



## Morpho – taxonomic studies on the genus *Mougeotia* C A Agardh (Chlorophyta) occurring in freshwater bodies of Jammu and Kashmir

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### ABSTRACT

Four species of *Mougeotia* C.A. Agardh 1824 (Zygnemophyta, Chlorophyceae) were collected during 2008 to 2010 from different freshwater habitats of three districts of Jammu province viz., Samba district, Jammu district and Udhampur district. They were taxonomically determined on the basis of vegetative structure and reproductive structure. Their reproduction was mostly studied during winters and spring seasons. Both lateral conjugation and scalariform conjugation were observed. The scalariform conjugation was most common type of conjugation method among species. *M. miamiana*, *M. trapezeiformis*, *M. floridana* and *M. uberosperma* were taxonomically determined and have been described for first time in Jammu. All four species were found abundantly in both lentic and lotic water habitat.

**Key words:** *Mougeotia*, Vegetative Structure, Reproductive structure, Lateral conjugation, Scalariform conjugation, morpho-taxonomic, lentic and lotic water bodies.

### INTRODUCTON

Zygnematales, commonly known as pond scum make up the filamentous periphyton in ponds, growing on and around the larger aquatic plants, generally occurring in every kind of fresh water habitat. This filamentous green algae has been studied by a large number of phycologists all around the world. The order zygnematales comprises of 13 genera i.e, *Mougeotiopsis*, *Tennogametum*, *Debarya*, *Mougeotia*, *Pleurodiscus*, *Zygonium*, *Zygnema*, *Zygnemopsis*, *Entransia*, *Sirogonium*, *Hallasea*, *Spirogyra*, *Sirogonium*, *Sicrocladium* (Randhawa,1959). This genus is characterized by simple or often branched filaments, symmetrical cells, elaborate chloroplasts and amoeboid gametes. Among these, the most important characters which keep the Zygnematales apart from all the green algae are the conjugation by amoeboid gametes.

Martens (1869) was the first to record the occurrence of Zygnematales in India from Raneeganj area of West Bengal. Randhawa (1940) recorded various filament green algae growing in Indian fresh water and later in 1959 compiled these filamentous green algae in his monogram '*Zygnemaceae*'.

Ahmed (1968) described the vegetative and reproductive structure of *Mougeotia elegantula* from algal flora of Madhya Pardesh. Chadha & Pandey (1983) gave an account of vegetative and reproductive characters of *Mougeotia* in the checklist of algae occurring in India.

Five species of *Mougeotia* were reported by Asheteka & Kamat (1978) from Aurangabad, Maharashtra. Kargupta (1998) identified 11 species including a new variety of genus *Mougeotia* from West Bengal.

In the records of Jammu, earlier work in recording 17 more taxa belonging to Zygnemataceae was conducted by Misra (1937) in fresh waters of J&K. Kant & Kachroo (1970) & Kant (1974) stated that about 80% of aquatic plants population in Lakes of Kashmir was represented by Conjugales. Kant & Raina (1990) reported four species of *Mougeotia* from ponds in Botanical Garden of University of Jammu.

Since then no much work had been done in the field of taxonomic studies of *Mougeotia* growing in Jammu waters. Keeping in view the paucity of the work done on morphology and taxonomic studies on *Mougeotia*, an extensive survey had been conducted

in three districts of Jammu (Jammu, Samba and Udhampur) from 2008 to 2010. While surveying various local water bodies like pond, puddles, road side ditches, lakes, slow moving streams, rivers etc. four species of *Mougeotia* were studied, all the four species described were new to taxonomy of Jammu i.e., *M. miamiana*, *M. trapeziformis*, *M. floridana* and *M. uberosperma*. While *M. miamiana* and *M. uberosperma* were even new to Indian Taxonomy.

## MATERIALS AND METHODS

Collections were made from Samba, Udhampur and Jammu districts of Jammu province during the period of January 2008 to March 2010. The specimens were obtained by hand-picking from various freshwater habitats like fountain water, running water channels, stagnant ponds and road-side puddles. They were preserved in glass bottles containing 5 % formalin and brought to the laboratory, where they were stained in iodine solution and examined in 10 % glycerin mounts under light microscope. Their drawings were made with the help of camera lucida and were micro photographed. The material was taxonomically determined with the help of authentic literature (Randhawa, 1959; Transeau, 1951; Chin-Chin, 1982; Vidyavati, 1995; Kargupta and Jha, 2004; Taft, 2009).

