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FLORISTIC COMPOSITION OF THE EPILITHIC DIATOMS OF CENTRAL HIGHLAND REGION OF INDIAN SUBCONTINENT; THALASSIOSIRACEAE, FRAGILARIACEAE, EUNOTIACEAE & ACHNANTHACEAE

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A study was designed to assess and understand the floral composition of freshwater lotic diatoms in the tributary of Ganga-Yamuna River System Ken, Paisuni, Tons India. Epilithic samples 33 in numbers were collected between November 2003 and April 2004, by scraping an area of 3x3 cm from cobble surface at the 11 sampling stations Ken, Tons, Paisuni situated between latitude 23°30' to 26° N and longitude 78°30' to 82° 30' E. The diatom flora of Vindhya rivers consisted of 293 species and 49 genera. The taxonomic richness in the River Ken, Tons and Paisuni was 205, 202, and 211 respectively. The distribution of diatom in family *Thalassiosiraceae, Fragilariaceae,* Eunotiaceae & Achnanthaceae were three, twenty eight, six & twenty five respectively. Synedra & Diatoma were species rich genera in family Fragilariaceae however Achnanthes, Planothidium & Cocconeis in family Achnantheaceae.

Key words: *central highland,* freshwater, lotic *diatom, Indian subcontinent,* tributary

Diatom flora has been studied from many parts of India, but remains unknown from Central India, especially from the Vindhyan rivers between the Narmada and the Ganga. Though complete flora has been studied in the rivers of this region by authors, the present study restricts to centric diatoms, the pennate araphid diatoms from suborder Araphidineae (with pseudoraphe) and the pennate raphid diatoms from suborder Raphidineae (diatoms with short raphe at valves ends and diatoms with one rapheless valve). The raphid diatoms with raphe on both valves form the bulk of diatom flora in this region. Floristic studies attain significance in view of the climate change threat and the proposed river linking programmes like the Ken - Betwa link. The knowledge on their floristic composition and distribution will help to understand their use as environmental indicators.

MATERIALS AND METHODS

Diatoms were collected from the rivers Ken, Paisuni and Tons (lat. 23°30' to 26°N, long. 78°30' to 82°30'E) in the Bundelkhand region. Standard techniques and literature were used to collect, mount and identify diatoms (Hustedt 1931-1959, Krammer and Lange-Bertalot 1991, 1999, 2004, Werum and Lange-Bertalot 2004, Metzeltin *et al*. 2005).

RESULTS AND DISCUSSION

The diatom flora consists of Centrale and Pennale elements. In total flora consisting 293 species, varieties and forms, only 3 species from 2 genera are centric elements. They belong to suborder Coscinodiscineae, family Thalassiosiraceae (*Aulacoseira* 1 species, *Cyclotella* 2 species). Rest of the flora (290 species from 47 genera) belongs to Pennales. The flora (63 taxa) described here consists of 5, 1 and 4 genera from family Fragilariaceae (araphid), Eunotiaceae (raphidiod) and Achnanthaceae (monoraphid), respectively. *Synedra* (22 species) among araphid of flora

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Table 1. The number of species occurring in various genera recorded from the Vindhyan Rivers.

GENERA	Ken	Paisuni	Tons
THALASSIOSIRACEAE			
1. *Aulacoseira*	1	1	-
2. *Cyclotella*	1	1	2
FRAGILARIACEAE			
3. *Diatoma*	2	1	4
4. *Fragilaria*	1	1	2
5. *Staurosira*	1	2	1
6. *Synedra*	13	14	15
7. *Tabellaria*	1	-	1
EUNOTIACEAE			
8. *Eunotia*	3	4	4
ACHNANTHACEAE			
9. *Achnanthes*	1	1	-
10. *Achnanthidium*	8	11	10
11. *Planothidium*	3	5	3
12. *Cocconeis*	6	3	3
NAVICULACEAE			
13. *Amphipleura*	-	1	-
14. *Amphora*	10	8	8
15. *Anomoeoneis*	-	1	1
16. *Brachysira*	1	2	2
17. *Caloneis*	5	3	5
18. *Cymbella*	21	22	20
19. *Cymbopleura*	12	6	10
20. *Encyonema*	4	4	4
21. *Diploneis*	5	5	4
22. *Frustulia*	1	-	-
23. *Gomphocymbelopsis*	1	1	-
24. *Gyrosigma*	2	2	3
25. *Gomphonema*	11	10	12
26. *Mastogloia*	1	-	-
27. *Navicula*	27	28	29
28. *Navicula sensu lato*	3	4	3
29. *Adlafia*	1	1	2
30. *Aneumastus*	-	2	-
31. *Craticula*	4	3	3
32. *Diadesmis*	1	2	1
33. *Fallacia*	1	1	2
34. *Geissleria*	1	1	1
35. *Hippodonta*	1	-	2
36. *Luticola*	6	3	7
37. *Placoneis*	2	1	2
38. *Sellaphora*	5	5	5
39. *Neidium*	2	4	2
40. *Pinnularia*	3	7	3
41. *Scoliopleura*	-	1	-
42. *Stauroneis*	2	-	-
EPITHEMIACEAE			
43. *Epithemia*	-	-	1
44. *Rhopalodia*	-	1	2
BACILLARIACEAE			
45. *Bacillaria*	-	-	1
46. *Denticula*	1	1	1
47. *Hantzschia*	1	1	-
48. *Nitzschia*	21	20	25
SURIRELLACEAE			
49. *Surirella*	8	7	5
TOTAL	**205**	**202**	**211**

