

The Genus *Spirogyra* (Chlorophyceae: Zygnematales) in Darbhanga, North Bihar

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ABSTRACT

Five taxa of the genus *Spirogyra* Link. (*S. bellis* Cleve, *S. columbiana* Czurda, *S. elliptica* Jao, *S. sahnii* Randhawa, and *S. turfosa* Gay) are reported from different regions of Darbhanga district in the present paper. Of these, four taxa are reported for the first time from eastern India (Bihar).

Key words: Distribution, Zygosporangium, Taxonomy, Zygnemataceae

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Introduction

Spirogyra, a member of Zygnematophyceae, is one of the most ubiquitous, easily recognizable fresh water algae of the world. Great significance has been attached to conjugating algae, now known to be a Charophyte, a critical lineage in the evolution of land plants (Stewart & Mattox, 1975; Darley, 1982; Syrett & Al-Houty, 1984; Wodniak et al., 2011; Timme et al., 2012).

In India, the genus *Spirogyra* Link is represented by about 187 species (Randhawa, 1959; Srinivasan, 1965; Sarma & Khan, 1980; Kargupta & Sarma, 1992) out of more than 500 species known across the globe so far (Kadlubowska, 1984, Guiry and Guiry, 2015). Randhawa (1959) in his monograph on Zygnemataceae included taxonomic description of 289 species of the genus *Spirogyra*, including 100 Indian species, mostly reported from the northern part of India. Apart from stray reports by Srinivasan (1965), Sarma & Khan (1980) and Patel (1990) this genus has not been studied systematically in the eastern region of India by many workers in the past. However, a handful of scholars have done extensive work in this regard. Kargupta & Sarma (1992) reported 50 species of *Spirogyra* including 7 new species and 3 new varieties from West Bengal. Kargupta & Ahmad (1995) described twenty-three taxa including a new species, two new varieties of genus *Spirogyra* from Mithilanchal region of Bihar. Kargupta and Jha (2004) have reported 80 species of *Spirogyra* from different parts of North Bihar.

Because of their abundance in nature, importance in pollution indicator studies and close relationship with higher plants (Mattox and Stewart, 1984), the investigation of the genus *Spirogyra* in particular need to be explored.

The present study deals with five taxa of *Spirogyra*, collected from different localities of Darbhanga, Bihar.

Materials and Methods

Algal samples were collected randomly from freshwater bodies in and around Darbhanga (26°10'12.00"N; 85°54'0"E), North Bihar between 2018 and 2021. All specimens were preserved in FAA each litre of which contained: 40% commercial formalin-100 ml, 60% ethyl alcohol-500 ml, glacial acetic acid-50 ml and water-350 ml. To each litre of this solution 50cc of pure glycerine was added to avoid complete desiccation. Specimens were treated with 8% KOH solution and lactic acid to observe sculpturing of zygosporangium wall. All specimens were mounted in 5% glycerine and sealed with a black or white glossy paint and kept for drying inside the petri-dish to avoid dust. After 24 hours, a second coating of sealant was applied. By this method, the natural colour of the material is maintained when slides are prepared from fresh materials (Kargupta and Jha, 2004). Observations were made using Olympus research microscope. Prism type camera lucida was used for drawing and photographs of the material were taken. Identification of taxa was made with the

help of monographs and available literature (Transeau, 1951; Randhawa, 1959; Kargupta and Sarma, 1992; Kadlubawska and Christensen, 1979). The materials investigated are kept in the herbarium, University Dept. of Botany, L.N.M. University, Bihar for reference and for future use.

Taxonomic Description:

In the present study five species of *Spirogyra* i.e., *S. bellis* (Hassall) Cleve, *S. columbiana* Czurda, *S. elliptica* Jao, *S. sahnii* Randhawa, and *S. turfosa* Gay are described. Barring *S. columbiana*, the remaining four species are reported for the first time from eastern India (Bihar).

***Spirogyra bellis* (Hassall) Cleve (Fig. 1A-C)**

(Randhawa 1959, p. 347, figs. 353)

Vegetative cells short 64-96 μm \times 48-112 μm with plane end wall, chloroplast usually 2-3 with 0.5 - 1 turn, conjugation scalariform, male gametangia 96-112 μm \times 48-112 μm , female gametangia 48-64 μm broad to 96 μm long inflated on both sides. Conjugation tube formed by both gametangia, zygospore ovoid to globular placed transversely in female gametangia, 32-64 μm \times 64-80 μm , yellow-brown. Ornamentation of zygospore wall smooth.

