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RESEARCH ARTICLE

DESMID *PLEUROTAENIUM* NAGELI FROM THE KOLE LANDS OF THRISSUR (PART OF VEMBANAD – KOL, RAMSAR SITE), KERALA, INDIA

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ABSTRACT

The Kole lands of Thrissur are part of Vembanad – Kol, a declared Ramsar site of Kerala, India. A systematic survey of the freshwater phytoplankton has been made from February 2005 to January 2006 and twenty three taxa of *Pleurotaenium* Nageli were collected and are described systematically with their distribution in India. *P. minutum* (Ralfs) Delp. var. *latum* Kaiser, *P. trabecula* (Ehr.) Nageli var. *crassum* Wittrock and *P. trabecula* (Ehr.) Nageli var. *trabecula* (Ehr.) Nageli are new reports from India. Nine taxa namely *P. coroniferum* (Borge) Krieg. var. *multinodosum* Scott & Prescott, *P. ehrenbergii* (Breb.) de Bary var. *elongatum* (West) West & West, *P. eugeneum* (Turn.) West & West, *P. minutum* (Ralfs) Delp. var. *latum* Kaiser, *P. subcoronulatum* (Turn.) West & West, *P. subcoronulatum* (Turn.) West & West var. *africanum* Schmidle, *P. trabecula* (Ehr.) Nageli, *P. trabecula* (Ehr.) Nageli var. *crassum* Wittrock and *P. trabecula* (Ehr.) Nageli var. *trabecula* (Ehr.) Nageli are recorded for the first time from Kerala.

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INTRODUCTION

Kerala state is situated in the west coast of peninsular India and Thrissur district located in almost the central portion of Kerala State. The Kole lands of Thrissur form a unique aquatic ecosystem and are part of one of the largest wetland systems on the southwest coast of India, namely Vembanad–Kol land system, which was declared as one of the Ramsar site (Ramsar convention, IUCN, 1971) of India in 2002. The Kole lands geographically distributed in Mukundapuram, Chavakkad and Thrissur taluks of Thrissur district of Kerala are designated as 'Thrissur Kole'. Suxena and Venkateswarlu (1966, 1968, 1970), Kamat (1968, 1975), Agarkar (1969, 1971), Bharati and Pai (1972), Agarkar and Agarkar (1977), Freitas and Kamat (1979), Agarkar *et al.* (1979, 1983), Bongale and Bharati (1980), Bharati and Hegde (1982), Gurudeva *et al.* (1983), Somashekar (1983), Prasad and Misra (1984, 1992), Hegde (1986), Isaacs and Hegde (1986), Kant and Gupta (1998), Tarar *et al.* (1998) and Perumal and Anand (2008) reported *Pleurotaenium* from different parts of India. Suxena *et al.* (1973), Shaji *et al.* (1989), Shaji and Patel (1991), Sindhu and Panikkar (1994, 1995), Shaji (2004), Sanilkumar and Thomas (2006), Jose and Francis (2007) and Tessy and Sreekumar (2009) reported *Pleurotaenium* from Kerala.

MATERIAL AND METHODS

The water samples were collected monthly from ten stations namely Pullur (PR), Muriyad (MD), Nambiankavu (NK),

Mapranam (MM), Chemmanda (CM), Cherpu (CP), Palakkal (PL), Chettupuzha (CT), Anthikkad (AK) and Enamavu (EM) during February 2005 to January 2006 and were preserved in 4% formalin. The taxa were identified with the help of monographs and research publications (West and West, 1904; Smith, 1924; Scott and Prescott, 1961; Bharati and Pai, 1972; Kouwets, 1987; Opute, 2000; Islam and Aktar, 2005; Islam and Irfanullah, 2005) and the Camera Lucida drawings were prepared.