and *Achnanthidium* (29 species) among monoraphid were species rich accounting for bulk of flora (51 taxa).

Centric diatoms are rare in lotic environment. Jüttner *et al.* (1996) reported no centric diatoms from Nepal. Nautiyal and Nautiyal (1999a) recorded only 1 species of *Cyclotella* in the lotic section and 2 spp. in the impounded section of the Ganga in the Himalayan foothills. Relatively more *Cyclotella* spp. has been reported from the Lakes of Jammu and Kashmir in Himalaya (Kant and Vohra 1999, Khan 2002) and Gujarat (Gandhi 1998).

Among pennate diatoms the araphids account for 10% of the flora. Similar proportions exist in the river Damodar (11%; Nautiyal and Nautiyal 1999b) located to east of Central Highlands (CH). The araphid share is relatively higher (17.5%) in the Alaknanda located in the Himalaya to north of CH. Distribution of araphid flora in the other Asian countries was also low; 9.4% to 16.7% (Ohtsuka 2002, Iijima 2002) in Japan and 9.4 % to 13.9 % (Kawecka 1971, 1974) in Bulgaria Rila Mts. and Tatra Mts. Poland. Even in tropical west Sumatra the share was low (9.8%; Asai *and Watanabe* 2004).

The raphidiod diatoms are few in CH (2.5%), the Himalaya (0.7%), and the Polish high Tatra Mts and Rila-Bulgaria, they are scarce (0.8%, 0.95%; Kawecka 1971, 1974). They were absent in Hii River Japan (Ohtushka 2002). The share of monoraphids in CH flora is low (8.5%), compared with Himalaya (14%; Nautiyal *et al.* 2004). In Russian river Medvedeva (1998) monoraphid exist in similar proportions (7% of total flora).

