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SPECIES OF *ZYGOGONIUM* KUTZING FROM KERALA, SOUTH INDIA

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Nine species of the terrestrial zygnematacean alga *Zygogonium* Kutzing, collected from different parts of Kerala have been described. Of these, two taxa are new reports for Karala, while the other six taxa are new to science.
Keywords : *Zygogonium*; Kerala; Terrestrial alga; New species.

Introduction

The genus *Zygogonium* Kutzing is primarily a terrestrial filamentous alga, growing on the surface of the soil during rainy season. The filaments are usually branched, branching irregular and some of the branches are turned into rhizoids. The vegetative cells are short, cylindric or slightly tumid having thick, opaque and lamellate cell walls; chloroplasts two, compressed globular, cushion-shaped or irregularly stellate. The cell sap is usually colourless or rarely purplish. Asexual reproduction is by zygospores, aplanospores and akinetes. Sexual reproduction is by both scalariform and lateral conjugations, isogamous.

Zygogonium is mainly a tropical alga and its distribution is restricted to Africa, South America, China, India and Australia (Randhawa, 1959). It is represented by 29 species (Hoshaw and Mc Court, 1988). Only seven species of *Zygogonium* have been so far reported from India (Sarma and Khan, 1980).

KEY TO THE SPECIES OF ZYGOGONIUM

1. Reproduction by zygospores 2
1. Reproduction by aplanospores 3
2. Mesospore yellow 4
2. Mesospore yellowish blue . . . . . .2.*Z.ramanii* sp.nov
4. Zygospore 13-23 µm x 20-33 µm . . . . . .3.*Z.ericetorium* Kützing
4. Zygospore 25.28 µm x 24-26 µm . . . . . .1.*Z.kumaoense* Randhawa
3. Mesospore smooth 5
3. Mesospore not smooth 6
5. Aplanospore marginal 7
5. Aplanospore not marginal 8
7. Aplanospores 16-33 µm . . . . . .6.*Z.talguppense Iyengar*
7. Aplanospores 13-16 µm . . . . . .7.*Z. jayaii* sp.nov.
8. Aplanospore middle . . . . . .4.*Z.lalithambikali* sp.nov.
8. Aplanospore lateral . . . . . .5.*Z.sakunthalaii* sp. nov.
6. Aplanospore marginal . . . . . .8.*Z.wilsonii* sp.nov.
6. Aplanospore middle . . . . . .9.*Z.arjunanii* sp.nov.

1. *Zygogonium kumaoense* Randhawa 1940 (Text-Figs. 1-3)

Jour. Indian Bot.Soc. p. 247-248, pl.247; Randhawa 1959, *Zygnemaceae*, p.271-272, fig.243; Ampili & Panikkar 1989, *J.Econ.Tax.*Bot.,p.71-73; M.S. Agarkar & D.S. Agarkar 1972, *Phykos*, p. 71-77.

Vegetative cells 9.5-14 µm x 29-55 µm; chloroplasts discoid, conspicuous; reproduction by both sexual and asexual; sexual by scalariform conjugation; zygospores 25-29 µm in diameter, globose, yellow with thick and smooth walls; asexual by both aplanospores and akinetes; aplanospores globose, middle or terminal with a diameter of 13-20 µm.

Habitat: On laterite soils growing along with *Scytonema* and *Stigonema* near Quilon.

Distribution: Kumaon, Himalayas; Western Ghats, Coorg; Pathanamthitta, Kerala.

2. *Zygogonium ramanii* sp. nov. (Text-Figs. 4-7)

The alga is collected from wet soil near Thenmala along with *Stigonema* and *Oedogonium*. The filaments are branched, produce rhizoids. The cells show a great variation in their size, contain two inconspicuous stellate chloroplasts. Reproduction is by both sexual and asexual, sexual by scalariform conjugation and asexual by aplanospores. The aplanosporangia are inflated with middle aplanospores.

Zygogonium ramanii sp.nov. (Text-Figs. 4-7)

Vegetative cells 22-60 µm x 6-10 µm ; two chloroplasts, each with a pyrenoid; reproduction mainly by aplanospores; conjugation scalariform; zygospore ovoid, 16-19 µm x 9-14 µm, yellowish blue and smooth; aplanospore globose 6-10 µm in diameter, walls thick and smooth.

