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Four new centric diatoms (Bacillariophyceae) from the Western Ghats, South India

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Abstract

Four new species, including two newly recorded genera of diatoms, are described from lentic habitats of Western Ghats, South India. The new species are *Pleurosira indica*, *Spicaticribra kodaikanaliana, Urosolenia curvata* and *U. extensa*. *Pleurosira indica* and *Spicaticribra kodaikanaliana* were collected from Kodaikanal Lake in Tamil Nadu and the two *Urosolenia* species are collected from Hirebhasker Dam in Karnataka, India. *Pleurosira indica* differs from other members of the genus by the irregularly arranged areolae and c-shaped depressions associated with the rimoportulae. *Spicaticribra kodaikanaliana* lacks the large central openings found in *S. kingstonii*, but is otherwise very similar to this North American taxon. The two new *Urosolenia* species, *U. extensa* and *U. curvata*, have distinct shapes to their valves, unlike other previously described species of the genus. All of these new species were observed with light and scanning electron microscopes, and we discuss their systematic positions.

Introduction

Diatom research in India has a history of over one hundred and fifty years (Ehrenberg 1845). Notable work on diatom taxonomy from this region includes the publications of Skvortzow (1935), Gonzalves and Gandhi (1952, 1953, 1954), Krishnamurthy (1954), Gandhi, (1959, 1966, 1970, 1998), Venkataraman (1957) and Sarode & Kamat (1984). Most of these works were focused on the pennate diatoms, with less or almost no attention given to the centric forms. For the first time, Desikachary's *Atlas of the Diatoms* (Desikachary & Ranjitha Devi 1986, Desikachary & Prema 1987, Desikachary *et al*. 1987, 1987a, Desikachary 1988, 1989) provided detailed illustrations and photomicrography of many recent marine and fossils centric forms from the Indian Ocean. Most of the freshwater centric forms are, however, often overlooked in plankton samples or fitted to the classical genera described from Europe (*viz Cyclotella* (Kützing) Brébisson, *Aulocoseira* G.H.K. Thwaites, *Melosira* C. A. Agardh and *Coscinodiscus* Ehrenberg), without further examination. It appears that studies on the ecology and taxonomy of freshwater diatoms have been dismally neglected in India although phytoplankton ecology has received frequent attention (Sarma & Khan 1991, Karthick 2010), as is the case generally for the tropics (Silva 2007). Consequently, studies on Indian freshwater centric diatoms are few, though there are a few recent works on the centric genera from the tropics (Rott *et al*. 2006, Sala *et al*. 2008). Kociolek & Spaulding (2002) and Khursevich & Kociolek (accepted) suggest these diatoms may have great importance for understanding evolutionary and ecological phenomena.

Freshwater centric diatom taxonomy and systematics has been undergoing significant revision and discovery over the past 30 years, with many new genera of fossil (e.g. *Pliocaenicus* Round *et* Håkansson *emend* Khursevich & Stachura-Suchoples (2008), *Tertiarius* Håkansson & Khursevich (1997), *Mesodicyton* Theriot & Bradbury (1987), *Mesodictyopsis* Khursevich *et al*. (2004), *Ectodictyon* Khursevich *et* Chernyaeva

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(1989), *Miosira* Krammer *et al*. (1997), *Stoermeria* Kociolek *et al*. (1996)) and Recent centric diatoms (e.g. *Discostella* Houk & Klee (2004), *Spicaticribra* Johansen *et al*. (2008), *Ellerbeckia* Crawford (1988), *Cyclotubicoalitus* Stoermer *et al*. 1990, *Stephanocostis* Genkal & Kuzmina 1985) having been described. These descriptions have been generated by either reinterpretation of previously described species as well as discoveries of new taxa and/or characters (and patterns of character distribution) in these freshwater forms.
In this paper we describe four new centric diatoms from a recreational lake in Southern Western Ghats and from a dam used for hydro electricity generation in Central Western Ghats belonging to the genera *Pleurosira*, *Spicaticribra* and *Urosolenia*. The Western Ghats, a chain of hills running parallel to the western coast of India, is a hotspot of biological diversity (Myers *et al*. 2000). This region harbors a high proportion of endemic plants and animals (Gunawardene *et al*. 2007); this endemism has been attributed to the prevailing geographical and climatic conditions. It is also interesting to note that Western Ghats retains multiple pockets of local endemic biodiversity (Gadgil *et al*. 2011).

Materials and methods

The material used in this paper include:

Sample #1: Diatoms from Epiphytic floating plants from Kodaikanal Lake, Dindigul District, Tamil Nadu State, India collected by Dinesh Kumar on 22nd December, 2008;

Sample #2: Fresh-water Diatoms from Hirebhaskar Dam Pavement, Karnataka State, India collected on 11th January 1955 by H P Gandhi (CESH Diatom Collection No. Sr.110).

In the case of sample No. 1, diatoms were collected from floating aquatic plants at Kodaikanal Lake by scrubbing the plants with a toothbrush and the resultant suspension was preserved in ethanol (Karthick *et al*. 2010). Water quality parameters were measure as per Standard methods for water and wastewater analysis (APHA 2005). Sample No.2 was collected by H.P. Gandhi in 1955 from Hirebhaskar Dam and preserved in formaldehyde.

Both the samples were digested using concentrated nitric acid and centrifuged several times to remove the acid. The cleaned materials were used for preparation of slides and Scanning Electron Microscope (SEM) observations. Microscopic slides were observed with Olympus BX-51 light microscopes equipped with differential interference contrast and 1.4 NA objectives. Digital images were taken with an Olympus DP-71 digital camera. Scanning electron microscopy was done with cleaned specimens air dried onto cover glasses, attached to aluminum stubs, sputter-coated with 10 nm of Au-Pd, and examined in high vacuum mode with a JSM-6480LV (LVSEM) at 15 kV, with a spot size of 30, and a working distance of 10 mm. SEM work was performed at the University of Colorado's Nanomaterials Characterization Facility. Terminology on the diatom valves follows Ross *et al*. (1979) and Rott *et al*. (2006).

Results

Analysis of the samples with light and scanning electron microscopic yielded four centric diatoms belonging to the genera *Pleurosira, Spicaticribra* and *Urosolenia*. Taxa observed in these samples differed in many aspects when compared to the previously described species. The detailed light and scanning electron microscopic observations are given below.

New species descriptions

Division Bacillariophyta
Sub-division Coscinodiscophytina Medlin & Kaczmarska 2004

Class Coscinodiscophyceae F.E. Round & R.M. Crawford in Round *et al*. 1990 emend. Medlin & Kaczmarska 2004
Subclass Coscinodiscophycidae F.E. Round & R.M. Crawford in Round *et al*. 1990
Order Triceratiales Round & R.M. Crawford in Round *et al*. 1990
Family Triceratiaceae (Schütt) Lemmermann 1899
Genus *Pleurosira* (G. Meneghini) V.B.A. Trevison 1848

Pleurosira indica* Karthick & Kociolek, *sp. nov. (Figures 1–2; holotype illustrated in Fig. 1–B)

Valvae circularae ad ellipticae 31.6–77.4 µm diametro. Superficies valvarum dilute hemisphaerica. Ocelli 2 raro 3, non-diligenter oppositi sibi. Rimoportulae 3–7, expansa super valvam. Sulcus circularis circa rimpoportulam. Striae radiatae 14–18/10 µm ad marginem. Areolae in seriebus brevibus radialibus ad marginem in parte centrali irregulariter disposita valvae, 13–18/10 µm. Spinulae praesentes super superficiem valvae.

