surirella subsalsa* W. SM. - 87—88. *S. apiculata* W. SMITH.