Zygogonium ramanii sp. nov.

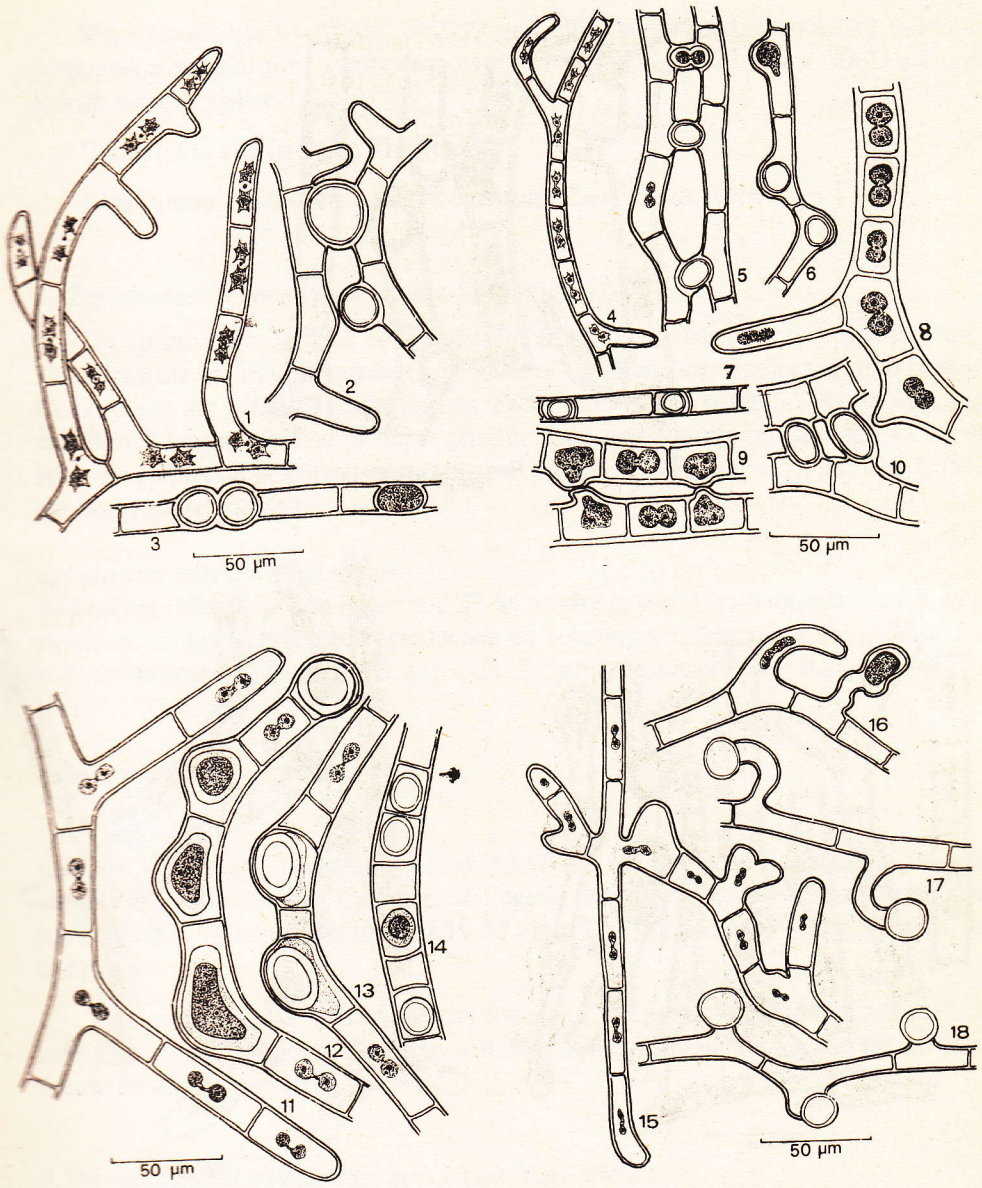
Latin diagnosis

Cellulae vegetativae 22-60 µm x 6-10 µm, ornata doubus chloroplastis singuli singula pyrenoida habentes; reproductio magna exparte aplanosporis fit; conjugatio scalariformis; zygospora ovoida, 16-19 µm x 9-14 µm, flavido cyaneus et leve; aplanospora globosa, 6-10 µm in diametro, crassum et leve.