Valves circular to elliptical, 31.6–77.4 μm in diameter. Valve face slightly hemispherical. Ocelli 2, rarely 3, and ocelli not exactly opposite one another. Rimoportulae 3–7 spread across valve. Circular groove present around rimoportula. Striae radiate 14–18/10 μm at margin of valve face. Areolae in short radial rows at margin, irregularly arranged in central part of valve, density ranging from 13–18 in 10μm. Spinules present across valve face.

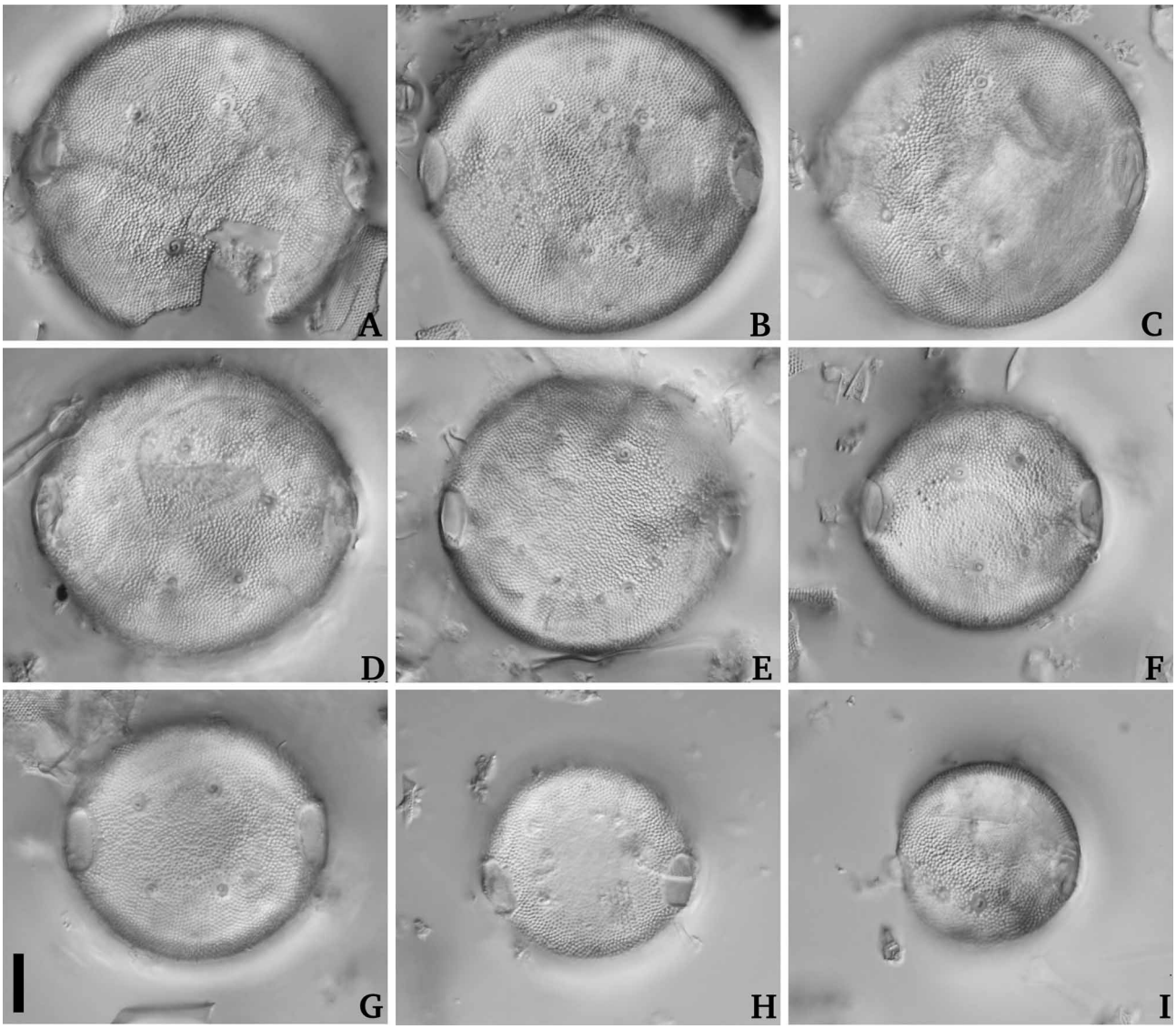


FIGURE 1. *Pleurosira indica* LM. Valves showing the size diminution series. Scale bar = 10 µm.

