

**SPIROTAENIA DIPLOHELICA spec. nov.
(CHLOROPHYTA, MESOTAENIACEAE)**

P. F. M. COESEL

Hugo de Vries-laboratorium, Universiteit van Amsterdam,
Plantage Middenlaan 2A, 1018 DD Amsterdam

SUMMARY

Spirotaenia diplohelica, found in a moorland pool near Staverden, The Netherlands is described as a new species. It is principally characterised by a double, spiralised and parietally situated chromatophore tape. The systematic position of the new taxon is discussed.

1. INTRODUCTION

In August, 1980, a species of *Spirotaenia* was discovered in a moorland pool near Staverden in the Dutch province of Gelderland, which species is characterised by a double, spiralised and parietal chromatophore tape. This was a remarkable find since all species of *Spirotaenia*, at least those hitherto described as having a chromatophore of the parietal type, were always reported to have a single coiled band (compare KRIEGER 1933). The only published indication of the occurrence of a double coiled chloroplast structure in *Spirotaenia* is in a paper by SKUJA (1964, p. 176, t. 30:15) who figured an alga under the name "*Spirotaenia spec.*" which agrees to a large extent with the recent Dutch find. In his accompanying description SKUJA (l.c.) states that he encountered only a few specimens and for that reason refrained from giving a definitive name and diagnosis. Our own material fortunately was ample enough to permit a description as a new taxon.

2. DESCRIPTION OF THE NEW SPECIES AND ITS HABITAT

As regards the terminology used in the diagnosis, the reader is referred to LÜTKEMÜLLER (1903) for the relevant criteria.

***Spirotaenia diplohelica* Coesel, spec. nov.**

Diagnosis: Cellulae fusiformes apicibus rotundatis diametro $4\frac{1}{2}$ –7 plo longiores. Chlorophorum parietale, consistens in binis taeniis angustis spiraliter contortis extremitatibus utrinque commissis pileolum erubescens. Taeniae laxae tortae 2–3 $\frac{1}{2}$ anfractibus pro cellula, media parte modice, ad apices praerupte adscendentes. Dimensiones: Longitudo 28–44 μm , crassitudo 5.8–7.1 μm . Habitat inter sphagna immersa in lacuna turfosa.

Iconotypus: Figura nostra 1a.