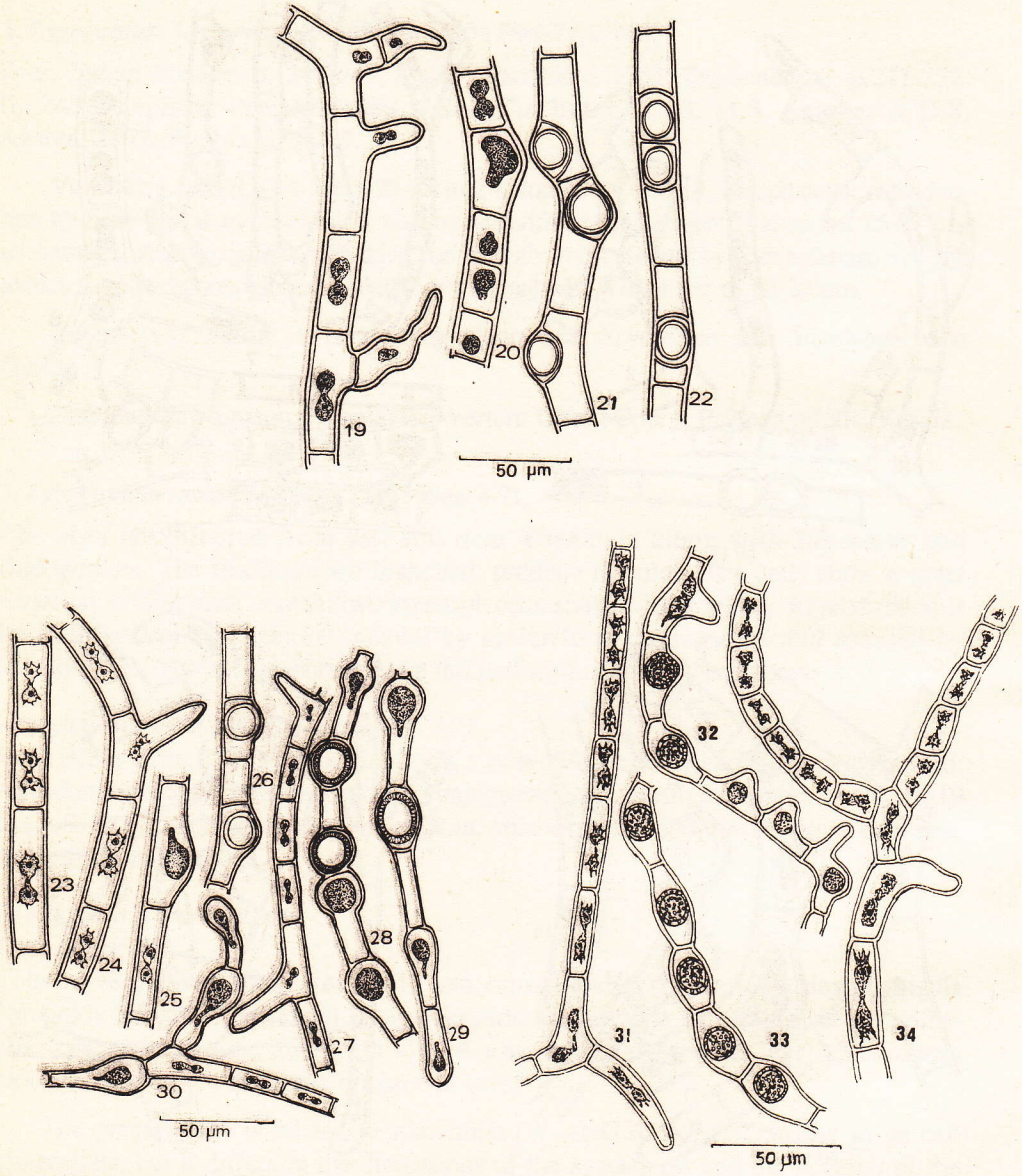
The present alga is related to *Z.mirabile* (W. & G.S. West) Transeau in its cell dimensions, but it differs in the dimensions of the zygospores and the position of the aplanospores.

3. *Zygogonium ericetorium* Kutzing 1843 (Text-Figs. 8-10)

Phycologia Generalis p.446; Randhawa 1959, *Zygnemaceae*, p.265, fig.231; Randhawa 1959, *Current Sci.*p.24-25.



