SOME PECULIARITIES IN CONJUGATION IN A NEW HIMALAYAN SPECIES OF *ZYGNEMA*

BY M. S. RANDHAWA
(*Allahabad*)

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AN interesting species of *Zygnema* was collected by the author from a fresh-water stream near Kapkot, district Almora, on the way to Pindari glacier on 14th September 1939. This alga shows a number of peculiarities in conjugation which it is desired to record in this paper.

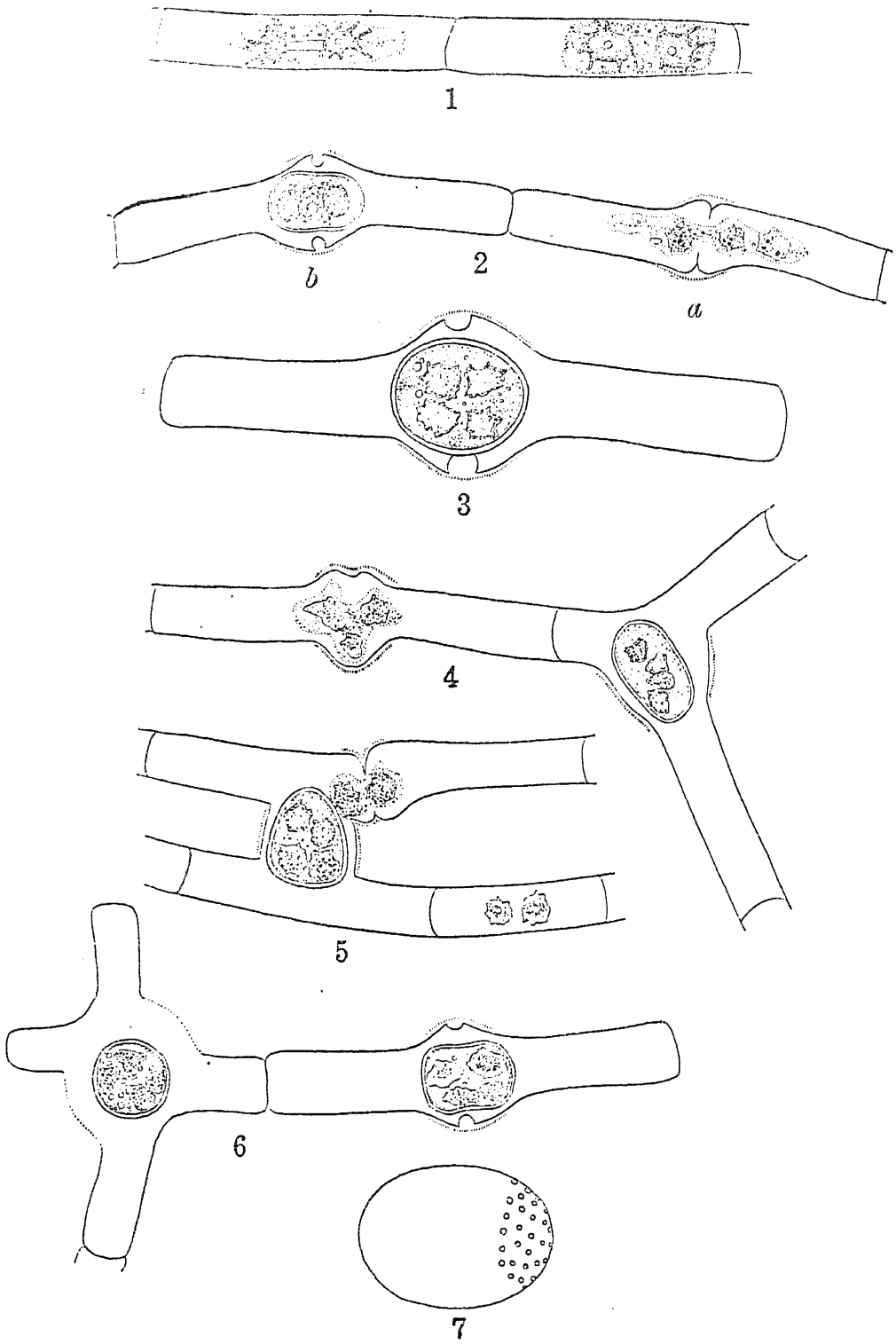
The vegetative cells are on the average 21 μ broad and 3–6 times as long. Usually each cell contains two stellate chloroplasts, but in some cases cells containing four chloroplasts were also found.