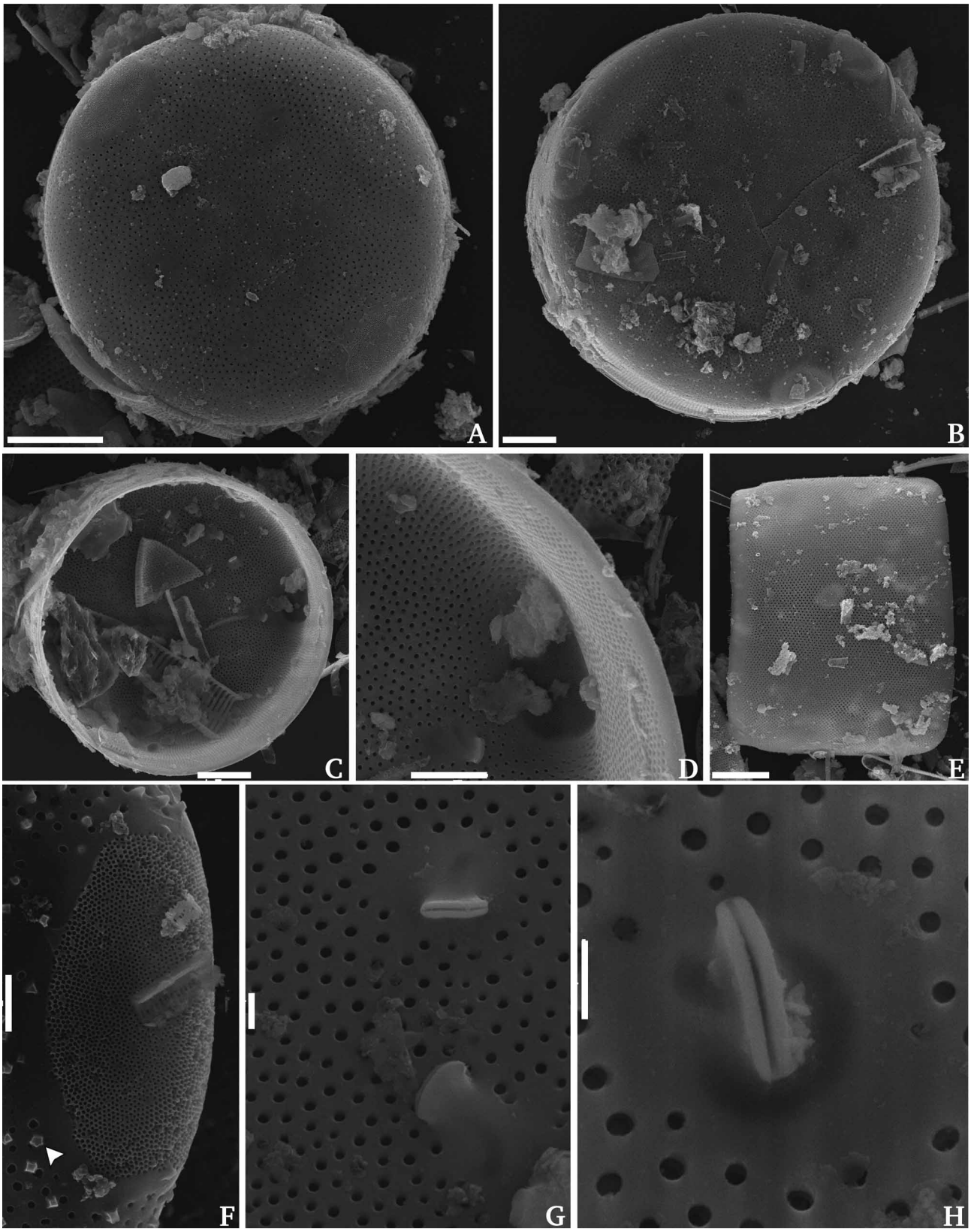


FIGURE 2. *Pleurosira indica* SEM. **A.** External view of the valve showing the irregular areolae across the face. **B.** External view of the valve with 3 ocelli. **C&D.** Internal view of the valve showing the ocelli appear as depressions at the valve face and mantle junction. **E.** External girdle view shows the areolae extend onto the mantle. **F.** External view of the ocelli. **G.** Internal view of the valve shows the different folding nature of the rimoportulae with areolae. **H.** Internal view of the view shows the c-shaped depression around the rimportula. Scale bars: Figs. A, B, C, E: 10 μm; Fig. D: 5 μm; Fig. F: 2 μm; Figs. G, H: 1μm

Type:—Kodaikanal Lake (10°14'03" N, 77°29'13"E, altitude 2090 meters above sea level), Dindigul District, Tamil Nadu, Collected by *Dinesh Kumar,* 22nd December 2008 (holotype CESH-5-1881, Centre for Ecological Science Herbarium Diatom Collection, Indian Institute of Science, Bangalore, INDIA; isotypes BM 101457).

Habitat:—Sample collected from a floating aquatic plant. This species occurs in slightly acidic water (pH: 6.25±0.12) with phosphates 0.06±0.02 mg l^{-1}; nitrates: 0.55±0.13 mg l^{-1} and dissolved oxygen 3.95±0.55 mg l^{-1}.

Distribution:—Currently known only from the type locality.

Etymology:—Named after the country name, India.

Observations:—In the SEM the valve has irregular areolae that occur across the face (Figs 2–A, B, C) and extend onto the mantle (Fig. 2–E). Two, rarely three (Fig. 2–B) ocelli are present. Ocelli are elliptical-elongate in shape and the porelli that comprise the ocelli are small and radiate in their organization (Figs 2–A, B, F). Internally, ocelli appear as depressions at the valve face/mantle junction (Figs 2–C, D). Rimportulae have round openings externally (Figs 2–A, B). Internally they are elevated and lip-like (Figs 2–G, H). There is a c–shaped depression around the rimportula internally (Fig. H). The girdle is wide, and copulae possess distinct pores.

Pleurosira indica differs from *P. laevis* (Ehrenb.) Compère by the presence of irregularly arranged areolae and presence of c–shaped depression around the rimoportulae. *Pleurosira laevis* (Fig. 1 in Compère 1982, Fig. 2–A in Kociolek *et al*. 1983) shows a clear pattern in areolae arrangement with striae radiating from the centre to margin and a silica surface which separate the porelli from areolae (Fig. 4 in Compère 1982) is also absent in *P. indica*. *Pleurosira indica* can be easily distinguished from *P. soctrensis* var. *pangeroni* Compère (Figs 33–36, 44 in Compère 1982) by valve outline and absence of a c–shaped depression around each rimportula. *Pleurosira soctrensis* var. *pangeroni* has also been reported from South India (Compère 1982). *Pleurosira indica* also differs from another Indian taxon, *Pleurosira socotrensis* var. *bengalensis* Compère (Figs 37, 38, 44 in Compère 1982), by the absence of the 6–15 labiate processes being arranged in a circular fashion.

Order Thalassiosirales Glezer & Makarova 1986
Family Thalassiosiraceae Lebour 1930
Genus *Spicaticribra* Johansen, P. Kociolek & R. Lowe 2008

Spicaticribra kodaikanaliana* Karthick & Kociolek, *sp. nov. (Figures 3–4; holotype is illustrated in Fig. 3–A)

Frustula 8–23 µm diametro. Fultoportulae marginales 8–14 in quoque valva, 2–3µm distantes. Rimoportulae 1–3 in quoque valva, intra annulum fultoportularum. Striae radiales, rectae, aliquandro centro extensae, aliquandro prae centro terminates, 16–22 in 10 µm. Areolae 25–32 in 10µm intra strias, areolis centralibus 2-4 grandibus noncenteris.

Frustules 8–23 μm in diameter. Marginal fultoportulae 8–14 per valve, with 2–3 μm between adjacent fultoportulae. Rimoportulae number 1–3 per valve with internal extensions at same height as fultoportulae. Striae radial, straight, extending from margin to center, others extending only partially to center, 16–22 in 10 μm. Areolae 25–32 in 10 μm within striae, with central areolae 2-4 times the size of other areolae.

Type:—Kodaikanal Lake (10°14'03" N, 77°29'13"E, altitude 2090 meters above sea level), Dindigul District, Tamil Nadu, Collected by *Dinesh Kumar*, 22nd December 2008 (holotype CESH-5-1882, Centre for Ecological Science Herbarium Diatom Collection, Indian Institute of Science, Bangalore, INDIA; isotypes BM 101458).

Habitat:—Sample collected from a floating aquatic plant. This species occurs in slightly acidic water (pH: 6.25±0.12) with phosphates 0.06±0.02 mg l^{-1}; Nitrates: 0.55±0.13 mg l^{-1} and dissolved oxygen 3.95±0.55 mg l^{-1}.