CONCLUSION

The araphid, raphidiod and monoraphid

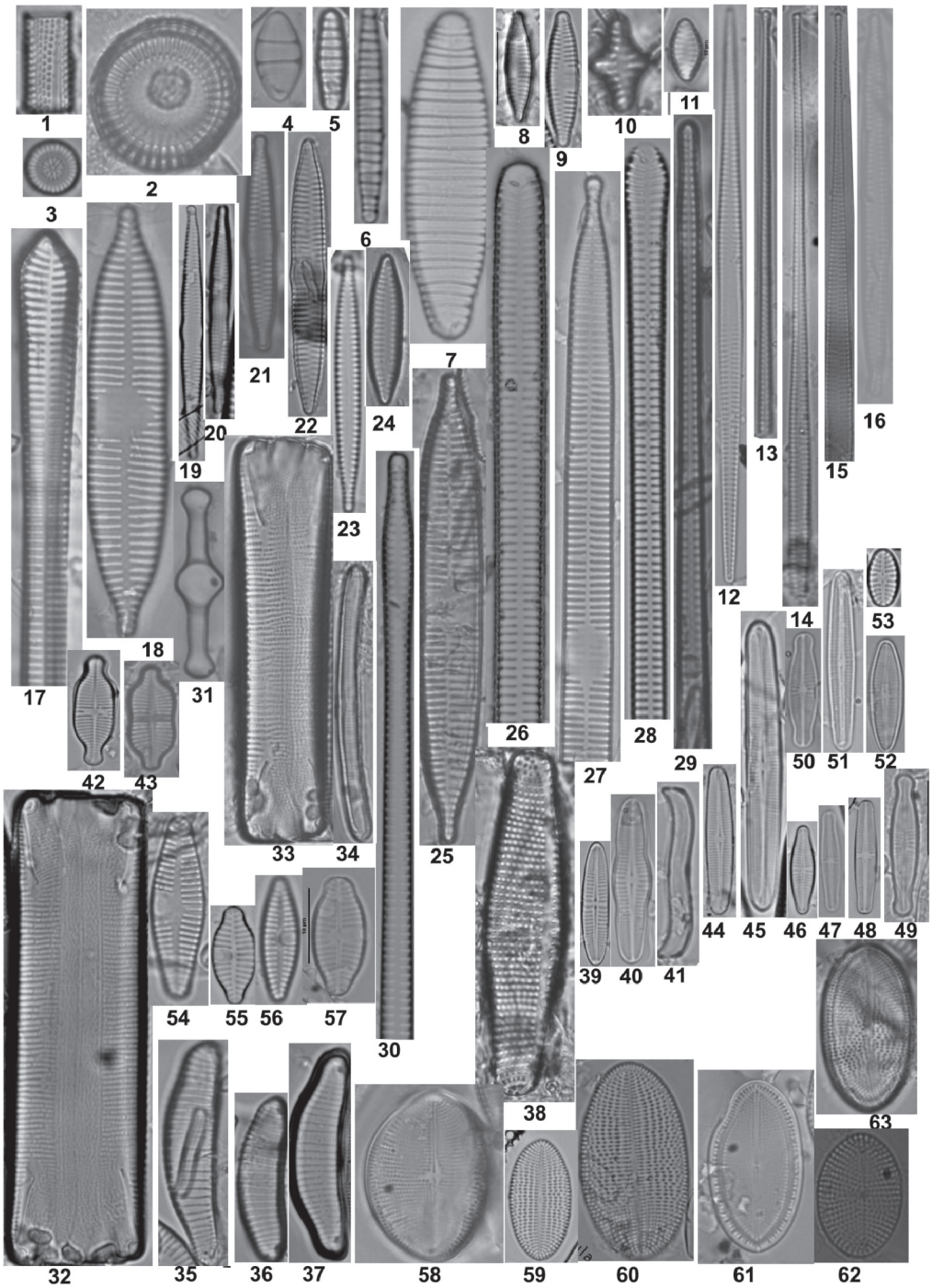

Plate 1: Figures 1-63. 1. ***Aulacoseira granulata, 2.Cyclotella meneghiniana 3.C. pseudostelligera, 4.Diatoma mesodon, 5.D. minus, 6.D. tenue, 7.D. vulgare v. product 8.Fragilaria cf. capucina, 9.F. capucina v. vaucheriae, 10.Staurosira longirostris, 11.S. pinnata, 12.Synedra acus, 13.S. a. v. angustissima, 14.S. a. v. nov., 15.S. a. v. radians, 16.S. amphicephela, 17.S. capitata, 18.S. dorsiventralis, 19.S. rumpens, 20.S. r. v. fragilaroides, 21.S. r. v. familiaris, 22.S. tabulata 24.S. t. v. fasciculate, 25.S. ulna, 26.S. u. v. aequalis, 27.S. u. v. amphirhynchus, 28.S. u.v. biceps, 29.S. u. v. danica, 30.S. u. v. spathulifera, 31.Synedra sp., 32.Tabellaria flocculosa, 33.Eunotia sp., 34.E. sp 2, 35.E. Lunaris, 36.E. pseudopectinalis, 37.E. Pseudofaba, 38.E. Suditica, 39.Achnanthes spec. cf. coarctata, 40.A. biasolettiana v. subatomus, 41.A. b. v. subatomus (inflata), 42.A. cf. exilis, 43.A. exigua v. exigua, 44.A. e. v. constricta, 45.A. lineare or petersenii, 46.A. minutissima v. jackii, 47.A. m. v. gracillima, 48.A. m. v. minutissima, 49.A. m. v. minutissima or var.?, 50.A. m. v. scotica, 51.A. modestiformis, 52.A. petersenii, 53.A. taeniata, 54.Planothidium lanceolata v. elliptica, 54.P. l. v. lanceolata 55.P. l. fo. rostrata, 56.P. l. ssp. frequentissima, 57.P. l. v. dubia,58.Cocconeis pediculus, 59.C. placentula, 60.C. p. v. euglypta,61. C. p. v. lineate, 62.C. cf. Scutellum, 63.Cocconeis sp.***

flora in the Bundelkhand region of Central India reveal 63 taxa accounting for 23% of total flora. Flora consists of 6 genera and 28 taxa from family Fragilariaceae, 1 genus and 6 species from Eunotiaceae and 4 genera, 26 taxa from Achnanthaceae. The proportions of araphids and monoraphids are low in the CH compared with the Himalaya.

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