The present specimen is similar to the earlier reports but differs in the number of chloroplasts. The number of chloroplasts of the present specimen is 2-3, whereas *S. bellis* is generally reported to have 5-7 chloroplasts.

Habitat: Freshwater

Collection No. AK-38, February 26, 2021, from a canal (pH 6.0, temp. 28°C) of Naraura (Darbhanga).

Distribution: India- Punjab (Randhawa 1959); Australia, Europe, United States of America and South Africa (Randhawa 1959).

This is the first record of this species from eastern India (Bihar).

***Spirogyra columbiana* Czurda (Fig. 1D-F)**

(Randhawa 1959, p. 318, figs. 295)

Vegetative cells 48-60 μm and 96-160 μm with plane end walls, chloroplasts usually 1-3, conjugation scalariform, conjugation tube formed by both gametangia. Female gametangia slightly inflated towards the conjugation tube. Zygospore ellipsoid, 48-60 μm \times 64-72 μm , median spore wall is smooth and yellowish brown.

The present specimen does not vary from previous description of the species.

Habitat: Stagnant freshwater, growing along with the *Odegonium* spp.

Collection No. AK-50, November 16, 2021, from a ditch (pH 6.5, temp 30°C) of Lahta village (Dist. Darbhanga).

Distribution: India: Bihar (Kargupta and Jha, 2004)), Uttar Pradesh (Randhawa, 1959), Kerala (dt Quilon, Usha Devi & Panikkar, 1994); Vietnam, Indonesia, Colombia, South Africa (Randhawa, 1959), Europe (Gauthier Lièvre, 1965).

***Spirogyra elliptica* C-C. Jao, (Fig. 1G-I)**

(Randhawa 1959, p. 322, figs. 302)

Vegetative cells 100-120 μm \times 220-330 μm with plane end walls, number of chloroplasts usually 3-5, conjugation scalariform, male gametangia 96-112 μm \times 80-176 μm female gametangia 100-120 μm broad to 192-208 μm long. Conjugation tube formed mostly by male gametangia. Zygospore ellipsoid with pointed end, 80 μm \times 144-160 μm , greenish yellow, median spore wall is smooth.

The present specimen is similar to the earlier reported species in all the aspects.

Habitat: Freshwater canal.

Collection No. AK-45, April 20, 2021, from a canal (pH 6.5, temp 30°C) of Lahta village (Dist. Darbhanga).

Distribution: India- Bombay (Randhawa, 1959); Szechwan, China.

This is the first record of the species from eastern India (Bihar).

***Spirogyra sahnii* Randhawa (Fig. 2A-C)**

(Randhawa, 1959, p. 307, figs. 274 a-e)

Vegetative cell 44-52 μm \times 48-72 μm , with 1 chloroplast, conjugation lateral. The neighbouring cell has tent like protuberances in usual way. Zygospore 32 μm \times 44 μm , wall composed of 3 layers with smooth and thick bluish green mesospore.

Parthenospores oval in shape but are slightly smaller than zygospore. Sometime it is also almost spherical in shape 24-32 μm \times 36 μm .

Present specimen resembles the earlier reported species, however the empty male cell of *Spirogyra sahnii* in the present specimen is much bigger in size than female cell reported in the earlier descriptions.