RESULTS AND DISCUSSION

Pleurotaenium Nageli comes under the family Desmidiaceae of the order Conjugales and the class Chlorophyceae. *Pleurotaenium* cells are straight, elongated and cylindrical, constricted in the middle, with a prominent suture, semicells with an inflated base, lateral margins straight, undulate, or nodulose, chloroplasts parietal, numerous, arranged in irregular longitudinal bands (West and West, 1904). During the present investigation twenty three taxa of *Pleurotaenium* have been identified from the Kol wetlands of Thrissur, Kerala and are described systematically with their distribution in India. The details regarding the locality and month of collection are given in bracket at the end of the description of each taxon.

Systematic description of genus *Pleurotaenium* Nageli

1. *P. baculoides* (Roy & Biss.) Playf. (Pl. 1, Fig. 1)
Scott and Prescott, 1961. p. 14, Pl. 3, Fig. 5.

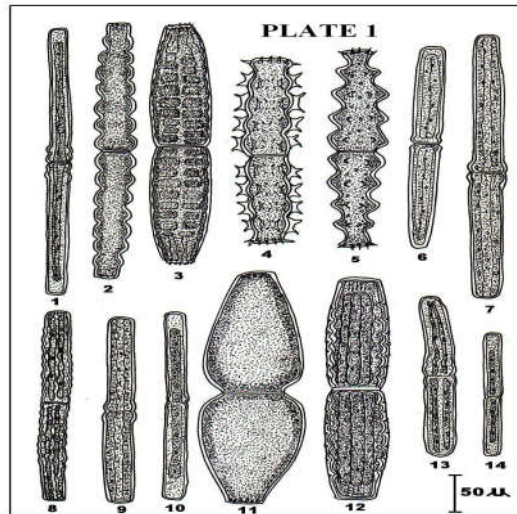


Plate – 1 (Figs. 1–14): 1. *P. baculoides* (Roy & Biss.) Playf. 2. *P. coroniferum* (Borge) Krieg. var. *multinodosum* Scott & Prescott 3. *P. verrucosum* (Bail.) Lund. var. *validum* Scott & Gronbl. 4. *P. kayei* (Arch.) Rab. 5. *P. nodosum* (Bail.) Lund. var. *borgei* Gronb. 6. *P. rectum* Delp. 7. *P. trabecula* (Ehr.) Nageli 8. *P. trabecula* (Ehr.) Nageli var. *undulata* Bharati & Pai 9. *P. trabecula* (Ehr.) Nageli var. *rectum* (Delp.) West & West 10. *P. minutum* (Ralfs) Delp. var. *latum* Kaiser 11. *P. ovatum* Nordst. 12. *P. verrucosum* (Bail.) Lund. var. *bulbosum* Krieg. 13. *P. trabecula* (Ehr.) Nageli var. *crassum* Wittrock 14. *P. minutum* (Ralfs) Delp. var. *gracile* (Wille) Krieg.

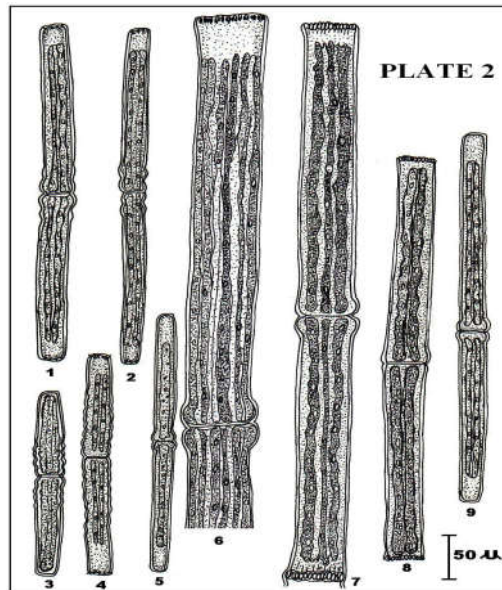


Plate – 2 (Figs. 1 – 9): 1. *P. ehrenbergii* (Breb.) de Bary 2. *P. ehrenbergii* (Breb.) de Bary var. *elongatum* (West) West & West 3. *P. crenulatum* (Ehr. ex Ralf) Rabenh. 4. *P. ehrenbergii* (Breb.) de Bary var. *undulatum* Schaarschmidt 5. *P. trabecula* (Ehr.) Nageli var. *elongatum* Cedergren 6. *P. eugeneum* (Turn.) West & West 7. *P. subcoronulatum* (Turn.) West & West 8. *P. subcoronulatum* (Turn.) West & West var. *africanum* Schmidle 9. *P. trabecula* (Ehr.) Nageli var. *trabecula* (Ehr.) Nageli

