

A reappraisal of *Staurastrum vestitum* J. Ralfs 1848 and its varieties

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Abstract

When researching *Staurastrum vestitum* for a separate project, it became clear that it was a taxonomically confused species complex. This manuscript is an attempt to provide the nominate species and the numerous associated infraspecific taxa with a more tightly defined structure.

Keywords

Desmids, *Staurastrum vestitum*, *Staurastrum vestitumiforme*, *Staurastrum parvestitumiforme*, *Staurastrum pseudovestitum*, *Staurastrum gymnovestitum*, *Staurastrum croasdaleae*, *Staurastrum landwasserense*

Introduction

In February 2026 I made a brief trip to the Isle of Lewis, the most northerly inhabited island in the Outer Hebridean archipelago. It is contiguous to the Isle of Harris without an identifiable border. Hence, they are usually spoken of as one: Harris and Lewis (fig. 1). The islands are composed of granite, predominantly Lewisian gneiss. I had enough time to sample two of the deep moorland lochs, which are noted for some scarce Atlantic *Staurastrum* taxa. I used a plankton net close to the loch-edge. There was some submerged vegetation, but it was unidentifiable so early in the year. The catch was small, but it included *Staurastrum vestitum* and *Staurastrum anatinum* var. *subanatinum*. Researching these taxa prompted this manuscript.

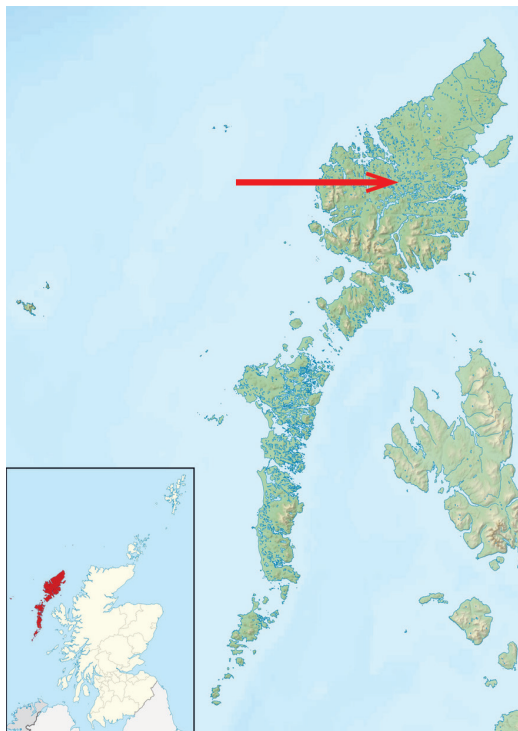


Figure 1. Map showing the geographical position of the Outer Hebrides (inset) and the linked northern islands of Harris and Lewis. Ordnance Survey data © Crown copyright.

Results and discussion

Staurastrum vestitum J. Ralfs 1848

var. *vestitum* f. *vestitum*

Heterotypic synonyms:

Staurastrum vestitum f. *minus* Schmidle 1898: 63, no fig. (as 'minor').

Staurastrum vestitum var. *splendidum* Grönblad 1920: 81, pl. 3: 100–102.

Staurastrum vestitum var. *tortum* West & G.S. West 1898: 317, pl. 18: 16

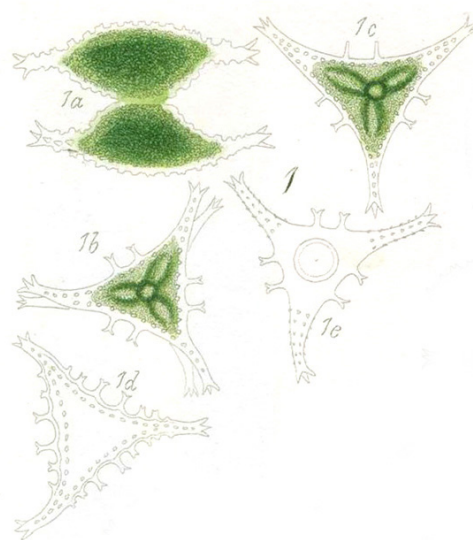
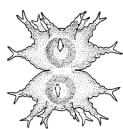


Figure 2. From Ralfs (1848) as *Staurastrum vestitum*.