Figs. 1-3. *Zygogonium kumaoense* Randhawa 1. Filament with branches, 2. *Zygospore* 3. Aplanospore; Figs. 4-7. *Zygogonium ramanii* sp. nov.; 4. Filament with rhizoids. 5. Scalariform conjugation. 6-7. Aplanospores.; Figs. 8-10. *Zygogonium ericetorium* Kutzing: 8. Filament with rhizoids. 9-10. Stages of scalariform conjugation Figs. 11-14 *Zygogonium lalithambikaii* sp.nov. 11. Filament with branches. 12-13. Aplanospores. 14. Akinete. Figs. 15-18. *Zygogonium sakunthalaii* sp.nov.; 15. Filament with rhizoids. 16-18. Aplanospores



Figs. 19-22. ***Zygogonium talguppense*** **Kutzing 19. Filament with rhizoids. 20-22. Stages of aplanospore formation Figs. 23-26.** ***Zygogonium jayaii*** **sp. nov. 23-24. Parts of filaments. 25-26. Stages of aplanospore formation. Figs. 27-30.** ***Zygogonium wilsonii*** **sp. nov. 27. Filament with rhizoids. 28-30. Bulbous cells and aplanospores. Figs. 31-34.** ***Zygogonium arjunanii*** **sp.nov. 31. Filament with rhizoids. 32-33. Development of aplanospores 34. Branched filament.**

Vegetative cells 13-30 µm x 13-39 µm; chloroplasts two, rounded or indefinite, conjugation scalariform; zygospores ovoid or ellipsoid, 13-23 µm x 20-33 µm, yellowish smooth walled.

Habitat: On laterite soils, Thenmala.

Distribution: Mahoot, Mysore; Kodaikanal: Devikulam, Kerala.

4. *Zygogonium lalithambikaii* sp. nov. (Text-Figs. 11-14)

It is an aplanosporic species collected from a cutting of the rail track near Thenmala. The filaments are richly branched and some of the branches transformed into rhizoids. Chloroplasts are small spherical masses, each with a single pyrenoid. Aplanosporangia are formed by the division of the vegetative cells, cytoplasmic residues left in the cell after the formation of aplanospores, the cell sap remains bluish in colour. The akinetes are also formed in chains.

Zygogonium lalithambikaii sp. nov.
Vegetative cells 16-20 µm broad and 33-66 µm long, with two chloroplast, each with a pyrenoid; conjugation absent; reproduction by aplanospores, formed in the middle of the cell, aplanospore globose, 19-23 µm x 23-27 µm, mesospore wall thick, smooth and blue.

Zygogonium lalithambikaii sp. nov.

Latin diagnosis
Cellulae vegetativae 16-20 µm latae et 33-66 µm longae, ornata doubus chloroplastis singuli singula pyrenoida habentes; conjugatio nulla; reproductio aplanosporis medio tubo formatis, aplanosporae globosa 19-23 µm x 23-27 µm, mesosporium crassum, leve et cyaneus.

This species shows some similarity towards *Z. sinense* Jao in the dimentions of the cells and the aplanospores, however, it differs in the position, colour and the ornamentations of the aplanospores.

5. *Zygogonium sakunthalaii* sp. nov. (Text- Figs. 15-18)

The alga has been collected from the wet crevices of a reck near Munnar. It was growing along with the species of *Oedogonium* and *Stigonema.* The filaments are profusely branched with irregular lateral branches. Some of the branches and in multicellular rhizoids. Reproduction is by aplanospores, and they are formed on the tip of lateral branches.

Zygogonium sakunthalaii sp. nov.
Vegetative cells 9-12 µm x 49-66 µm; chloroplasts two, indistinct, each with a pyrenoid at the centre; reproduction by aplanospore, aplanospore globose, 14-17 µm x 16-20 µm, mesospore smooth, exospore greenish blue and mesospore colourless.

Zygogonium sakunthalaii sp. nov.
Latin diagnosis
Cellulae vegetativae 9-12 µm x 49-66 µm; chloroplastis due indistinctum, singuli singula habentes in medio pyrenoida; reproductio aplanosporis, aplanosporae globosa 14-17 µm x 16- 20 µm, mesosporium crassum, exosporae caerulea ad mesosporae incolorata.