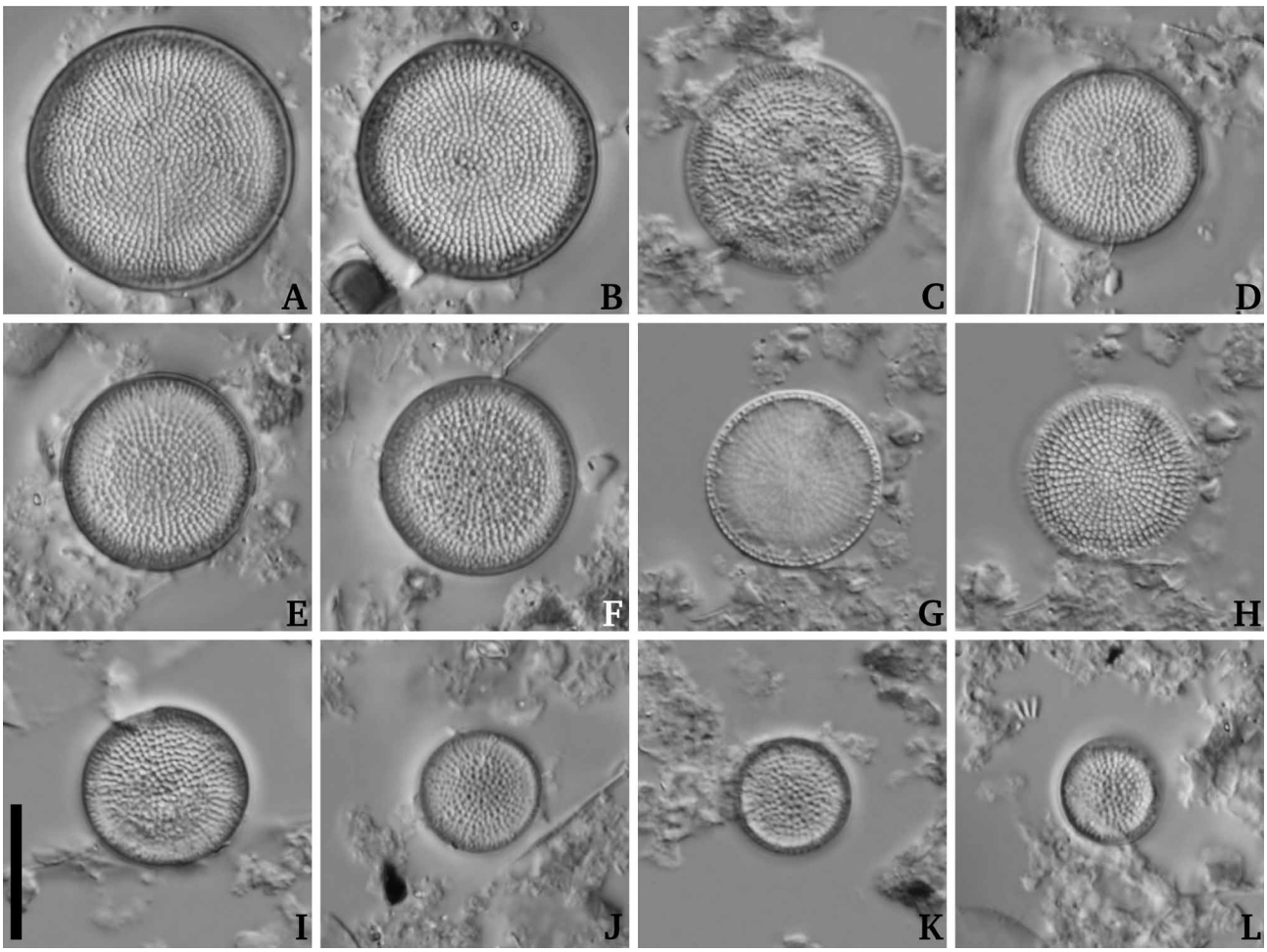


FIGURE 3. *Spicaticribra kodaikanaliana* LM. Valves showing the size diminution series. Scale bar = 10 μm.

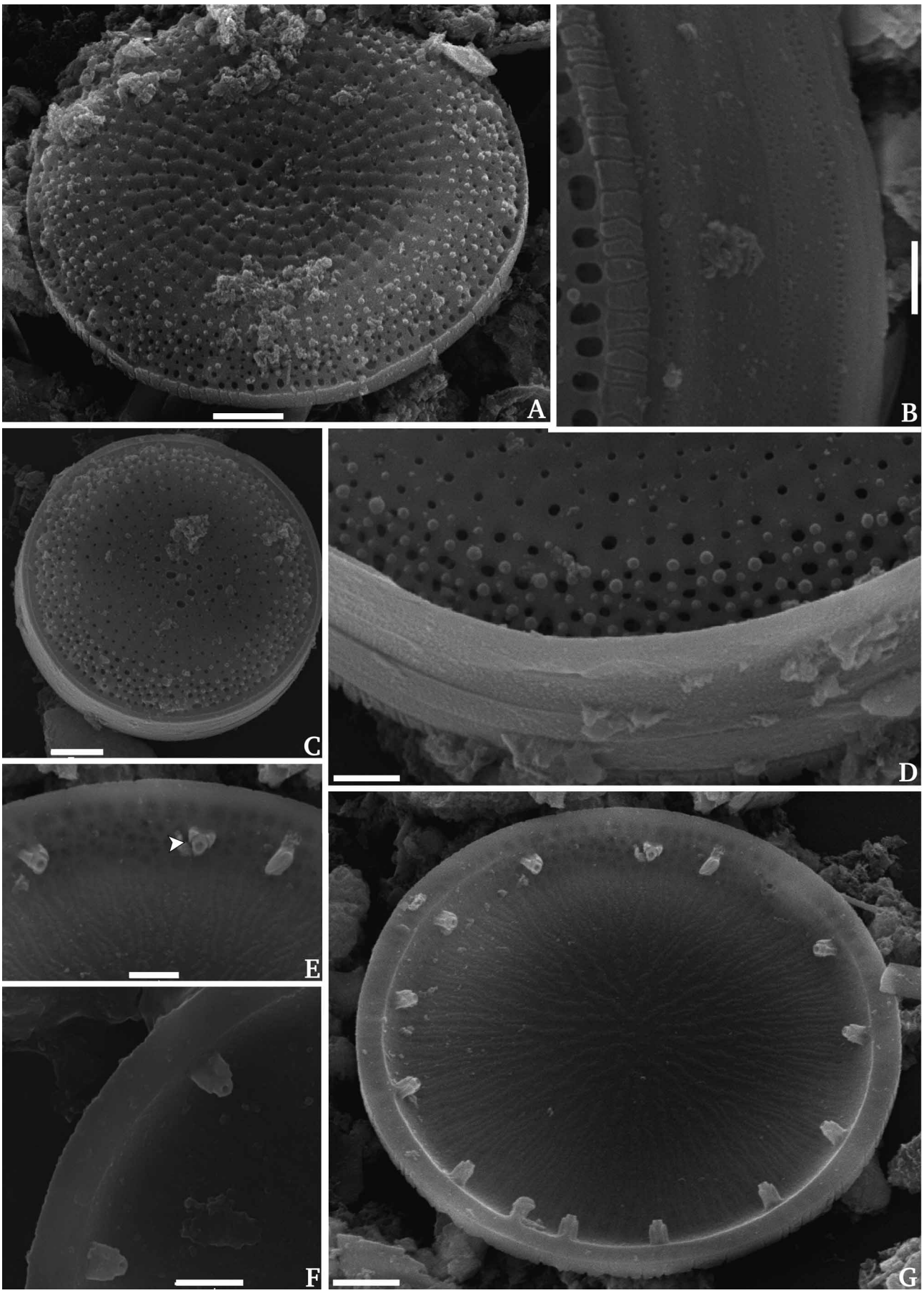
Distribution:—Currently known only from the type locality.