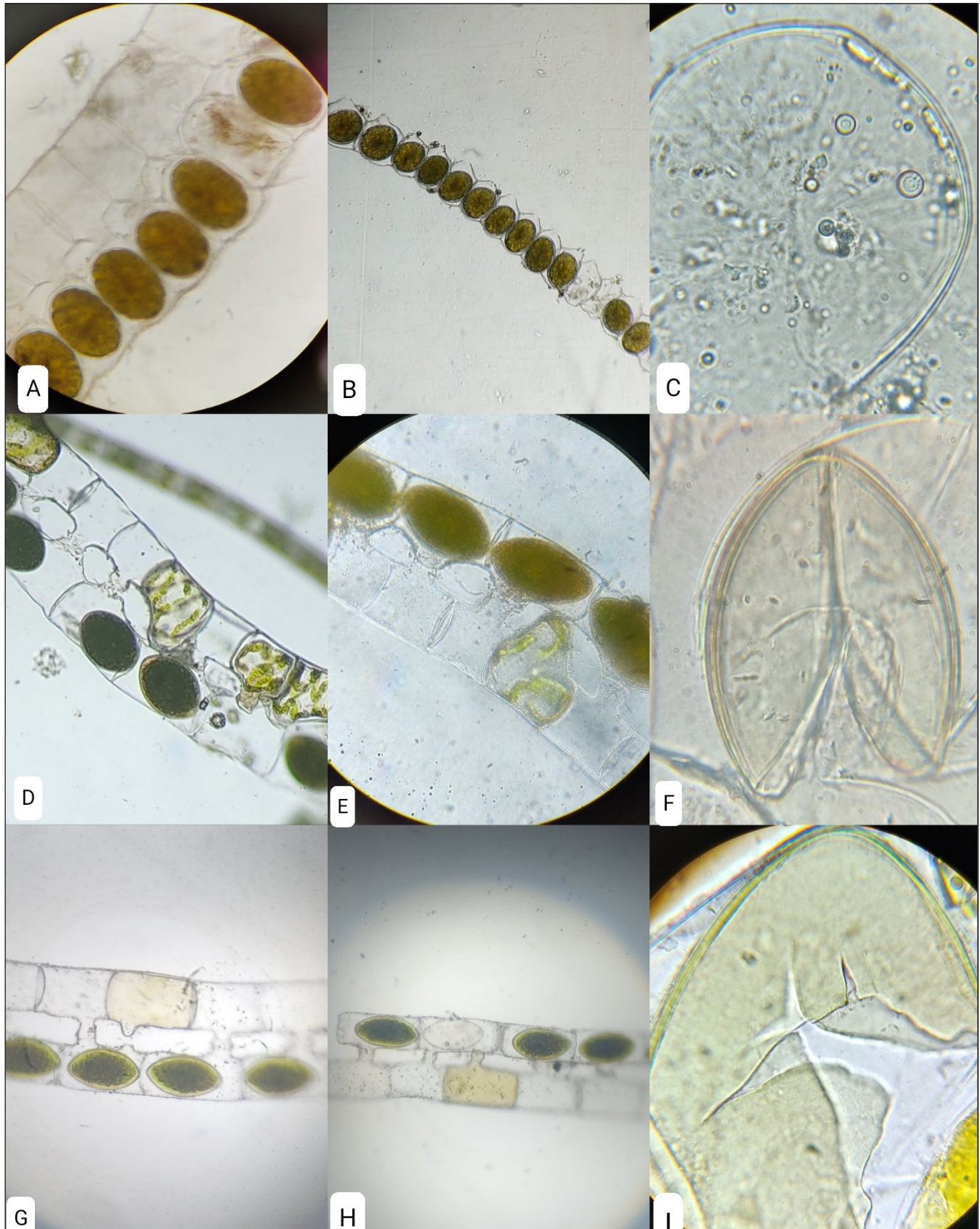


Figure 1: (A-C): *Spirogyra bellis* Cleve; (D-F): *Spirogyra columbiana* Czurda; (G-I): *Spirogyra elliptica* Jao

Habitat: Freshwater canal.

Collection No. AK-59, December 13, 2021, from a canal (pH 6.5, temp 22°C) of Sonki (Dist. Darbhanga).

Distribution: India- Punjab (Randhawa, 1959).

This is the first record of the species from eastern India (Bihar).

***Spirogyra turfosa* Gay (Fig. 2D-F)**

(Randhawa, 1959, p. 319, figs. 297)

Vegetative cells 64-72 μm \times 136-188 μm with plane end walls, chloroplasts 3-4 with 3 turns, conjugation scalariform, conjugation tube formed by both gametangia, zygospore pointed ellipsoid 68-72 μm \times 108-120 μm , yellow, median spore wall is smooth.