A medium-sized cell with an open sinus, predominantly 3-radiate, occasionally 4-radiate. Semicells subfusiform to bowl-shaped, apex convex with about six emarginate teeth. On the ventral side there are two or three emarginate teeth extending down from the processes. There are two spines positioned near the centre of the semi-cell, which can be simple or bifurcate. The processes are relatively short and parallel to slightly convergent with three or four spines at the tips. Ralfs (1848: 143) describes them as 'minute', but they vary considerably between populations and can be quite large. In apical view the processes occasionally display some curvature. Also, in apical view the two central spines are prominent, they are quite variable and can be present as simple or bifurcate, the length is also variable but on well ornamented cells they are the most prominent. On either side of these spine are additional teeth which vary from vestigial to quite large and emarginate. Chloroplast axile with a single pyrenoid per semicell. West, West &



Carter (1923: 158) give overall dimensions of LxB: 28–43 x 46–90 μm (I believe the extreme breadth noted here came from a population in the west of Ireland), whereas Ralfs' (l.c.) dimensions (calculated from inches) are LxB: 40 x 60 μm (figs. 2–3).

Overall cell dimensions from the literature: L: 28–53 μm ; B: 40–61(–90) μm ; Is: (9–)11.6–17 μm , L/B: 0.66–0.70.

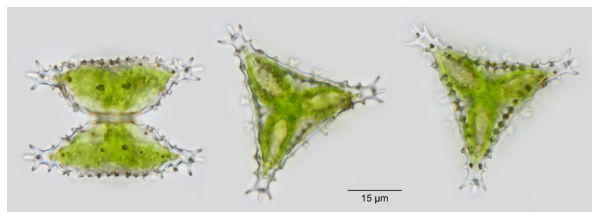


Figure 3. *Staurastrum vestitum*. Photo © Chris Johnson.

Occurrence

A widespread species in Europe and North America but not common. Found in slightly acidic habitats such as in the plankton of lochs and lakes, especially at altitude.

Notes

Much has been written and debated regarding this extremely variable species and its relationship with *St. aculeatum* Ralfs 1848, but there is little to be gained by reciting these texts except where it is pertinent to the varieties under discussion.

From northern Sweden Schmidle (1898: 63, no fig.) described a small taxon as *Staurastrum vestitum* f. *minus*, (as 'minor'). His dimensions (L: 32; B: 40–46 μm) fit the lower range of the nominate variety. It has been synonymised here.

From Finland Grönblad (1920: 81, pl. 3: 100–102) described a 4-radiate cell which he named as *St. vestitum* var. *splendidum*. For cell dimensions he gives L: 53 μm ; B: 68 μm ; Is: 17 μm . Single measurements suggest just a single specimen was recorded. The rather broad isthmus might be a feature of the 4-radiate cells. I see nothing here that is outside *St. vestitum*'s natural variability, hence, it has been synonymised here (fig. 4).

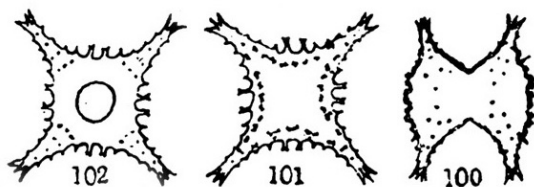


Figure 4. From Grönblad (1920) as *Staurastrum vestitum* var. *splendidum*.

Coesel & Meesters (2013, pl. 82: 6–9) include other cells as var. *splendidum*. In their figure 9 after Kouwets (1987, erroneously dated 1989) the face and apical views are linked, which is not the case in Kouwets' original drawing (l.c., pl. 19: 15–16). I see Kouwets' (l.c., figs. 13, 15–16) drawings all conforming to *St. vestitum*. On the

same plate (l.c., fig. 14), with its divergent processes, this would be better described as *St. pseudovestitum* (see its description below) (fig. 5).