Etymology:—Named after the type locality, Kodaikanal Lake.

Observations:—In the SEM the external valve face is domed slightly (Figs 4–A, C). Areolae are arranged into uniseriate striae, which alternate with wide, raised fascicles. The central areolae appear slightly enlarged, perhaps 2–3× greater than the diameters of other valve face areolae. There are small, siliceous nodules scattered across the periphery of the valve face and mantle (Figs 4–A, C, D). Internally, there is a covering across the valve face, creating an internal covering over the areolae (Figs 4–E, F, G). There is a ring of marginal fultoportulae; each bearing three satellite pores (Figs 4-E, F). Rimoportulae number 2–3/valve, and are located at the same level as the fultoportulae (Figs 4–E, F, G). The valvocopulae has a fimbriate margin (Fig. 4–B). Central fultoportulae are absent.

Spicaticribra kodaikanaliana differs from *Spicaticribra kingstonii* Johansen *et al*. by the presence of small siliceous plaques on the periphery of the valve and the absence of larger sized areolae in the center of the valve (Figs 19, 20 in Johansen *et al*. 2008). The raised external pores of the fultoportulae (Fig. 20 in Johansen *et al*. 2008) are very prominent in *S. kingstonii*.

FIGURE 4. *Spicaticribra kodaikanaliana* SEM. **A.** External view of the valve face. **B.** External view of the valve mantle. **C.** External view of the valve face showing the siliceous nodules scattered across the periphery of the valve. **D.** Detailed view of the siliceous nodules on the valve periphery. **E&F** Tilted valve showing three pores on each fultoportula. **G.** Internal view of the valve with pore field radiating from valve center with structures of fultoportula. Scale bars: Figs. A, C, G: 2 μm; Figs. B, D, E, F: 1μm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Order Rhizosoleniales Silva 1962
Family Rhizosoleniaceae De Toni 1890
Genus *Urosolenia* F.E. Round & R.M. Crawford in Round *et al*. 1990

Urosolenia curvata* Karthick & Kociolek, *sp. nov. (Figs 5–6; holotype illustrated in Fig. 5–B)

Cellulae singulars vel binatim. Frustula sub-cyclindrica valvis asymmetrica conicis terminatibus extensa tubulari. Calyptra rotundata ad basim, late angusto base perforata ab areolam. Areolae dispositae plus minusve fasciculis. Extensio curva origine in latere uno valva flexa versus latis oppositum. Frustula omnia fracta, hinc longitudinem frustuli non suppetum. Lamina extensa visibilis in LM. Latitudo frustuli 4.5–6.8 µm. Longitudo processus 15.9–25.0 µm. Copulae 7–8/10 µm.

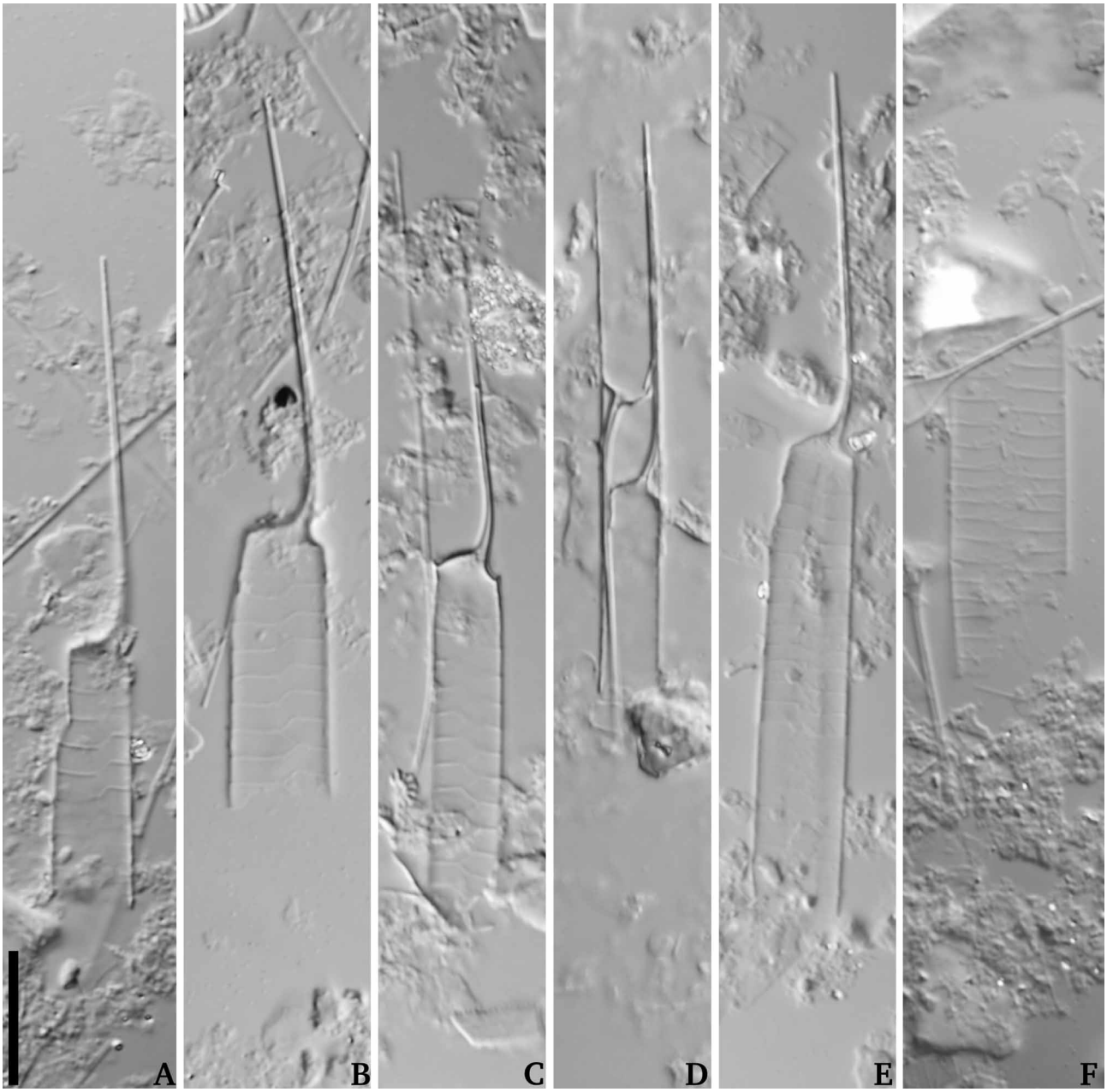

FIGURE 5. *Urosolenia curvata* LM. Details of valves, process and girdle bands. Scale bar = 10 µm.