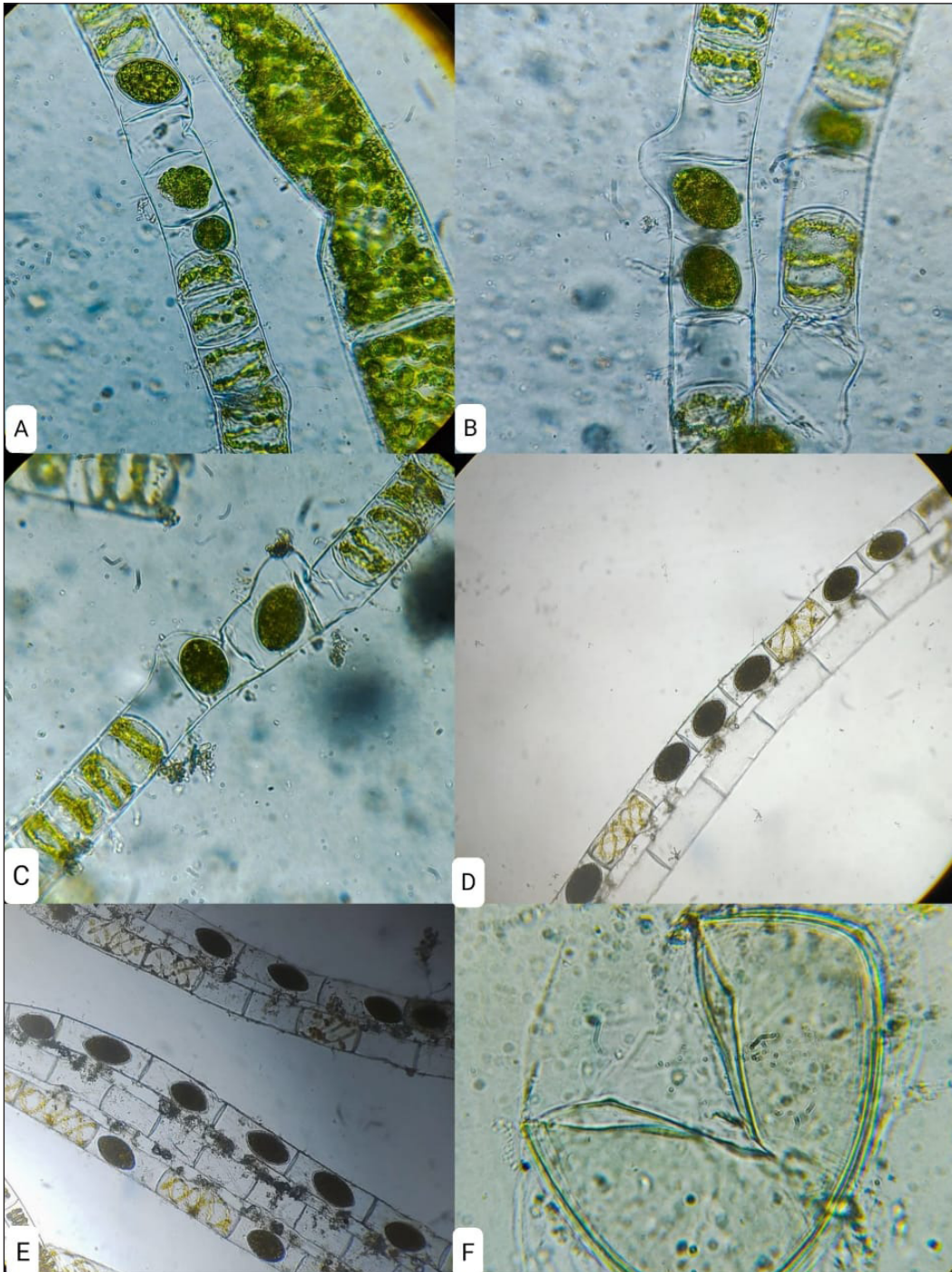


Figure 2: (A-C): *Spirogyra sahnii* Randhawa; (D-F): *Spirogyra turfosa* Gay; (G-L)

The present specimen has one interesting feature – the male filament conjugates with one female filament on either side of it and zygospores form in an alternating pattern.

Habitat: Freshwater ditch

Collection No. AK-56, December 13, 2021, from a ditch (pH 6.5, temp 22°C) of Dharuara (Dist. Darbhanga) growing along with *Oedogonium*.

Distribution: India-Bombay (Randhawa, 1959), Kerala (DIST. Quilon, Usha Devi & Panikkar, 1994); Galicia, United States of America (Randhawa, 1959).

This is the first record of the species from eastern India (Bihar).

Discussion:

None except *Spirogyra columbiana* showed repeated occurrences in different habitats of the region. Survey of literature (Kargupta & Jha, 2004) also confirms this. It appears from current investigations that *Spirogyra* prefers shallow water of ditches, puddles and temporary water bodies. A period between the second week of January to the last week of March appears most favourable for the growth of *Spirogyra* species in Indian conditions. Moreover, in India fully mature fruiting stage is observed at pH 6 to 7.5 and temperature 17°C to 30°C (Kargupta & Jha, 1995) while in the U.S.A the favourable pH and temperature for the growth of Zygnemataceae are 6.1 and 19°C (McCourt et al., 1986). The study of distribution of all the five taxa reveals that *S. columbiana* is commonly occurring taxon. Hence, it may be selected for further study as pollution indicator, bioremediation and other purpose.

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