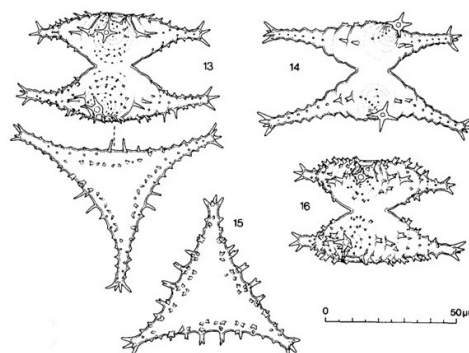


Figure 5. From Kouwets (1987) captioned as *Staurastrum vestitum* (as *S. vestitum* Ralfs, morphae in the text (l.c.: 255)).

Coesel & Meesters (l.c., fig. 7) after Lenzenweger (1989a: 41, fig. 123), illustrate a 4-radiate cell with concave sides in apical view giving the impression that the ornamentation is of a similar length. A closer look shows that the two central bifurcate spines on three of the four sides are longer, suggesting that this is just a well ornamented cell and should be described as *St. vestitum* (fig. 6). Interestingly, the isthmus, calculated

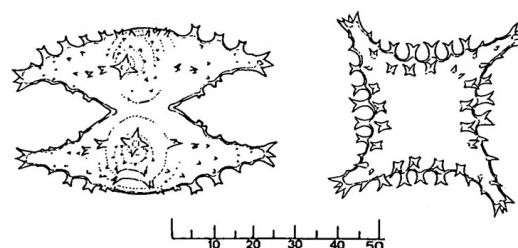


Figure 6. From Lenzenweger (1989a) as *Staurastrum vestitum* var. *splendidum*.

from the scale bar is 17 μm , identical to Grönblad's (l.c.) 4-radiate cell. The final image in Coesel & Meesters (l.c., fig. 8) after Lenzenweger (1989b: 531, fig. 54) was originally described as *St. vestitum*. In apical view it has the characteristic two central spines as simple or bifurcate, rather camouflaged by the abundant subapical bifurcate spines. It has little in common with the doubtful and

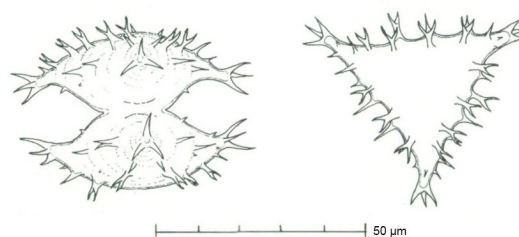


Figure 7. From Lenzenweger (1989b) as *Staurastrum vestitum*.

now synonymised *St. vestitum* var. *splendidum*. The spiny termini to the processes have a little in common with *St. aculeatum* but it is better left as originally designated (fig. 7).

From North America we get *St. vestitum* var. *tortum* West & West (1898, pl. 18: 16) and later from Canada by Irénée-Marie (1939, pl. 56: 4–5). It is named for a curvature in the processes and an insignificant axial twist when viewed apically. Neither of these works illustrates the cell in face-view (fig. 8). Ralfs (l.c., pl. 23: 1d – see our fig. 2) shows some cells having a propensity to display a curvature of the processes. Ralfs does not specifically mention this in the text but having illustrated it, it is not unreasonable to suggest it is an occasional feature. Var. *tortum* has been synonymised here.

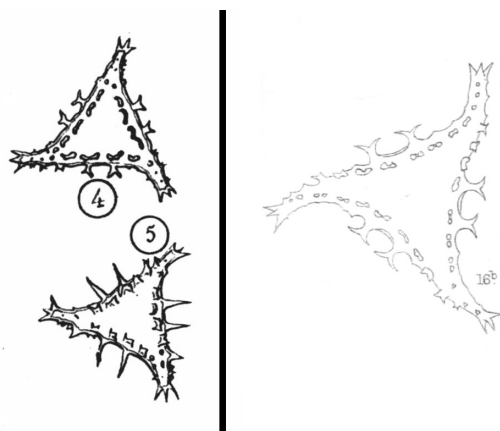


Figure 8. From West & West (1898) (right) Irénée-Marie (1939) (left) as *Staurastrum vestitum* var. *tortum*.

Below are several varieties associated with *St. vestitum*, which are treated separately.