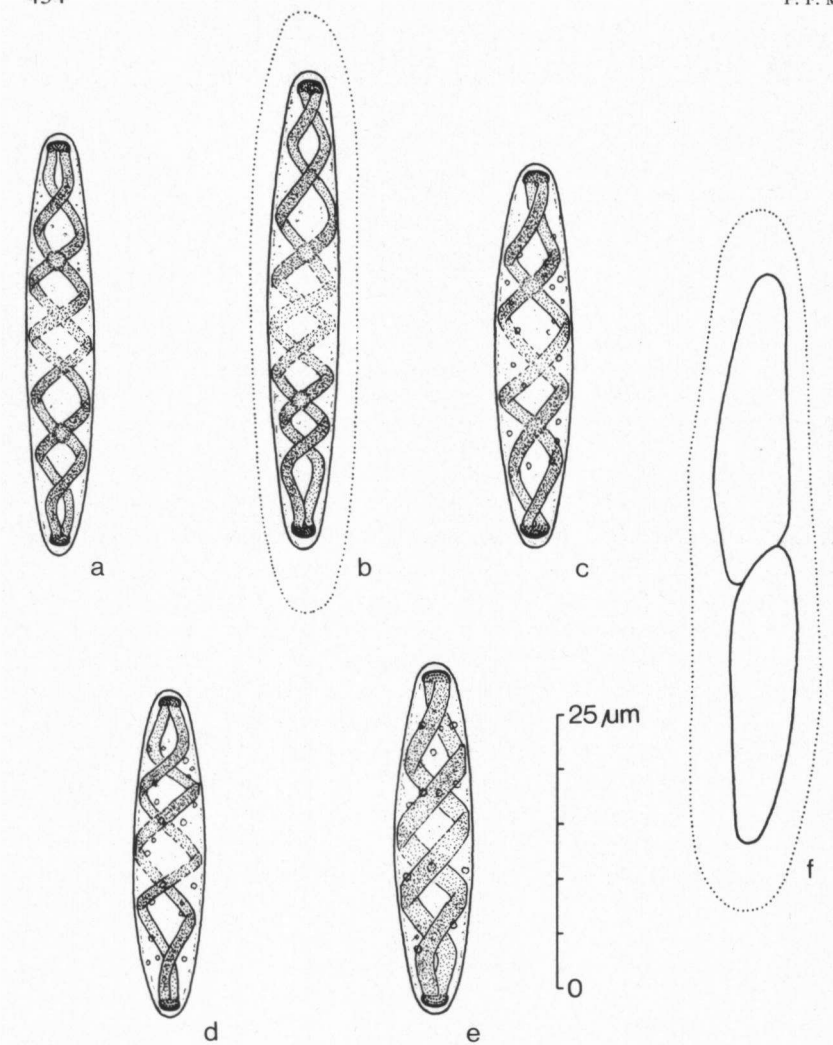


Fig. 1. *Spirotaenia diplohelica* Coesel, spec. nov. — a: iconotypus; f: contours of a recently divided cell (embedded in a mucilaginous envelope).

***Spirotaenia diplohelica* Coesel, spec. nov.**

Diagnosis: Cells fusiform with rounded ends, $4\frac{1}{2}$ –7 times longer than broad. Chromatophore parietal, consisting of two narrow helically coiled tapes connected at both ends to form a cap suffused with red. The tapes are loosely coiled with $2\text{--}3\frac{1}{2}$ coils per cell and moderately sloping in the middle part but more steeply towards the ends.

Dimensions: Length 28–44 μm , breadth 5.8–7.1 μm .

Habitat: In a small peaty pool among submerged *Sphagnum*.

Iconotype: Our figure 1a.

S. diplohelica is a small species with a delicate chloroplast structure which is often but poorly discernible especially when granular assimilates have accumulated. The most striking feature is the presence of two parietally oriented and coiled chloroplast tapes. In the middle of the cell, where the nucleus is situated, the outlines of these bands are often only vaguely defined. Where the tapes reach the two polar ends of the cell they join to form a U-shaped connecting cap which is suffused with red and has a distinct and contrasting red outer contour line. Sometimes a conspicuous mucilaginous sheath can be observed (*figs. 1b, f*) but not infrequently it is not discernible. Conceivably such a sheath is always formed in principle but not rarely liquifies to such an extent that it becomes invisible. It is not clear whether pyrenoids are present or not. In many cases, but by no means consistently, the chloroplast exhibits one or two somewhat lighter and more or less globose structures at the sites where the tapes cross one another in the vertical projection on a flat surface (see *figs. 1a, b, c*). The contours of these structures are so vague, however, that the present author does not venture to identify them as pyrenoids.