## RESULTS

Four species of pond scum genus *Mougeotia* ( phylum Chlorophyta, class Chlorophyceae, order Zygnemetales, family Zygnemetales) have been identified. Their taxonomic enumeration is as follows:

### *Mougeotia* C.A Agardh 1824

The genus *Mougeotia* was founded by Agardh in 1824 and is represented by large number of species, filaments are free floating and rarely attached.

**Vegetative features:** Filament unbranched consisting of cylindrical cells; cells many times longer than broad with plane end walls; chloroplast a flat, axial plate with the nucleus opposed to the cell wall.

**Reproductive features:** Reproduction by zygospores, while in some by aplanospores; conjugation largely scalar form rarely lateral; during conjungtanganal bulges and the ggation, a small papillae develop by the conjugating cells which unite and fuse to form conjugating tube, subsequently, the conjugation canal bulges and the gametangia are cut off by one or two walls; Cytoplasmic residue is left behind in the gametangia and aplanosporangia, zygospores spheroid, compressed- spheroid, ovoid, ellipsoid, dolioform or quadrate- ovoid, median wall either colourless and smooth or variously coloured and ornamented; aplanospores resemble zygospore.

The following four species were collected which may be distinguished as follows:

### Key to the local species of genus *Mougeotia*

- 1(a) Reproduction by aplanospores..... *M. miamiana*
- 1(b) Reproduction by zygospores..... 2
- 2 (a) Sporangia dividing one of the gametangia..... 3
- 3 (a) Vegetative cell less than 14 $\mu$  broad ..... *M. trapeziformis*
- 3 (b) Vegetative cell more than 14 $\mu$  broad..... *M. floridana*
- 2 (b) Sporangia dividing both gametangia ..... *M. uberosperma*

#### 1. *Mougeotia miamiana* Transeau.

(Transeau.1934.Trans. Amer.Micros.Soc. p.222, pl.19, figs. 41-42; Randhawa, 1959, The Zygnemataceae, p 168, fig. 102 a-b)

**Habitat and Habit:** Lentic/ lotic water conditions ; Free floating.

**Vegetative feature:** Vegetative cells 6 -10 $\mu$  x 100-125 $\mu$  ; end wall plane ; chloroplast single, with 4-6 pyrenoids in a row ( Plate-I; Fig-1).

**Reproductive features :** Conjugation unknown; aplanospores formed in the middle of the straight or slightly angled cells; Zygosporangia ellipsoid , 15-20 $\mu$  x 22-32  $\mu$ ; spore wall punctuate, brown ( Plate-I; Fig-2 &3).

**Geographical distribution:**

World : U.S.A.

India: Not reported earlier (**new record**).

Jammu: Paddy fields of R S Pura (17-9-2009); overflown water at Bari-Brahmanan (21-11-2008). **New records**.

**Variations recorded :** This species was collected in winter seasons from the ditches, fields, ponds and puddles. This species is highly variable in vegetative cell dimensions; end wall shows variability; reproductive cells also showed variability in nature i.e., varied from cylindrical to enlarged shape, conjugation types differed from scalariform to lateral ; Zygosporangia layers also showed variations.

2. *Mougeotia trapaeziformes* Iyenger .

( Iyenger ;Randhawa, 1959, The Zygnemataceae : p. 173, fig.107,a-c; Mahota& Mahota.1999).

**Habitat and Habit:** Lentic water condition ; Free floating.

**Vegetative feature:** vegetative cells 4 – 5.5 $\mu$  x 30-60 $\mu$  ; end wall plane ; chloroplast single with 4-6 pyrenoid in row. (Plate-I; Fig-4).

**Reproductive features :** Conjugation unknown; Zygosporangia elliptic with the ends produced into short conical end, 12-13 x 15-20  $\mu$ ; spore wall smooth, yellowish brown. (Plate-I; Fig-5 & 6).

**Geographical Distribution:**

India: Banglore,Mysore state.

Jammu: Barren fields Tikkri, Udhampur (19-11-2008), Pond of Sagoon (21-10- 2008), River Tawi tributary, Sacoon (14-12-2008). **New record**.

**Variation recorded:** This species was collected in winter seasons from the ditches, fields, ponds and puddles and is rice field after monsoons. This species is highly variable in vegetative cell dimensions; Zygosporangia variations in dimension and shape differed.

3. *Mougeotia floridana* Transeau.