Cells slender, 358–373.4 μm long, 15.6–21.4 μm broad, pole 13.6–18.5 μm , isthmus 15.6–20.4 μm (MD/Jul, PL/Sep, CT/feb, Jul).

Distribution in India: Maharashtra (Kamat, 1975); Karnataka (Bharati and Hegde, 1982; Isaacs and Hegde, 1986); Kerala (Sindhu and Panikkar, 1994).

2. *P. coroniferum* (Borge) Krieg. var. *multinodosum* Scott & Prescott (Pl. 1, Fig. 2) Scott and Prescott, 1961. p. 15, Pl. 5, Fig. 2.

Cells 330.7–369.6 μm long, 28.2–31 μm broad, pole 17.5–23.3 μm , isthmus 20.4–29 μm (PR/Jul, Sep, NK/Jul, CM/Mar).

Distribution in India: Karnataka (Bharati and Hegde, 1982; Hegde, 1986).

3. *P. crenulatum* (Ehr. ex Ralf) Rabenh. (Pl. 2, Fig. 3) Kouwets, 1987. p. 207, Pl. 6, Fig. 1. Cells 210–225.6 μm long, 19.5–27.2 μm broad, pole 17.5–22.4 μm , isthmus 18.5–25.3 μm (EM/Dec). Distribution in India: Kerala: (Sindhu and Panikkar, 1994).

Table: 1. Seasonal and spatial variation of genus *Pleurotaenium* Nageli in Thrissur Kole lands, Kerala

Sl. No:	Name of taxa	SEASONS			STATIONS									
		S i	S ii	S iii	1	2	3	4	5	6	7	8	9	10
1	<i>P. baculoides</i>	+	+	-	-	+	-	-	-	-	+	+	-	-
2	<i>P. coroniferum</i> var. <i>multinodosum</i>	+	+	-	+	-	+	-	+	-	-	-	-	-
3	<i>P. crenulatum</i>	-	-	+	-	-	-	-	-	-	-	-	-	+
4	<i>P. ehrenbergii</i>	-	+	+	+	-	+	-	+	-	-	-	-	-
5	<i>P. ehrenbergii</i> var. <i>elongatum</i>	+	+	+	+	-	-	+	+	-	+	-	-	+
6	<i>P. ehrenbergii</i> var. <i>undulatum</i>	+	+	+	-	+	+	+	+	-	+	+	+	+
7	<i>P. eugeneum</i>	-	+	-	-	+	-	-	-	-	-	-	-	-
8	<i>P. kayei</i>	-	+	+	+	-	-	-	+	-	-	-	-	-
9	<i>P. minutum</i> var. <i>gracile</i>	-	-	+	-	-	-	+	-	-	-	-	-	-
10	<i>P. minutum</i> var. <i>latum</i>	+	-	-	-	-	-	+	-	-	-	-	-	-
11	<i>P. nodosum</i> var. <i>borgei</i>	-	+	+	+	+	-	-	-	-	-	-	-	-
12	<i>P. ovatum</i>	-	+	+	-	-	-	-	+	-	-	-	+	-
13	<i>P. rectum</i>	-	-	+	-	-	-	-	-	-	-	-	-	+
14	<i>P. subcoronulatum</i>	-	+	-	-	+	-	-	-	-	-	-	-	-
15	<i>P. subcoronulatum</i> var. <i>africanum</i>	-	+	+	-	+	-	+	+	-	-	+	-	-
16	<i>P. trabecula</i>	-	-	+	-	-	-	-	+	-	+	-	-	-
17	<i>P. trabecula</i> var. <i>crassum</i>	-	+	-	-	+	+	+	-	-	-	-	-	-
18	<i>P. trabecula</i> var. <i>elongatum</i>	+	+	+	+	-	+	+	+	-	+	-	+	-
19	<i>P. trabecula</i> var. <i>rectum</i>	+	+	+	+	+	+	+	-	-	-	-	-	-
20	<i>P. trabecula</i> var. <i>trabecula</i>	+	-	-	-	-	-	+	-	-	-	-	-	-
21	<i>P. trabecula</i> var. <i>undulata</i>	+	-	+	+	+	-	-	-	-	-	-	+	-
22	<i>P. verrucosum</i> var. <i>bulbosum</i>	+	+	+	+	-	-	-	-	-	-	-	+	-
23	<i>P. verrucosum</i> var. <i>validum</i>	-	-	+	-	-	-	+	-	-	-	-	-	-
		10	15	16	9	9	5	11	8	0	5	3	5	4

