

Taxonomic concepts of *Cosmarium* species in three different floras, and their relations

Marien van Westen & Frans Kouwets

mvanwesten@home.nl & fac.kouwets@tiscali.nl

In the past three years, three works have been published in the Netherlands relevant to the taxonomy of desmids. After the second edition of the so-called Lowlands flora (Coesel & Meesters, 2023), the atlas 'Sieralgen in Drenthe' (Van Westen, 2024) was published, and finally the extensive European *Cosmarium* flora (Kouwets, 2025).

Van Westen's taxonomic views differ somewhat from those of Coesel & Meesters, but since no new species are discussed in his atlas, this generally causes few problems in identification.

Since the publication of Kouwets' flora, in this respect the situation has become considerably more complex. Many new taxa were described, but also several taxa listed in Coesel & Meesters' flora have been renamed for various reasons. In addition, some very common species have been split up. It will therefore take some time for most researchers and laboratory technicians to get used to these changes.

Unfortunately, shortly after Kouwets's flora was published, it became apparent that two of the new *Cosmarium* names were illegitimate homonyms. Therefore, replacement names were published in a publication in *Notulae Algarum* (Kouwets, 2025b). These species do not play a role in the tables below.

When analyzing Dutch material (or material from the lowlands of surrounding countries), the flora of Coesel & Meesters will be the first choice, as it covers all genera. Although the atlas of Van Westen is not intended as a flora, the many photos (LM and SEM) published in it are very helpful in identifying problematic species. For identifying *Cosmarium* species, Kouwets' flora provides the most detailed and up-to-date information. It therefore seems inevitable that all three works will be used simultaneously in the analysis.

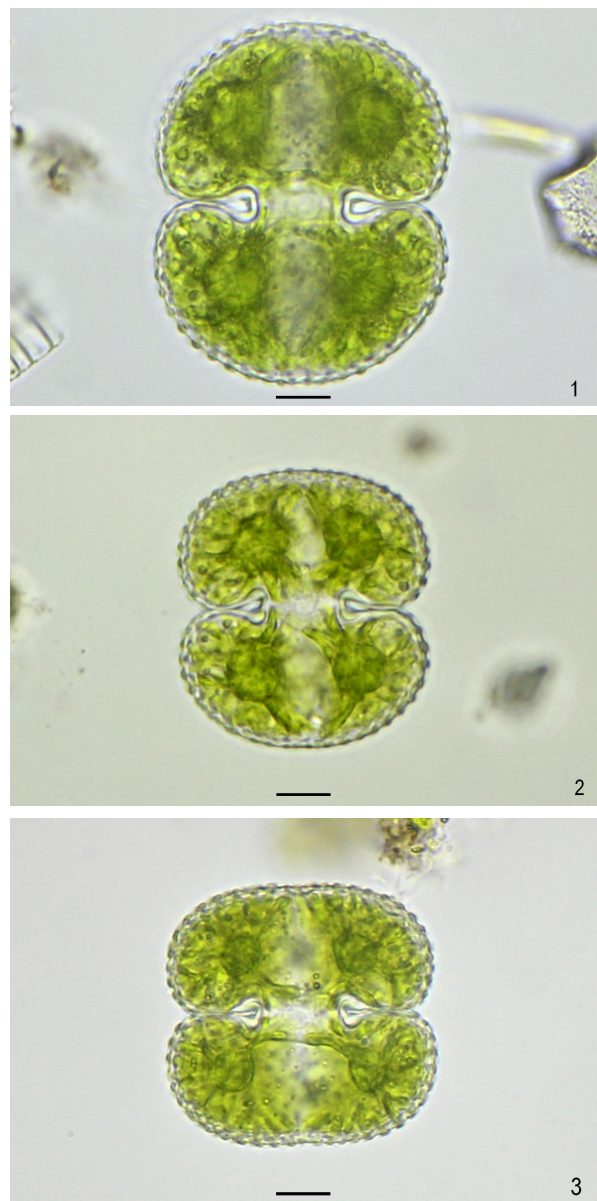
For the genus *Cosmarium* we propose to use from now on in publications in DM the names as included in Kouwets' flora. However, as indicated above, the differences in species concepts – especially between Coesel & Meesters and Kouwets – seriously hamper unambiguous identification.