The present species related to *Z. kumaoense* Randhawa only in the dimensions of aplanospores, but it differs in the nature of branching, position of aplanospores and in the dimensions of the vegetative cells.

6. *Zygogonium talguppense* Iyengar 1932 (Text-Figs. 19-22)

Rev.Algol. p.263-274; Randhawa, Zygnemaceae, p.270, fig.241.
The filaments are branched, the upper cells of the filaments are 16-19 µm x 26-60 µm, while the lower cells of the filaments are 13-16 µm x 23-45 µm. Filaments forming thick felt on soil showing an increase in width upwards. Sexual reproduction is absent, asexual reproduction is by aplanospores, 12-26 µm x 13-33 µm, ellipsoid to subglobose, light blue, walls thick and smooth, lateral in position, cut off from the parent cell by a wall.

Habitat: On wet soil, growing along with *Stigonema* near Thenmala. Distribution: Coorg, Mysore.

7. *Zygogonium jayaii* sp. nov. (Text-Figs. 23-26)

The alga has been collected from a wet ground near Munnar. The filaments are branched, some of the branches turned into unicellular rhizoids, Chloroplasts are stellate with two prominent pyrenoids. It is aplanosporic, aplanosporangia slightly inflated and the aplanospores are found laterally in the middle region.

Zygogonium jayaii sp.nov.
Vegetative cells 13-16 µm x 33-69 µm with two chloroplasts, each with a pyrenoid; conjugation absent, reproduction by aplanospores, aplanospore globose 13-16 µm in diameter, mesospore smooth and yellowish.

Zygogonium jayaii sp. nov.
Latin diagnosis
Cellulae vegetativae 13-16 µm x 33-69 µm ornata doubus chloroplastis, singuli singula pyrenoida habentes; conjugatio nulla, reproductio aplanosporis, aplanosporae globosa 13-16 µm in diametro, mesosporium leve et flavido.

This species is entirelly different from all the other aplanosporic species described from this region.

8. *Zygogonium wilsonii* sp. nov. (Text-Figs. 27-30)

The alga is collected from the crevices of a rock near Munnar. Filaments are profusely branched, branches often short with bulbous cells. Reproduction is by aplanospores, aplanosporangia inflated and the spores are formed at the end walls.

Zygogonium wilsonii sp. nov.
Vegetative cells 6-9 µm x 26-56 µm with two chloroplasts, each with a pyrenoid; conjugation absent; reproduction by aplanospores, aplanospore globose, 16-20 µm in diameter, mesospore wall thick and light blue, exospore pitted and mesospore smooth.

Zygogonium wilsonii sp. nov.
Cellulae vegetativae 6-9 µm x 26-56 µm, ornata doubus chloroplastis, singuli singula pyrenoida habentes; conjugatio nullo; reproductio aplanosporis, aplanosporae globosa 16-20 µm in diametero, mesosporium crassum et modice caeruleum, exospora pitata et mesosporae leve.

9. *Zygogonium arjunanii* sp. nov. (Text-Figs. 31-34)

The alga has been collected from the wet crevices of rocks near Munnar along with *Scytonema*, *Stigonema* and *Nostoc*. The filaments are branched, often with a number of unicellular rhizoidal projections. Reproduction is only by aplanospores, aplanosporangia inflated and the spores are formed in the middle. Aplanospores are globose, golden yellowish with scorbiculate spore wall.

Zygogonium arjunanii sp. nov.
Vegetative cells 6-9 µm broad and 19-40 µm long with two chloroplasts, indistinct; conjugation absent, reproduction by aplanospores, aplanospores globose, 8-12 µm in diameter, yellowish-brown, mesospore wall scorbiculate.

Zygogonium arjunanii sp. nov.
Latin diagnosis
Cellulae vegetativae 6-9 µm latae et 19-40 µm longae, ornata doubus chloroplastis, indistinctum; conjugation nulla, reproductio per aplanosporis, aplanosporae globosae, 8-12 µm in diametro, cinnamomeum, mesospora scorbiculatum.

The present alga shows similarity towards *Z.capense* (Hodgetts) Transeau only in the thickening of the spore wall, however, it differs in the dimensions of the cells and the spores. It also differs in the position of the spore and the shape of aplanosporangia.

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