+ = Present, - = Absent,

S i = Pre-monsoon season, S ii = Monsoon season, S iii = Post-monsoon season.

Stations: (1) Pullur, (2) Muriyad, (3) Nambiankavu, (4) Mapranam, (5) Chemmunda, (6) Cherpu, (7) Palakkal, (8) Chettupuzha, (9) Anthikkad, (10) Enamavu

4. *P. ehrenbergii* (Breb.) de Bary (Pl. 2, Fig. 1)

West and West, 1904. vol. 1, p. 205, Pl. 29, Fig. 9–11, Pl. 30, Fig. 1.

Cells 404.6–424 µm long, 19.5–26.3 µm broad, pole 17.5–23.3 µm, isthmus 18.5–24.3 µm (PR/Aug, MM/Jun, MM/Aug, Oct, Nov).

Distribution in India: Andhra Pradesh (Suxena and Venkateswarlu, 1966); Kashmir (Suxena and Venkateswarlu, 1968); Madhya Pradesh (Agarkar, 1971; Agarkar *et al.*, 1983); Tamil Nadu (Bharati and Pai, 1972; Perumal and Anand, 2008); Maharashtra (Kamat, 1975; Freitas and Kamat, 1979; Tarar *et al.*, 1998); Karnataka (Bongale and Bharati, 1980; Bharati and Hegde, 1982; Gurudeva *et al.*, 1983; Somashekar, 1983); Goa (Bharati and Hegde, 1982); Andaman and Nicobar Islands (Prasad and Misra, 1992); Kerala (Sindhu and Panikkar, 1994; Sanilkumar and Thomas, 2006; Tessy and Sreekumar, 2009); Jammu and Kashmir (Kant and Gupta, 1998).5. *P. ehrenbergii* (Breb.) de Bary var. *elongatum* (West)

West & West (Pl. 2, Fig. 2)

Scott and Prescott, 1961. p. 15, Pl. 3, Fig. 14.

Cells 404.6–420 µm long, 15.6–19.5 µm broad, pole 14.6–15.6 µm, isthmus 14.6–15.6 µm (PR/Nov, MM/Jun, Jul, CM/Aug, PL/Feb, Jul, Dec, AK/ Feb, Sep, Jan, EM/May, Jun).

Distribution in India: Karnataka (Bharati and Hegde, 1982).

6. *P. ehrenbergii* (Breb.) de Bary var. *undulatum*

Schaarschmidt (Pl. 2, Fig. 4)

Scott and Prescott 1961. p. 15, Pl. 3, Fig. 12.

Cells medium, lateral margins undulate from base towards apex, 256.7–264.5 µm long, 19.5–20.4 µm broad, pole 14.6–15.6 µm, isthmus 14.6–15.6 µm (MD/ Sep, Dec, NK/Oct, MM/Dec, CM/Sep, PL/Apr, Jun, CT/Jul, Aug, Sep, Oct, EM/Nov, Dec).