The type locality of *S. diplohelica* is an area near Staverden (municipality of Ermelo) known as "De Leemputten" a moist moorland containing a number of larger and smaller pools with a varying degree of trophism and containing a rich and varied desmid flora (COESEL & KOOYMAN-VAN BLOKLAND 1976). The first record of *S. diplohelica* dated from August, 1980, when it was found in a small and shallow pool of about 1 m diam. and about 25 cm deep lying in a soggy stand of *Erica tetralix* L. with much *Sphagnum*, some sparse *Phragmites australis* (Cav.) Trin. ex Steud. and locally much *Narthecium ossifragum* (L.) Huds. In the pool proper *Sphagnum crassifolium* Warnst. var. *obesum* (Wils.) Schimp. and *Sphagnum cuspidatum* Ehrh. were growing and these peat mosses were mostly covered with a brown precipitate of ferric compounds. The sample of algae including *Spirotaenia diplohelica* was obtained by squeezing these two submerged *Sphagnum*-species and contained as dominant species: *Microspora* spp., *Binuclearia tectorum* (Kütz.) Beger ex Wichm., *Frustulia rhomboides* (Ehr.) De Toni var. *saxonica* (Rab.) De Toni, *Closterium striolatum* Ehr. ex Ralfs, *Cosmarium tinctum* Ralfs and *Staurastrum arnellii* Boldt var. *spiniferum* W. & G. S. West. *Spirotaenia diplohelica* was collected in the same pool again later in the autumn, 1980, and in the spring of 1981 and appeared to be locally common. At this site the pH fluctuates between 4.1 and 4.9, and the pH-corrected conductivity between 20 μS and 70 $\mu\text{S}/\text{cm}$ (at 25°C). Since *S. diplohelica* was never encountered in any of the other, less acid and more mesotrophic pools during repeated collecting trips in that same area (Mrs. A. Ellis-Adam, pers. comm.), this species can for the time being be ecologically characterised as a benthic, acidophilous, oligotraphentous (and at the same time dystraphentous) organism.

3. DISCUSSION

Of the newly described species of *Spirotaenia* only the vegetative stage was

collected. MOLLENHAUER (in press) has pointed out that the genus *Spirotaenia* has an adequate diagnosis only within the scope of conjugatophycean algae. There is as yet no universally valid criterion to distinguish vegetative conjugatophycean algae from other green algae, and, therefore, the vegetative stage of representatives of the genus *Spirotaenia* form some longish, coccoid and single-celled green algae with a similar chloroplast morphology such as *Koliella spirotaenia* (G. S. West) Hindák and *Elakatothrix spirochroma* (Reverdin) Hindák. Although in this problem of taxonomic identity the mode of sexual reproduction is the only fully convincing criterion, at least a number of representatives of the genus *Spirotaenia* exhibit features hitherto not recorded in other groups of green algae. Many species of *Spirotaenia*, for instance, exhibit the phenomenon that after a nuclear division the new transverse cell wall is initially perpendicular to the longitudinal axis of the cell but soon assumes a slanting position (KRIEGER 1933, p. 48). Subsequently the two daughter cells shift along laterally one beside the other whilst they at the same time grow out to assume the contour of the mother cell. This process constitutes according to MOLLENHAUER (in press) a conjugatophycean-like cell division never found in chlorococcalean green algae. Another typical feature of a number of species of *Spirotaenia* is the reddish suffusion of the polar ends of the chromatophore by the local accumulation of carotenoids. According to GEITLER (1943, 1959) this phenomenon is not met with in any other group of green algae. Unfortunately not all species of *Spirotaenia* exhibit both characteristics, so that the presence of these features cannot serve as a general taxonomic criterion to define the genus. Since our new species shows both the cross wall inclination (see *fig. 1f*) and the local carotenoid accumulation, however, there are cogent reasons to refer it – naturally also on account of its chloroplast morphology – to the genus *Spirotaenia*.

The genus *Spirotaenia* was divided by RABENHORST (1863, p. 177) into two subgenera on account of the presence of one tape per cell (in the subgenus *Monotaeniae*) or of more tapes (in the *Polytaeniae*). LÜTKEMÜLLER (1895), after painstaking observations of crudely cultured material, came to the conclusion that in *Spirotaenia* the chromatophore is not consistently of the parietal type as had previously always been assumed. In at least four species he established the presence of a central (*i.e.*, axial) chromatophore provided with a number of helical longitudinal ridges, and he, accordingly, subdivided the genus into a group with a parietal and one with a centrally situated chromatophore. Since his classification coincided with the previously current one in *Monotaeniae* and *Polytaeniae* LÜTKEMÜLLER retained the names introduced by RABENHORST (1863) but adapted the diagnostic characterisation of these subgenera accordingly. In this emended diagnosis of the *Monotaeniae* Rabh. and *Polytaeniae* Rabh. of LÜTKEMÜLLER (1895), adopted in, *e.g.*, the well-known desmid floras of WEST & WEST (1904) and of KRIEGER (1933), therefore, not the number of chromatophore tapes is so crucial any more but rather the parietal or central position of the chromatophore.