***Staurastrum vestitumiforme* C.D.N. Johnson 2026 nom. & stat. nov.**

Homotypic synonyms:

Staurastrum vestitum var. *subanatinum* W. & G.S. West 1902: 54, pl. 1: 28 (replaced synonym).

Staurastrum anatinum var. *subanatinum* (W. & G.S. West) P.F.M. Coesel & J.K. Meesters 2013: 63, pl. 85: 1–3.

A medium to large cell, predominantly (entirely?) 3-radiate, deeply constricted with an open acute sinus. Semicells cup- or bowl-shaped with the apex roughly truncate embellished with up to six emarginate or simple teeth. The lengthy processes are divergent to varying degrees ornamented with a concentric series of denticulations, which, towards the cell-body, can be emarginate. The processes are tipped with usually three spines of varying length. In face-view there are two bifurcate spines close to the median line of the semicell. On either side there is often a series of smaller or larger dentitions, some occasionally bifurcate. In apical view these two bifurcate spines show prominently.

Chloroplast axile with a single pyrenoid per semicell (figs. 9–10).

Overall cell dimensions from the literature: L: 34–44 µm; B: 70–102 µm; ls: 11.6–13.5 µm; L/B: 0.49–0.60.

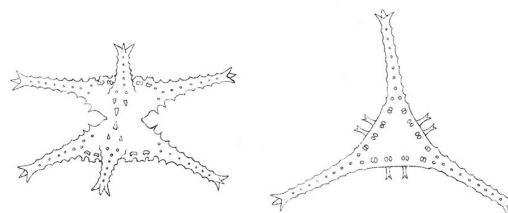


Figure 9. From West & West (1902) as *Staurastrum vestitum* var. *subanatinum*.

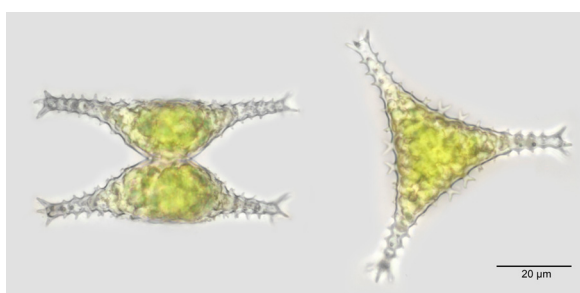


Figure 10. *Staurastrum vestitum* var. *subanatinum*. Photo © Chris Johnson.

Occurrence

Found in slightly acidic habitats mainly in the plankton of deeper lochs and lakes, especially at altitude and less frequently in moorland pools with *Sphagnum*. The Wests (l.c.) record it in abundance in County Galway and from Donegal in Ireland. It is infrequently recorded in the Outer Hebrides. Because of earlier taxonomic confusion, its general distribution is unclear. It probably has an Atlantic-subarctic range.

Notes

West & West (1902: 54) made this a variety of *St. vestitum* based on the characteristic bifurcate spines, as seen best in apical view, but acknowledged the striking resemblance to *St. anatinum* Cooke & Wills 1881. Coesel & Meesters (2013: 63) considered there was a greater affinity to *St. anatinum* and made it a variety of that species, but this is not a view shared here. The Wests (l.c.) considered the two bifurcate central spines as the fundamental diagnostic feature. A quote from Smith (1924: 93) reinforces this view: “This variety is very happily named since it bears a striking resemblance to some of the pelagic varieties of *S. anatinum* Cooke & Wills. The presence of the characteristic verrucae on the side of the semicells shows, however, that the variety belongs with *S. vestitum*.” This taxon clearly straddles two species in its morphological features but doesn’t fit comfortably with either. It is here raised to species level with a charitable nod to *St. vestitum*.

***Staurastrum parvestitumiforme* C.D.N. Johnson 2026
nom. & stat. nov.**

Homotypic synonym:

Staurastrum vestitum var. *parvum* Nygaard 1949:
113–114, fig. 59 (replaced synonym).

A small cell, 3-radiate, deeply constricted with an open acute sinus. Semicells triangular with the apex about truncate embellished with two emarginate teeth. The relatively long processes are divergent and ornamented with four concentric series of denticulations, tipped with small spines. In face-view there are two bifurcate spines close to the median line of the semicells. In apical view the sides are slightly concave with two prominent bifurcate spines (fig. 11).