Distribution in India: Kerala (Suxena *et al.*, 1973); Karnataka (Bharati and Hegde, 1982; Hegde, 1986); Andaman and Nicobar Islands (Prasad and Misra, 1992).7. *P. eugeneum* (Turn.) West & West (Pl. 2, Fig. 6)

Scott and Prescott, 1961. p. 16, Pl. 4, Fig. 3.

Cells very large and stout, cylindrical, semicells parallel, apex truncate with a peripheral ring of teeth – like tubercles, 836.4–855.8 µm long, 41.8–54.5 µm broad, and pole 39–50.6 µm, isthmus 36–46.7 µm (MD/Sep).

Distribution in India: Maharashtra (Freitas and Kamat, 1979; Tarar *et al.*, 1998); Karnataka (Bharati and Hegde, 1982); Tamil Nadu (Perumal and Anand, 2008).8. *P. kayei* (Arch.) Rab. (Pl. 1, Fig. 4)

Scott and Prescott, 1961. p. 16, Pl. 5, Figs. 10, 11.

Cells cylindrical, broader, apex with a ring of 10–12 spines, the apical spines are horizontal, 241.2–276.2 µm long, 44.7–49.6 µm broad without spine, 58.4–63.2 µm broad with spine, pole 17.5–26.2 µm, isthmus 24.3–28.2 µm (PR/Aug, Sep, CM/Aug, Oct).

Distribution in India: Kerala (Suxena *et al.*, 1973; Sindhu and Panikkar, 1994; Jose and Francis, 2007; Tessy and Sreekumar, 2009); Karnataka (Bharati and Hegde, 1982).9. *P. minutum* (Ralfs) Delp. var. *gracile* (Wille) Krieg.

(Pl. 1, Fig. 14)

Islam and Akter, 2005. Pl. 1, Fig. 1.

Cells slender, small, straight, cylindrical, 159.5–182.8 µm long, 10.7–16.5 µm broad, pole 8.8–14.6 µm, isthmus 7.8–13.6 µm (MM/Oct).

Distribution in India: Andhra Pradesh (Suxena and Venkateswarlu, 1966); Kerala (Shaji and Patel, 1991).

10. *P. minutum* (Ralfs) Delp. var. *latum* Kaiser (Pl. 1, Fig. 10)

Scott and Prescott, 1961. p. 16, Pl. 2, Fig. 25.

Cells small, 253–272.3 µm long, 15.6–19.5 µm broad, pole 12.6–14.6 µm, isthmus 14.6–16.5 µm (MM/May).