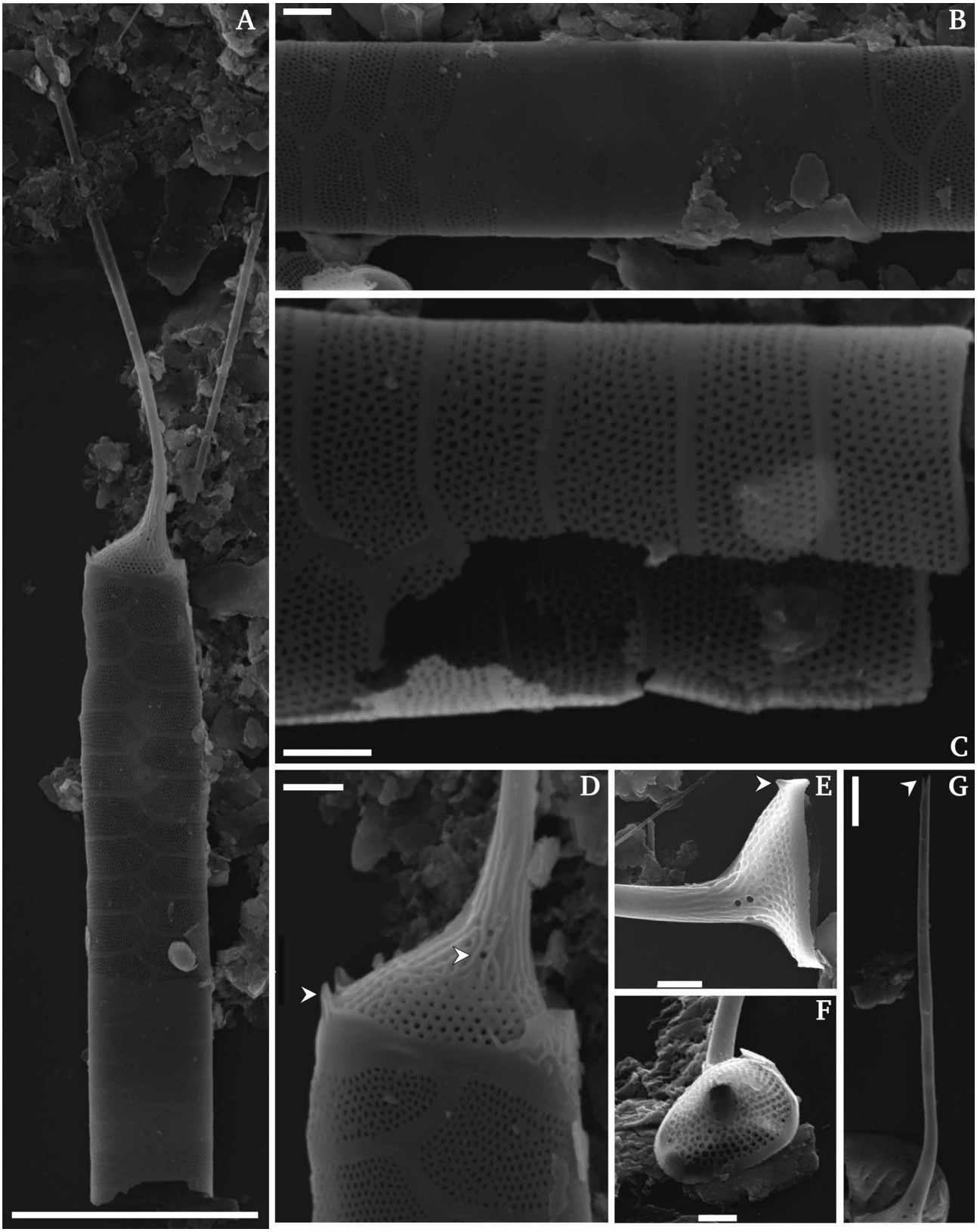

FIGURE 6. *Urosolenia curvata* SEM. **A.** External view showing the valve and the long valve extension. **B.** External view of the valve copula region without areolae. **C.** External and internal view of the areolae on the girdle band. **D.** External view of the valve showing the structure of the valve lamina and poroids on the base of the valve extension. **E.** External view of the valve extension base showing the ribs and poroids. **F.** Internal view of the valve showing the absence of rimoportula. **G.** External view of the valve extension shows the terminal end of the process are sharp pointed open with teeth. Scale bars: Fig. A: 10 µm; Fig. G: 2 µm; Figs. B, C, D, E, F: 1µm

Cells isolated or joined in pairs. Frustules sub-cylindrical with asymmetric, conical valves that end with a tubular extension. Calyptra rounded at base, with mantle narrow and base perforated. Areolae organized more or less into fascicles. Curved tubular extension originates from one side of valve and bend towards opposite side. (All frustules observed were broken; hence total frustule length is not available). Extended lamina visible in LM. Frustule width 4.5–6.8 μm, length of process 15.9–25.0 μm, copulae density 7–8/10 μm.

Type:—Fresh-water Diatoms Hirebhaskar Dam (14°05'48" N, 74°53'30"E, altitude 552 meters above sea level), Sharavathi River, Shimoga District, Karnataka, India. Collected by *H P Gandhi* on 11th January 1955. (Sample No. Sr. 110 in Gandhi's collection) (holotype CESH-5-1883, Centre for Ecological Science Herbarium Diatom Collection, Indian Institute of Science, Bangalore, INDIA; isotypes BM 101459).

Etymology:—Named for the curved process of the valve terminus.

Observations:—In the SEM, the calyptra is rounded at the base (Fig. 6–F), with a narrow mantle (Figs 6–A, D, E). It has long, arched process. The base of the calyptra is perforated by areolae, which are organized more or less into indistinct fascicles. Narrow ribs extend onto and up and along the calyptra's extension (Figs 6–D, G). Girdle bands are imbricated, composed of 9–11 rows of round to irregularly–shaped porelli (Figs 6–B, C). Marginal lamina extended into teeth (Fig 6–D, E). Areolae on copulae 9–10 in1 μm and areolae on valve 6–7 in 1μm. Number of poroids ranges from 2–5 on the valve. The terminal end of the process is sharp pointed open with teeth (Fig 6–G).

Urosolenia curvata differs from *U. diademata* Rott & Kling by the shape and tip of the seta. The process of *U. curvata* is strongly curved when compared to other known *Urosolenia* (Rott *et al*. 2006, Sala *et al*. 2008). *Urosolenia diademata* has a seta tip with sharp pointed teeth, sometimes with a central ligula and lateral teeth (Fig 9 in Rott *et al*. 2006) or extended into a long fine hair-like seta (Fig 8 in Rott *et al*. 2006). The ribs along the base of the process in *U. curvata* are well developed when compared to those in *U. diademata* (Fig 30 in Rott *et al*. 2006). It is difficult to compare features of the copulae between *U.curvata* and *U. diademata* since it has not been illustrated for the latter species. *Urosolenia curvata* also differs from *U. amazonica* by shape and lack of ornamentation on the valvocopula.

Urosolenia extensa* Karthick & Kociolek, *sp. nov. (Figs 7–8, holotype illustrated in Fig. 7–A)

Frustula cylindrica. Valvae symmertica conicae, angustatis longissimis, rectis ad undulates. Processus positatus ad centrum valvae, extense ramo-simili visibili LM. Latitudo frustuli 3.2–5.1 µm. Longitudo processes 15.4–44.4 µm. Copulae 5–7/10 µm.

Frustules cylindrical. Valves symmetrical, conical, continuing in a very long straight to slightly undulated process. Process positioned on valve center. Process possessing branch-like extension visible in LM. Frustules width 3.2–5.1 μm, length of process 15.4–44.4 μm, copulae density 5–7/10 μm.