Cell dimensions after Nygaard: Length without processes 15 µm, with processes 22 µm; B: 31–33 µm; Is: 5.5 µm.

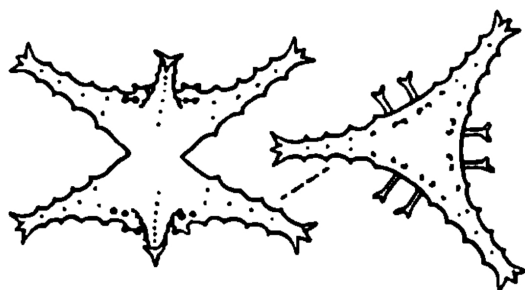


Figure 11. From Nygaard (1950) as *Staurastrum vestitum* var. *parvum*.

Occurrence

Found in Holmsø, north of Esbjerg, West Jutland, Denmark, ‘free-swimming’ with plankton dominated by *Peridinium willei*. It was found in oligotrophic, acidic waters with a pH 4.6. The taxon was found in very small quantities.

Notes

Nygaard (l.c.) notes it bears most resemblance to *St. vestitum* var. *subanatinum* West & G.S. West 1902 but less than half its size. Apart from the size difference, it seems to prefer a markedly acidic environment. This seemingly unique taxon justifies a species name and a link to the newly proposed *St. vestitumiforme* Johnson 2026 is desirable.

***Staurastrum pseudovestitum* C.D.N. Johnson 2026
nom. & stat. nov.**

Homotypic synonym:

Staurastrum vestitum var. *abundans* Korschikov 1941:
66, 74, pl. 6: 7 (replaced synonym).

A robust medium-sized cell a little broader than long, 3-radiate, deeply constricted with an open acute sinus. Semicells fusiform with parallel processes ending in five

or six short spines. The apices are convex and support 6 or 7 emarginate teeth, the central ones being doubly furcate, becoming simple towards the processes. On the ventral side of the semicells from the centre to the tips are two emarginate teeth, and at the base is an encircling row of small spines. In face-view are two bifurcate spines near the median line of the semicells, seen protruding from the sides in apical view, diagnostic of *St. vestitum* (fig. 12).

Cell dimensions after Korschikov: L: 50 µm; B: c.60 µm; Is: 14.5–15 µm.

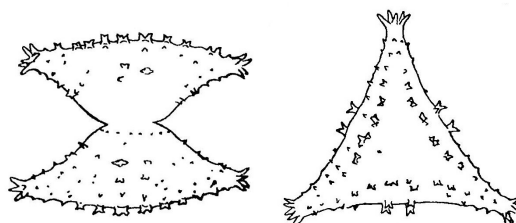


Figure 12. From Korschikov (1941) as *Staurastrum vestitum* var. *abundans*.

Occurrence

Only known from plankton in the Niva River in Murmansk Oblast, Russia, which flows into the Kandalaksha Gulf of the White Sea. Presumably from a backwater where the flow was almost still.

Notes

It has the characteristic median bifurcate spines diagnostic of *St. vestitum* but differs in several details. It is more robust and closer to the upper length measurements; the numerous spines at the tip of the processes and the encircling small teeth at the semicell base. Moreover, it has a riverine habitat, located just inside the Arctic Circle. The varietal name given: *abundans* is thought to relate to the abundance of spines. Korschikov (l.c.: 71) in the English summary states that “The general quantity of the planktic population was very small.” This would explain the consistent cell dimensions. It differs sufficiently to warrant species rank but with a name that maintains its link with *St. vestitum*.

***Staurastrum gymnovestitum* C.D.N. Johnson 2026
nom. & stat. nov.**

Homotypic synonym:

Staurastrum vestitum var. *denudatum* Nordstedt 1870:
230, pl. 4: 40 (replaced synonym).

Heterotypic synonym:

Staurastrum vestitum var. *gymnocephalum* Scott & Prescott 1961: 118, pl. 58: 9.