Conjugation

Lateral conjugation is the predominant mode of conjugation in this species of *Zygnema*, though scalariform conjugation is also seen in some filaments. In some cases neighbouring cells may be found conjugating in a ladder-like and lateral fashion (Fig. 6). Between these two set modes of conjugation, we find a number of intermixed stages showing a conflict between two different sexual tendencies of this alga. In one case it was seen that though a zygospore had formed by the fusion of protoplasm from two opposite cells in the conjugation canal, still the chloroplasts and protoplasm from a neighbouring cell had invaded a portion of one of the cells in an abortive attempt to conjugate laterally (Fig. 5). An opposite case was also noticed where two neighbouring cells had conjugated laterally and produced an immature zygospore, and a contiguous cell of a neighbouring filament gave out a broad conjugation canal which could be seen attached to it.

In one instance it was seen that the terminal cell of a filament had fused with the middle part of another resulting in the formation of a zygospore surrounded by three arms of the gametangia (Fig. 4). This resembles the three-horned zygospores described by the present author in various species of *Zygnemopsis*.

Lateral Conjugation.—However it is in its peculiar mode of lateral conjugation that this alga differs from other species of *Zygnema* as well as other members of the order Zygnemales. In most of the laterally conjugating species of *Zygnema* and *Spirogyra* tent-like conjugation processes arise



TEXT-FIGS. 1–7. *Zygnema himalayensis* sp. nov.

1. Vegetative cells. 2. Early stages in lateral conjugation. 3. A later stage in lateral conjugation. 4. and 5. Abnormalities in conjugation. 6. Lateral and scalariform conjugation in neighbouring cells. 7. A ripe spore.

All figs. are × 320 except 3 and 7 which are × 410.

from adjacent ends of neighbouring cells, as a result of a gradual protrusion of the longitudinal wall on either side of the septum. In the region of the protrusion the septum breaks down, and the male protoplast passes over to the female cell, where it fuses with the female protoplast. From among Indian forms such a mode of lateral conjugation is seen in *Zygnema mucigena* Randhawa.[4] This is an isogamous mode of lateral conjugation with the zygospore lodged in the female gametangium and is the commonest type prevalent.

Taking the various isogamous modes of conjugation in species of *Zygnema*, the most highly advanced type is seen in *Zygnema Heydrichii* **Schmidle**,[1] in which the conjugation canal area is cut off by a partition wall from the remaining parts of the gametangia, and the zygospore lies in a dome-like space. Comparatively more primitive is the mode of lateral conjugation seen in *Zygnema Czurdae* Randhawa[3] in which also the zygospore lies in the middle and no partition walls are formed. In this case however tent-like outgrowths are formed, and geniculation of cells takes place.

A third and the most primitive type of isogamous lateral conjugation is seen in the present Himalayan form. Unlike all the forms described above, no tent-like projections arise in the present form. In this alga lateral elongation of longitudinal walls takes place on all sides, rather than on one side. As a result the septum ruptures and the protoplasts and chloroplasts from both the mating cells move towards the middle (Fig. 2). This elongation of the side walls is evident from the fact that the cell-walls in the area of fusion bulge out considerably though the chloroplasts are still in a linear row showing the direction in which they have moved (Fig. *a*). Later on the chloroplasts become grouped in a quartette, and the spore-wall is secreted by the protoplasm (Fig. *b*).

The possibilities of such a direct mode of lateral isogamous conjugation were discussed by the present author in his description of *Zygnema terrestris* Randhawa.[4] However unlike the present form no actual fusions in a straight line were observed in that species. The mode of lateral conjugation observed in the present Himalayan form is the simplest and the most primitive described so far.

Mature zygospores are globose or sub-globose, are bluish-green in colour, 36 to 40 μ broad, and 45 to 72 μ long. The spore-wall is scrobiculate with pits 1 to $1\frac{1}{2}$ μ in diameter and 3–4 μ apart (Fig. 7).

This alga differs from all the previously described species of *Zygnema* in its peculiar mode of lateral conjugation and position of zygospores,

and hence it is desirable to describe it as a new species which is called *Z. himalayensis*.

Zygnema himalayensis sp. nov.

Cellulis vegetativis 20–22 μ latis, 60–120 μ longis, conjugation laterali vel interdum scalari, cum fusione gametarum in medio ; zygosporis in tubo conjugationis, globosis vel sub globosis ; 36–40 μ latis, 45–72 μ longis, mesosporio coeruleus-viridio scrobiculato ; scorbiculis 1–1$\frac{1}{2}$ μ diametro, intervallis 3–4 μ.

Habit.—Fresh-water stream, Loharkhet, 5750 feet above sea level, Almora, 15th September 1939.

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