11. *P. nodosum* (Bail.) Lund. var. *borgei* Gronbl. (Pl.1, Fig. 5)
Scott and Prescott, 1961. p. 16, Pl. 5, Fig. 5.
Cells 249–280 µm long, 43.7–50.6 µm broad, pole 21.3–25.3 µm, isthmus 22.4–25.3 µm (PR/ Aug, Sep, MD/ Dec). Distribution in India: Kerala (Shaji *et al.*, 1989; Jose and Francis, 2007; Tessa and Sreekumar, 2009).
12. *P. ovatum* Nordst. (Pl. 1, Fig. 11)
Scott and Prescott, 1961. p. 17, Pl. 6, Figs. 1, 2.
Cells 311.2–330.7 µm long, 85.6–97.3 µm broad, isthmus 45.7–50.6 µm, pole 33–35 µm, bearing a ring of tubercles (CM/Jun, AK/Jan).
Distribution in India: Andhra Pradesh (Suxena and Venkareswarlu, 1970); Maharashtra (Kamat, 1975; Freitas and Kamat, 1979); Karnataka and Goa (Bharati and Hegde, 1982); Madhya Pradesh (Agarkar *et al.*, 1983); Kerala (Shaji *et al.*, 1989); Tamil Nadu (Perumal and Anand, 2008).
13. *P. rectum* Delp. (Pl. 1, Fig. 6)
Kouwets, 1987. p. 208, Pl. 6, Fig. 3.
Cells 253–272.3 µm long, 23.3–29.2 µm broad, pole 17.5–20.4 µm, isthmus 15.6–19.5 µm (EM/ Nov, Dec, Jan).
Distribution in India: Kerala: (Sindhu and Panikkar, 1994).
14. *P. subcoronulatum* (Turn.) West & West (Pl. 2, Fig. 7)
Scott and Prescott, 1961. p. 17, Pl. 4, Figs. 1, 2.
Cells large, broad and long, forming chains of short filaments, semicells cylindrical, apex with a ring of conical tubercles, 614.6–645.7 µm long, 39–42.8 µm broad, pole 37–41 µm, isthmus 36–41.8 µm (MD/Sep).
Distribution in India: Maharashtra (Kamat, 1968 and 1975); Tamil Nadu (Bharati and Pai, 1972); Goa (Bharati and Hegde, 1982); Karnataka (Bharati and Hegde, 1982; Somashekar, 1983).
15. *P. subcoronulatum* (Turn.) West & West var. *africanum* Schmidle (Pl. 2, Fig. 8)
Opote, 2000. Pl. 4: 2,3, Fig. 5: 6.
Cells large, narrow, 393–490 µm long, 23.3–33 µm broad, pole 23.3–34 µm, isthmus 23.3–32 µm (MD/Aug, Dec, MM/Jul, CM/Jun, Nov, CT/Aug).
Distribution in India: Madhya Pradesh (Agarkar, 1971)
16. *P. trabecula* (Ehr.) Nageli (Pl. 1, Fig. 7)
West and West, 1904. vol. 1, p. 205, Pl. 29, Figs. 9–11; Pl. 30, Fig. 1.
Cells 338.4–358 µm long, 21.4–25.3 µm broad, pole 18.5–22.4 µm, isthmus 19.5–24.3 µm (CM/Jan, PL/ Oct).
Distribution in India: Maharashtra (Kamat, 1968, 1975; Freitas and Kamat, 1979); Madhya Pradesh (Agarkar, 1969; Agarker and Agarkar, 1977; Agarkar *et al.*, 1979; Agarkar *et al.*, 1983); Karnataka (Bongale and Bharati, 1980; Bharati and Hegde, 1982; Gurudeva *et al.*, 1983; Somashekar, 1983); Jammu and Kashmir (Kant and Gupta, 1998); Tamil Nadu (Perumal and Anand, 2008).
17. *P. trabecula* (Ehr.) Nageli var. *crassum* Wittrock (Pl. 1, Fig. 13)
Islam and Irfanullah, 2005. Pl. 3, Fig. 25.
Cells 167.3–186.7 µm long, 19.5–20.4 µm broad, pole 13.6–16.5 µm, isthmus 16.5–20.4 µm (MD/Sep, NK/ Jul, Sep, MM/ Jul, Aug).
18. *P. trabecula* (Ehr.) Nageli var. *elongatum* Cedergren (Pl. 2, Fig. 5)
Islam and Irfanullah, 2005. Pl. 3, Fig. 26; Pl. 4, Fig. 36.
Cells large, 276.2–295.6 µm long, 13.6–18.4 µm broad, pole 11.7–14.6 µm, isthmus 12.6–16.5 µm (PR/Apr, Aug, Sep, Nov, Jan, NK/Apr, Jun, Jul, Aug, Sep, MM/ Sep, Jan, CM/May, Jun, Jul, PL/Sep, AK/Aug, Dec).
Distribution in India: Maharashtra (Freitas and Kamat, 1979; Tarar *et al.*, 1998); Kerala (Sindhu and Panikkar, 1994).
19. *P. trabecula* (Ehr.) Nageli var. *rectum* (Delp.) West & West (Pl. 1, Fig. 9)
West and West, 1904. vol. 1, p. 212, Pl. 30, Fig. 9–10.
Cells of medium size, semicells without undulations above the basal inflations, 245–256.7 µm long, 15.6–19.5 µm broad, pole 14.6–15.6 µm, isthmus 15.6–17.5 µm (PR/Apr, Jul, Jan, MD/May, Aug, NK/Feb, MM/Jun, Jul).
Distribution in India: Maharashtra (Kamat, 1975); Andaman and Nicobar Islands (Prasad and Misra, 1992); Kerala (Sindhu and Panikkar, 1994).
20. *P. trabecula* (Ehr.) Nageli var. *trabecula* (Ehr.) Nageli (Pl. 2, Fig. 9)
Islam and Akter, 2005. Pl. 1, Figs. 6, 7; Pl. 2, Figs. 14–16.
Cells 416.2–451.2 µm long, 18.5–23.3 µm broad, pole 14.6–20.4 µm, isthmus 19.5–22.4 µm (MM/ Feb).
21. *P. trabecula* (Ehr.) Nageli var. *undulata* Bharati & Pai (Pl. 1, Fig. 8)
Bharati and Pai, 1972. p. 29, Fig. 14.
Cells 214–245 µm long, 22.4–25.3 µm broad, pole 20.4–23.3 µm, isthmus 12.6–15.6 µm (PR/ Nov, Jan, MD/May, AK/ Dec).
Distribution in India: Tamil Nadu (Bharati and Pai, 1972); Kerala (Sindhu and Panikkar, 1995; Tessa and Sreekumar, 2009).
22. *P. verrucosum* (Bail.) Lund. var. *bulbosum* Krieg. (Pl. 1, Fig. 12)
Scott and Prescott, 1961. p. 20, Pl. 5, Figs. 7, 8.
Cells 288–299.5 µm long, 50.6–58.4 µm broad, pole 31–35 µm, isthmus 40.8–43.8 µm (PR/Sep, AK/Feb, May, Jul, Jan).
Distribution in India: Tamil Nadu (Bharati and Pai, 1972); Kerala (Suxena *et al.*, 1973; Sindhu and Panikkar, 1995); Karnataka (Bharati and Hegde, 1982).
23. *P. verrucosum* (Bail.) Lund. var. *validum* Scott & Gronbl. (Pl. 1, Fig. 3)
Scott and Prescott, 1961. p. 20, Pl. 5, Fig. 9.
Cells 280–311.2 µm long, 47.7–54.5 µm broad, isthmus 32–39 µm and pole 27.2–31 µm (MM/Oct).
Distribution in India: Tamil Nadu (Bharati and Pai, 1972); Karnataka (Bharati and Hegde, 1982); Kerala (Shaji *et al.*, 1989).