None of the authors give much in the way of a description noting they are smaller than the nominate variety and completely lacking in apical verrucae. In all other respects they reflect the nominate variety.

Cell dimensions: L 19–23 µm; B: 32–43 µm; Is: ca.7 µm.

Notes

Both synonyms noted above display the features of *St. vestitum* but are a lot shorter in length and lack apical ornamentation. Both varietal names refer to this lack of ornamentation. Therefore, 'gymno' meaning unadorned, has been introduced into the epithet (fig. 13).

Occurrence

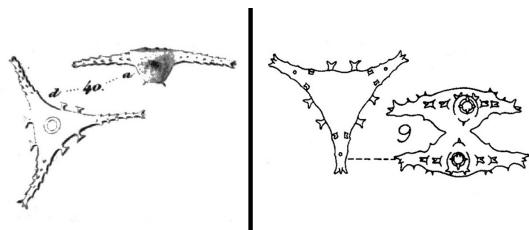


Figure 13. From Nordstedt (1870) as *Staurastrum vestitum* var. *denudatum* (left); Scott & Prescott (1961) as *Staurastrum vestitum* var. *gymnocephalum* (right).

Both collections have come from below the equator: Java, Indonesia and Brazil, hence subject to hot climatic conditions. The author is not aware of any similar taxa being found in the northern hemisphere and it may be exclusively a southern hemisphere desmid.

Staurastrum croasdaleae C.D.N. Johnson 2026 nom. & stat. nov.

Homotypic synonym:

Staurastrum vestitum var. *cedercreutzii* Croasdale 1964: 207, pl. 20: 14, pl. 21: 1–4 (replaced synonym).

A small to medium-sized cell, 3–4-radiate, rarely 5-radiate, deeply constricted with an open acute sinus. Semicells fusiform with parallel processes ending in four (rarely five) short spines. The apices are convex and support simple irregular spines on the margin and across the face of the semicell. In apical view the sides of the triradiate cells are straight, in the 4-radiate they are concave. The denticulate ornamentation is mainly simple, short, and quite random in its distribution (fig. 14).

Cell dimensions after Croasdale: L: 20–35 µm; B: 25–49 µm; Is: 8.5–11 µm.

Occurrence

The collection was made at their designated Station 6, which is in the south-eastern area of Spotted Island off the Labrador coast. From Croasdale's text: "The bedrock consists of Precambrian crystalline rocks of mainly acid character. It is overlaid by Wisconsin Age drift. ... The variety was abundant and variable." No pH was given but it is probably acidic.

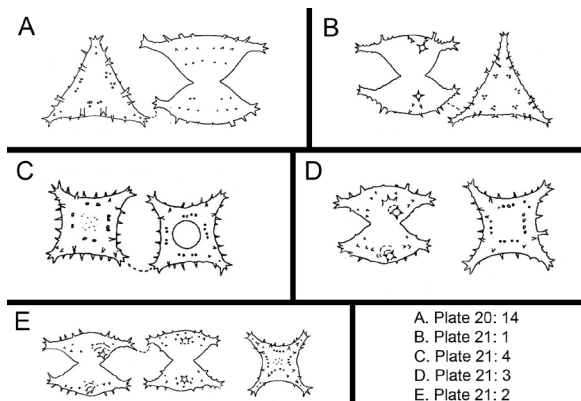


Figure 14. From Croasdale & Grönblad (1964) as *Staurastrum vestitum* var. *cedercreutzii*.

Notes

It is clear from Croasdale's text that the authors were uncertain where to place this taxon. Croasdale's initial thought was as a variety of *St. aculeatum*, but Grönblad pointed out that "*S. aculeatum* has much more numerous spines – always." After more suggestions it was decided to attach it as a variety of *St. vestitum*. There are some random emarginate teeth but not in the characteristic position that defines *St. vestitum*. It is also worth noting that its length is quite a bit smaller than either of those species, with little overlap. It clearly does not fit comfortably with either of those species the authors considered and would be better given an unrelated name.

Named in honour of Dr Hannah Thompson Croasdale, American botanist (1905–1999).

Staurastrum landwasserense C.D.N. Johnson 2026 nom. & stat. nov.