(Transeau.1934.Trans. Amer. Micros. Soc. p.224; Randhawa, 1959, The Zygnemataceae : p.154, fig.74 a-b).

**Habitat and Habit:** Lentic /Lotic water condition ; Free floating.

**Vegetative feature:** Vegetative cells 12 - 22 $\mu$  x 60 - 120 $\mu$  ; with plane ends ;chloroplast with 6-8 pyrenoids . (Plate-I; Fig-7).

**Reproductive features :** Conjugation Scalariform; Zygosporangia occupying the middle of receptive gametangia ; Zygosporangia globose to ovoid, 30-42 x 36-50 $\mu$  ; spore wall smooth ,brown . (Plate-I; Fig-8 & 9).

**Geographical distribution:**

World : U.S.A.

India: U.P.

Jammu: Slow moving stream Pragwal (19-11-2008), River Tawi tributary at Nagrota (24-10-2008), ditches at Pragwal (19-11-2009). **New record.**

**Variation recorded:** This species was collected in winter seasons from the ditches, fields, ponds and puddles. This species is highly variable in vegetative cell dimensions, Conjugation type varied . Zygospore show variations in dimension, shape and number of layers.

#### 4. *Mougeotia ubersperma* West.

(West.1987. Jour. Bot.53, p. 37; Randhawa .1959. The Zygnemataceae. p.159, fig.85 a-b).

**Habitat and Habit:** Letic/ Lotic water condition ; Free floating.

**Vegetative feature:** Vegetative cells 8-10 $\mu$  x 30-62 $\mu$  ; plane end walls; chloroplast 1 plate-like. (Plate-I; Fig-10).

**Reproductive features :** Conjugation scalariform; aplanospores ellipsoid, 18-25 x 21-27  $\mu$ ; smooth walled, brown (Plate-I; Fig-11).

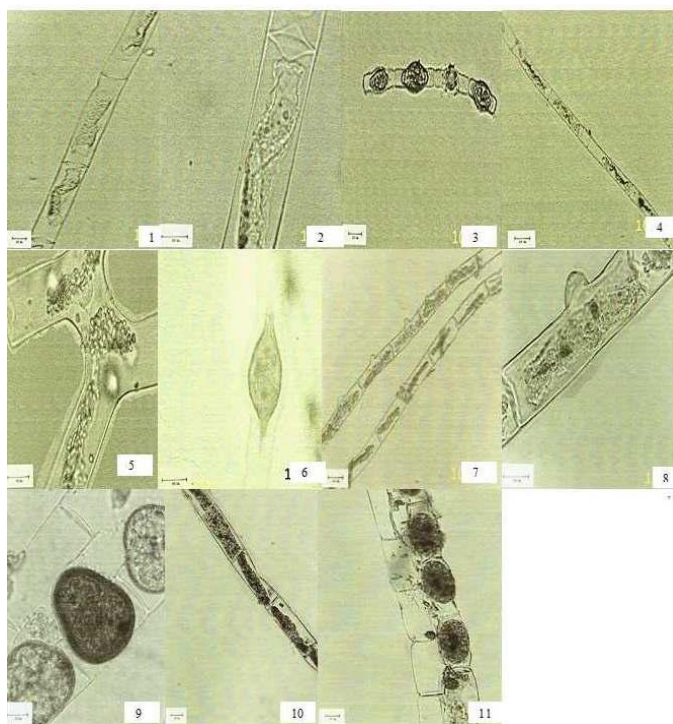
**Geographical distribution:**

World : Africa.

India: Not reported earlier. **New record.**

Jammu: Paddy field at RS Pura (15-08-2009), cannal for irrigation at Bishnah (26-11-2008).

**Variation recorded:** This species was collected in winter seasons from the ditches, fields, ponds and puddles. This species is highly variable in vegetative cell dimensions; Zygospore varied in dimensions and wall layers.



**Plate 1** Fig.1- *M. miamiana* vegetative filament; Fig.2- *M. miamiana* coeligate septa formed by the filament; Fig.3- *M. miamiana* Aplanospore; Fig.4- *M. trapezeiformes* vegetative filament; Fig.5-*M. trapezeiformes* scalariform conjugation ; Fig.6- *M. trapezeiformes* Zygospores within the gametangia; Fig.7- *M. floridana* vegetative filament; Fig.8- *M. floridana* filament with papilla; Fig.9- *M. floridana* Aplanospores; Fig.10- *M. ubersperma* vegetative filament; Fig.11- *M. ubersperma* conjugation tubes formed by filament.

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