Seasonal and spatial variation of genus *Pleurotaenium* Nageli in Thrissur Kol wetlands were given in Table 1. Eleven *Pleurotaenium* taxa was found at Mapranam (station 4) followed by nine taxa at Pullur and Muriyad (station 1 and 2). The seasonal biodiversity analysis in the study area shows that sixteen taxa of *Pleurotaenium* was found during post-monsoon (Oct-Jan), fifteen during monsoon (Jun-Sep) and ten during pre-monsoon (Feb-May) season (Table 1). *P. minutum* (Ralfs) Delp. var. *latum* Kaiser, *P. trabecula* (Ehr.) Nageli var. *crassum* Wittrock and *P. trabecula* (Ehr.) Nageli var. *trabecula* (Ehr.) Nageli are recorded for the first time from India. Nine taxa namely *P. coroniferum* (Borge) Krieg. var. *multinodosum* Scott & Prescott, *P. ehrenbergii* (Breb.) de Bary var. *elongatum* (West) West & West, *P. eugeneum*

(Turn.) West & West, *P. minutum* (Ralfs) Delp. var. *latum* Kaiser, *P. subcoronulatum* (Turn.) West & West, *P. subcoronulatum* (Turn.) West & West var. *africanum* Schmidle, *P. trabecula* (Ehr.) Nageli, *P. trabecula* (Ehr.) Nageli var. *crassum* Wittrock and *P. trabecula* (Ehr.) Nageli var. *trabecula* (Ehr.) Nageli are new reports to Kerala.

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