Homotypic synonym:

Staurastrum vestitum var. *persplendidum* Messikommer 1942: 171, pl. 18: 8–9 (replaced synonym).

Heterotypic synonym:

Staurastrum vestitum var. *montanum* Lenzenweger 1986: 118, pl. 9: 3–6, pl. 11.

A small to medium-sized cell, predominantly 3–5-radiate, deeply constricted with an open acute sinus. Semicells cup- to bell-shaped with stocky, short, parallel processes ending in short spines. Semicells are strongly twisted at the isthmus and are best seen in apical view. In face-view the apices are convex and support usually four emarginate denticulations. Near the semicell centre are two emarginate denticulations, which show clearly in apical view, especially in the 3-radiate cell where the sides are almost straight. They are not quite so obvious in the 4–5-radiate cells where the sides are concave. The remaining dentition, mainly around the processes, is simple. A ring of simple teeth encircles the semicells' bases (figs. 15–18).

Cell dimensions: L: 33.2–38 µm; B: 40–47 µm; Is: 10.8–15 µm.

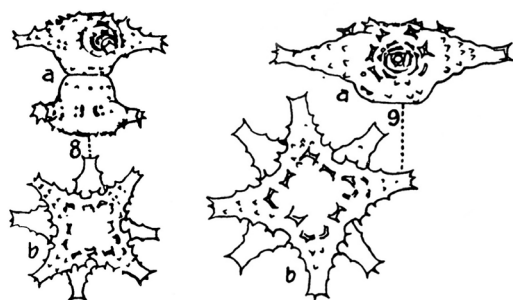


Figure 15. From Messikommer (1942) as *Staurastrum vestitum* var. *persplendidum*.

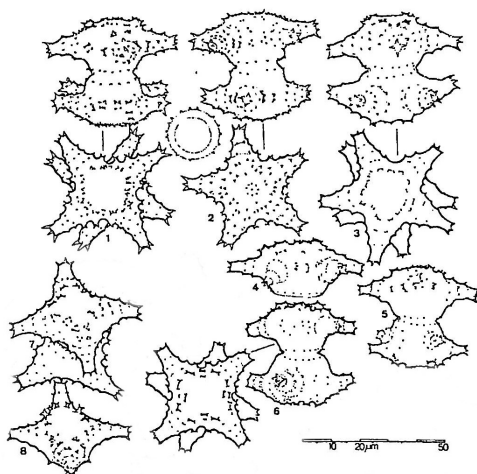


Figure 16. From Lenzenweger (1986) as *Staurastrum vestitum* var. *persplendidum*.

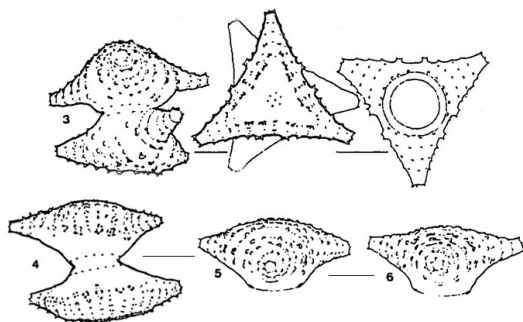


Figure 17. From Lenzenweger (1986) as *Staurastrum vestitum* var. *montanum*.

Occurrence

Messikommer (l.c.) found this taxon at an altitude of over 2500 metres on both sides of the Landwasser valley, near Davos, Switzerland. Collections were made from various waterbodies in the summer months of July and August of 1935 at high altitude before the lakes froze over. It was also found by Lenzenweger (1986: 119, pl. 8: 1–8) in drainage zones of small mountain lakes (Karsee, Pichl-Kainisch, Styria and Hirkarsee, south of Obertraun, Upper Austria) at medium altitudes (500–800 metres). He also found it in the high-altitude

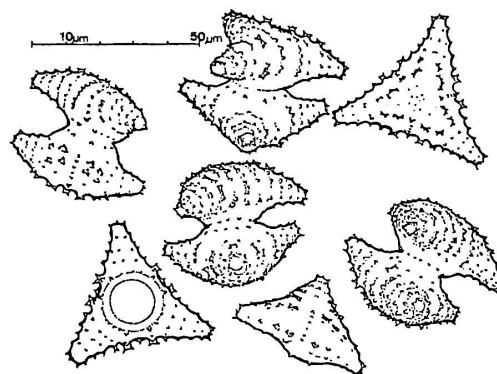


Figure 18. From Lenzenweger (1986) as *Staurastrum vestitum* var. *montanum*.

region around Obertauern. It was found frequently but always in small numbers.