Type: Hirebhaskar Dam (14°05'48" N, 74°53'30"E, altitude 552 meters above sea level), Sharavathi River, Shimoga District, Karnataka, India. Collected by *H P Gandhi* on 11th January 1955. (Sample No. Sr. 110 in Gandhi's collection) (holotype CESH-5-1884, Centre for Ecological Science Herbarium Diatom Collection, Indian Institute of Science, Bangalore, INDIA; isotypes BM 101460).

Etymology: Named for the elongated process of the valve.

In the SEM, the calyptra is funnel-shaped, tapered to form a tubular, extended process (Figs 8–A, B). Striae of the calyptra are in linear rows (Figs 8–A, G). The linearly arranged striae can be interrupted by elongated, narrowly rectangular openings (Figs 8–B, E). The elongated girdle consists of imbricate broad half bands, each isolated by a rim-like structure. Regularly distributed elongated areolae are present on the girdle (Fig 8–C, D). The base of the calyptra is a rim without additional ornamentation. The conical part of the valve has small areolae with density of 8–9/1 μm. The extension process possesses a small branch like projections and ends bluntly pointed (Fig 8–F).

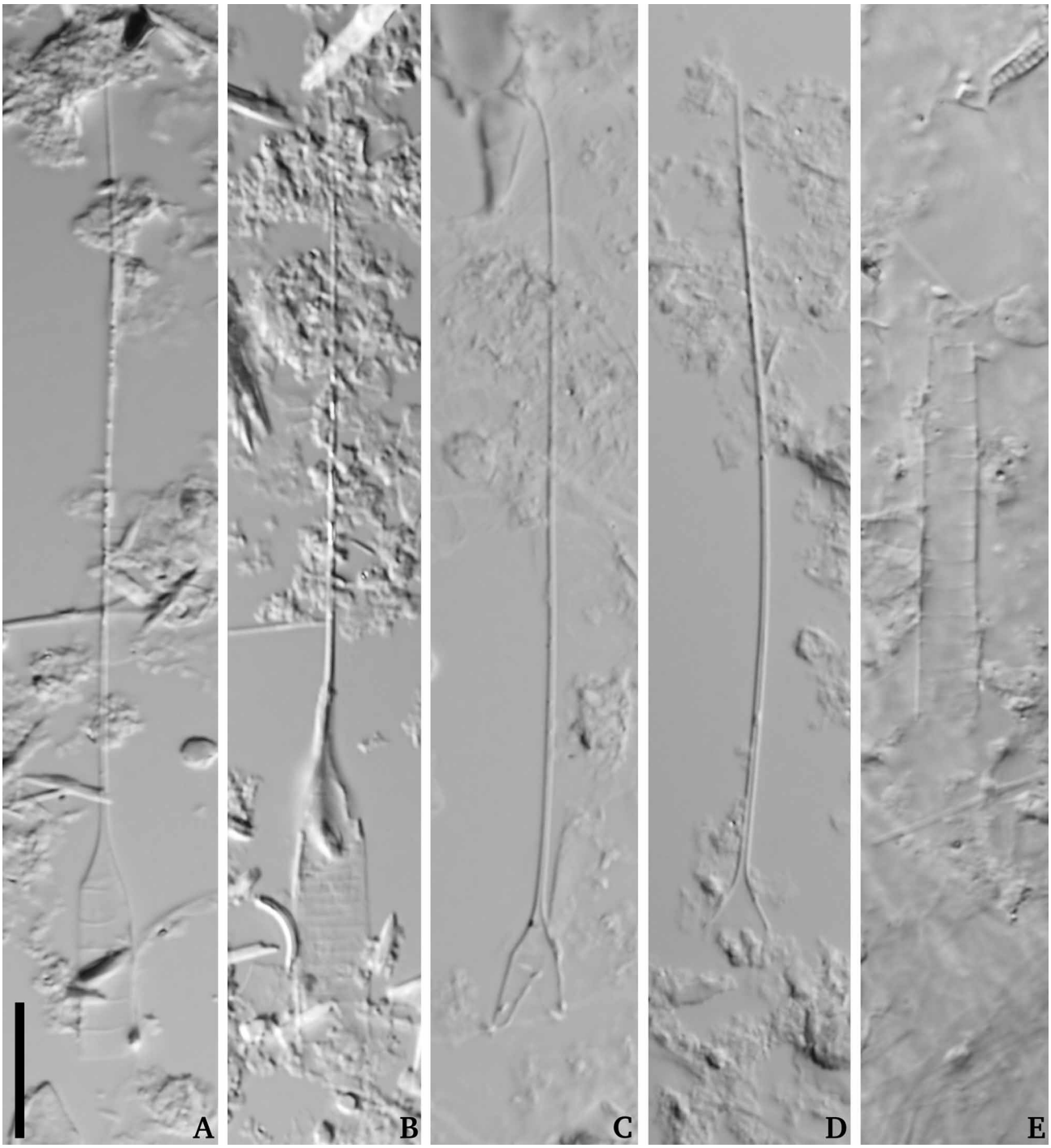

FIGURE 7. *Urosolenia extensa* LM. Details of valves, process and girdle bands. Scale bar = 10 µm.

Urosolenia extensa differs from all other known *Urosolenia* species by its shape and absence of structure on valve lamina as observed in *U. curvata* and *U. diademata* Rott & Kling *(*Rott *et al*. 2006). *U. extensa* can be differentiated from the *U. delicatissima* by the absence of buttonhole shaped external labiate opening on the valve (Sala *et al*. 2008. Fig 13, 14) and the presence of branch like projections on the process (Fig 8–F).