It goes without saying that the species *S. diplohelica* described in the present paper even if provided with two chromatophore tapes, is most closely related to

the section (or subgenus) *Monotaeniae*. As far as can be ascertained, apart from the previously mentioned, incompletely diagnosed species discussed by SKUJA (1964), *S. diplohelica* is the only species of the genus with two parietal chromatophore tapes. A rather similar diagnosis of *S. bispiralis* by WEST (1892) was queried by LÜTKEMÜLLER (1895) and was subsequently emended in WEST & WEST (1904) by characterising the species in question as having a central chromatophore and by referring it accordingly to the *Polytaeniae*.

The species with an undoubtedly bitaeniata, parietal chromatophore mentioned by SKUJA (1964) is almost certainly closely related with *S. diplohelica*, but it differs clearly from it in several respects: the *Spirotaenia* spec. of SKUJA (l.c.) is much larger (78–82 μm \times 9–9.5 μm), it has more truncate than rounded ends, its chromatophore tapes slant more evenly from pole to pole and it has differently constructed polar terminations of these tapes (they are provided with two oblong, orange carotenoid bodies connected by a less intensively coloured zone, which image presumably represents the lateral projection of what is in fact a subannular single carotenoid body). As long as no additional material of SKUJA's species has been found (so that an insight can be obtained into the range of variation of a number of characters) it is better to refrain from giving it a definite taxonomic status.

ACKNOWLEDGEMENTS

The author wishes to express his indebtedness to Mrs. A. Ellis-Adam for putting the samples at his disposal and for providing the Latin diagnosis.

Professor A. D. J. Meeuse kindly took care of the English rendering of the manuscript.

REFERENCES

- COESEL, P. F. M. & H. KOOYMAN-VAN BLOKLAND (1976): Bijdragen tot de kennis der Nederlandse Desmidiaceenflora 4. De leemputten bij Staverden. *Gorteria* **8**: 61–69.
- GEITLER, L. (1943): Lokalisierte Karotinbildung in langgestreckten Algenzellen. *Oesterr. Bot. Z.* **92**: 212–214.
- (1959): Morphologische, entwicklungsgeschichtliche und systematische Notizen über einige Süßwasseralgen. *Oesterr. Bot. Z.* **106**: 159–171.
- KRIEGER, W. (1933): Die Desmidiaceen Europas, mit Berücksichtigung der aussereuropäischen Arten. *Rabenhorst's Kryptogam. – Fl. Deutschl., Öst., Schweiz.* Band 13, Abt. 1, Teil 1, Lief. 1. Akademische Verlagsgesellschaft, Leipzig.
- LÜTKEMÜLLER, J. (1895): Über die Gattung *Spirotaenia* Bréb. *Oesterr. Bot. Z.* **45**: 1–6, 51–57, 88–94.
- (1903): Über die Gattung *Spirotaenia* Bréb. II, *Oesterr. Bot. Z.* **53**: 396–405, 483–488.
- MOLLENHAUER, D.: Contributions towards a revision of the genus *Spirotaenia* (Mesotaeniaceae). *Beih. Nova Hedwigia* **56** (in press).
- RABENHORST, L. (1863). *Kryptogamenflora von Sachsen, der Ober-Lausitz, Thüringen und Nordböhmen, mit Berücksichtigung der benachbarten Länder.* I Abt., Leipzig.
- SKUJA, H. (1964): Grundzüge der Algenflora und Algenvegetation der Fjeldgegenden um Abisko in Schwedisch-Lappland. *Nova Acta Regiae Soc. Sci. Upsal.*, ser. 4, **18**: 1–465.
- WEST, W. (1892): A contribution to the freshwater algae of West Ireland. *J. Linn. Soc., Bot.* **29**: 103–216.
- & G. S. WEST (1904): *A monograph of the British Desmidiaceae.* Vol. 1. Ray Society, London.