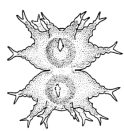
Notes

Most interestingly, Lenzenweger (1986) reported both var. *persplendidum* and his new var. *montanum* from the same region, and commented on their similarity, especially in apical view. I initially had these varieties described as separate species, but close examination of the texts and images persuaded me they were the same. One set of collections was predominantly 4–5-radiate, the other predominantly 3-radiate. It is not always easy to make comparisons with different radiations as the cell shape alters slightly.

Features that are the same: semicells cup- to bell-shaped; semicells twisted at the isthmus, processes stocky at their base; a ring of simple teeth encircles the semicells' bases; a pair of emarginate spines protrude prominently at the midpoint of each semicell side. This is not a known characteristic outside of *St. vestitum*, which are diminutive in comparison to that species. As they appear identical in both the above authors' descriptions and images, it is too much of a coincidence, so I concluded they are the same species. They are also from the same geographical area and altitude. Lenzenweger (l.c.) also commented on the resemblance to *St. vestitum* var. *persplendidum*. The only remote link to *St. vestitum* is the two bifurcate spines emanating from the semicells' centre and seen protruding in apical view. They are quite small leading me to conclude that this is coincidental and a new name, distancing this taxon from *St. vestitum*, is desirable. To avoid any future taxonomic confusion a name has been chosen that reflects the collecting area, noted above.

Doubtful or rejected infraspecific taxa:

Staurastrum vestitum var. *distortum* Wolle 1883: 21, pl. 27: 5–5a. - Wolle's brief description and lack of cell dimensions leaves this cell difficult to evaluate. It seems to have more in common with *St. controversum*.



Staurastrum vestitum f. *minus* F.E. Fritsch & M.F. Rich, nom. illeg. 1937: 214, fig. 27 E. Name already taken: *Staurastrum vestitum* f. *minus* Schmidle, 1898. The authors note: “no good specimens showing the individuals in front-view were obtained, ...” yet they give length and remarkably narrow isthmus dimensions?

Staurastrum vestitum var. *koreana* Skvortzov 1932: 154, pl. 5: 66. – The body is cup-shape to cylindric with a wide-open sinus with a small acute notch at the isthmus. This is more akin to some smaller forms of *Staurastrum manfeldtii* Delponte 1878. It should not be associated with *St. vestitum*.

Staurastrum vestitum var. *incurvum* Hegde 1986: 153, fig. 11. – This unusual desmid is poorly described. The six trifurcate spines are apically positioned. The dimensions given bear no relation to the scaled drawing. It should not be associated with *St. vestitum*.

Staurastrum vestitum var. *orbelicum* Petkoff. – I am unable to trace a written account or drawing of this taxon. It appears in Stoyneva-Gärtner, et al. (2015: 42) as “DD - Data Defficient”.

Conclusions

When researching for this manuscript, I initially used Coesel & Meesters’ (2013) major work on the genus *Staurastrum*. Under *St. vestitum* (l.c.: 164) they listed several varieties as “taxa excluded” and made some suggestions on species with closer affinities. They also renamed two, one of which the current author has a different opinion on as noted above. Algaebase (Guiry & Guiry, 2026) was also consulted for a more comprehensive list of intraspecific taxa. The references wouldn’t be complete without mention of Brook (1959). This was a huge undertaking and the results complex. He produced 18 plates with 156 figures, many with triple, hyphenated epithets. Although the work is largely superseded by later authors it emphasises the huge variability of certain species within this genus. The current author has taken a broader view when describing both *St. vestitum* and several of its varieties. The variability tends to be in the ornamentation rather than the cell shape, although comparing 3-, 4- and 5-radiate cells often involves a slight change in semicell shape.

Acknowledgements

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