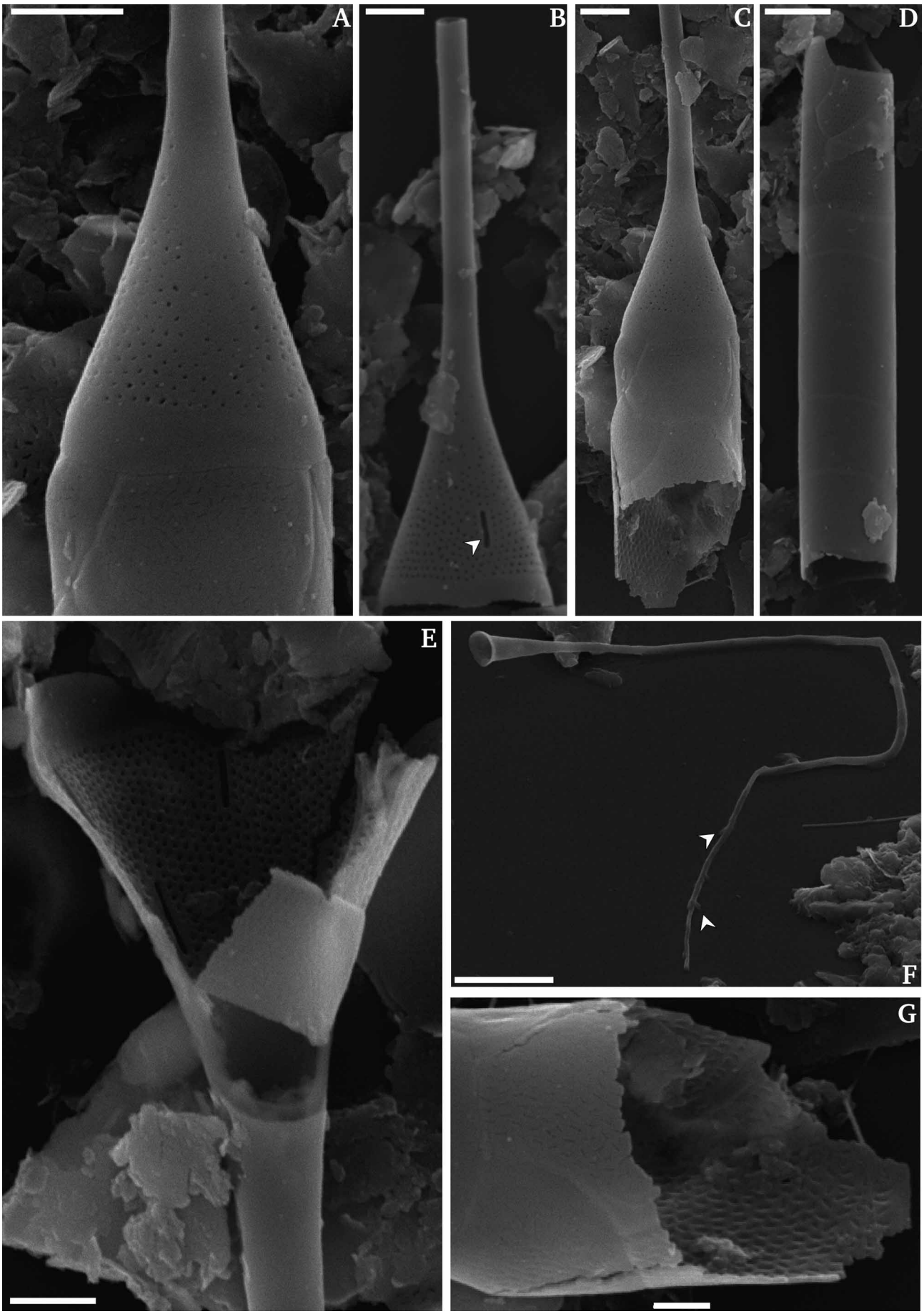
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FIGURE 8. *Urosolenia extensa* SEM. **A.** External view showing the conical valve. **B**. External view of the valve with rectangular openings. **C.** External view of the valve, girdle bands and base of the process. **D.** External view of the valve copula region without areolae. **E.** Internal view of the valve with areolae and rectangular openings. **F.** External details of the process showing the presence of branch like structures. **G.** External and internal view of the areolae on the copula. Scale bars: Figs. A, B, C, D, E: 1 μm; Fig. F: 5 μm; Fig. G: 0.5 μm

Discussion

Of the three genera reported in the present study, two, *Spicaticribra* and *Urosolenia,* are reported for the first time from India. Compère previously (Compère 1982) studied members of *Pleurosira* from the Indian sub continent, including *P. laevis* (Ehrenb.) Compère, *P. laevis* f. *polymorpha* Compère, *P. socotrensis* var. *pangeroni* and *P. socotrensis* var. *bengalensis* from India and Sri Lanka (then Ceylon). *Pleurosira indica* differs from most of the known taxa of the genus by its valve outline and ultrastructure details. In *P. indica* the number of ocelli varies from two to three, this kind of variation is also observed in other species of *Pleurosira* and related genera (Compère 1982). For example, in *Proteucylindrus taiwanensis* Li & Chiang, a genus closely related to *Pleurosira,* variation in number of ocelli has been shown to be related to salinity concentrations (Li & Chaing 1979).

The genus *Spicaticribra* was originally understood as a monotypic genus known only from North America (Johansen *et al*. 2008). It was described for a previously undescribed fultoportula-bearing species that had a flat covering cribra across the internal surface, versus domed cribra across the internal surface of each individual areola. A year later the genus *Contricribra* Stachura-Suchoples & D.M. Williams (2009) was proposed for species formerly placed in *Thalassiosira* with the same feature. Khursevich & Kociolek (accepted) have proposed *Contricribra* Stachura-Suchoples & D.M. Williams is a later synonym of *Spicaticribra* and placed species of *Thalassiosira* with a similar internal cribra structure in *Spicaticribra*. The genus now numbers 6 taxa, with species known from North America, Europe, Asia and South America (Khursevich & Kociolek accepted). *Spicaticribra* differs from other common centric genera, like *Thalassiosira,* by the presence of a flat perforated covering across the areolae on the internal valve surface. It is possible that earlier workers could have misidentified this *S. kodaikanaliana* as a member of *Thalassiosira*. Species currently placed in *Urosolenia* would previously have been assigned to *Rhizosolenia* Brightwell, based on the single elongated seta and imbricating girdle bands. *Urosolenia* species were separated out of *Rhizosolenia* based on their freshwater habit and a wide range of morphological differences, including their lack of rimoportulae (Round *et al*. 1990). *Urosolenia* is a genus with lightly silicified valves and girdle and that occurs in planktonic habitats around the world, although most of the recently described species have been from the southern hemisphere (Rott *et al*. 2006, Sala *et al*. 2008). Even though there are many studies from India focused on phytoplankton communities (for a detailed review, see Karthick 2010), there are no previous reports of the genus from India (Sarma & Khan 1980). To date, only three publications have considered the ultrastructure details of *Urosolenia* (Round *et al*. 1990, Rott *et al*. 2006, Sala *et al*. 2008) and all three articles introduce and describe new and/or different sets of morphological features for this genus. It seems clear that is still a tremendous amount of work to be done to understand the morphological and taxonomic diversity of this easily over-looked genus.

Urosolenia curvata shares many morphological features with *U. diademata* Rott & Kling, which is reported from Sri Lanka. Sri Lanka and Western Ghats shares many endemic and closely related species (Gunawardene *et al*. 2007). In addition, Sri Lanka and South India share other endemic freshwater diatoms, such as *Gomphonema magnifica* Gandhi (Foged 1976, Karthick & Kociolek submitted). Sri Lanka is a continental island separated from South India by the 20-meter deep Palk Strait but it was connected to South India 10,000 years ago (Vaz 2000). This has lead to high degree of morphological similarity in several aquatic and terrestrial taxa suggesting biotic interchange between the landmass (Bossuyt *et al*. 2004).

Urosolenia is known for significant morphological changes during auxospore formation (Edlund & Stoermer 1993) but the phenomenon is unknown for the two new taxa described here. A slit-like opening on the valve of *U. extensa* is similar to *U. delicatissima* S.E. Sala, M. Núñez-Avellaneda & A.A. Vouilloud, a neotropical species described from Amazon (Sala *et al*. 2008). Up to this point, this structure is known only from two *Urosolenia* species. The present report of two *Urosolenia* species from the same locality triggers a further question concerning their ecological niche, which is completely unknown. Future studies on their frustule morphology, ecology and distribution will shed more light on these interesting taxa from tropical India.

This first report of species in the genera *Spicaticribra* and *Urosolenia* and the description of a new species of *Pleurosira* holds the promise of further, similarly intriguing, reports in the diatom diversity of India.

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