To facilitate comparison, we here publish a list of *Cosmarium* taxa whose species concepts differ among the authors mentioned (table 1). Some terms and colour codes from this table 1 require clarification: this is indicated in table 2. In the last column of table 1, the

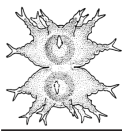
numbers refer to the annotations (justification of the change in identification) regarding the taxonomy of the taxa concerned shown in table 3.

Finally, tables of the individual species (table 4) are included for four species complexes, providing an overview of the distinguishing morphological characters and their ecological preferences. It should be emphasized

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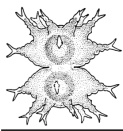


Three cells from the *Cosmarium reniforme* complex. Compare table 4. Photos © Marien van Westen. 1. *C. alteroreniforme*; 2. *C. reniforme*; 3. *C. stratiotica*. Maatstreep=10 µm.



Coesel & Meesters 2023		Van Westen 2024		page	Kouwets 2025	
<i>C. planctonicum</i>		<i>C. abbreviatum</i> var. <i>planctonicum</i>		364	<i>C. subabbreviatum</i>	1
<i>C. angulosum</i> var. <i>concinnum</i>		<i>C. angulosum</i> var. <i>concinnum</i>	p.p.	375	<i>C. subangulosum</i>	2
<i>C. bioculatum</i>		<i>C. bioculatum</i>	morpha b	393	<i>C. subbioculatum</i>	
		<i>C. bioculatum</i>	morpha a	392	<i>C. cantalense</i>	3
<i>C. bireme</i>		<i>C. bireme</i>	morpha	362	<i>C. biremiforme</i>	4
<i>C. crenulatum</i>		<i>C. crenulatum</i>		381	<i>C. neocrenulatum</i>	
<i>C. didymochondrum</i> var. <i>compressum</i>		<i>C. didymochondrum</i> var. <i>compressum</i>		468	<i>C. compressum</i>	
<i>C. angulosum</i> var. <i>angulosum</i>		<i>C. difficile</i> var. <i>messikommeri</i>		349	<i>C. perdifficile</i>	5
<i>C. paraganatoides</i>		<i>C. difficile</i> var. <i>subimpressulum</i>		350	<i>C. paraganatoides</i>	
<i>C. eichlerianum</i>	p.p. (pl. 74: 2-3)	<i>C. eichlerianum</i>	sensu Coesel 1991 p.p.	346	<i>C. pseudoeichlerianum</i>	6
<i>C. furcatospermum</i>		<i>C. furcatospermum</i>		412	<i>C. pseudofurcatospermum</i>	7
<i>C. granatum</i> var. <i>messikommeri</i>		<i>C. granatum</i> var. <i>messikommeri</i>		328	<i>C. citriforme</i>	
<i>C. granatum</i> var. <i>nordstedtii</i>		<i>C. granatum</i> var. <i>nordstedtii</i>		327	<i>C. mitriforme</i>	
<i>C. pygmaeum</i>		<i>C. heimerlii</i>		411	<i>C. heimerlii</i> var. <i>heimerlii</i>	
<i>C. impressulum</i>		<i>C. impressulum</i>	morpha, p.p.	379	<i>C. impressuliforme</i>	8
<i>C. kjellmanii</i>	forma	<i>C. kjellmanii</i>	morpha	493	<i>C. pseudokjellmanii</i>	
<i>C. meneghinii</i>		<i>C. meneghinii</i> var. <i>borgei</i>		373	<i>C. submeneghinii</i>	9
<i>C. norimbergense</i> var. <i>depressum</i>		<i>C. norimbergense</i> var. <i>depressum</i>	p.p.?	374	<i>C. norimbergensiforme</i>	10
<i>C. parvulum</i>		<i>C. parvulum</i>		356	<i>C. parvuloides</i>	11
<i>C. phaseolus</i> var. <i>elevatum</i>		<i>C. phaseolus</i> var. <i>elevatum</i>		338	<i>C. elevatiforme</i>	
<i>C. phaseolus</i> var. <i>phaseolus</i>		<i>C. phaseolus</i> var. <i>phaseolus</i>		337	<i>C. pseudoplanctonicum</i>	12
		<i>C. polygonum</i> var. <i>depressum</i>	morpha	408	<i>C. gemellum</i>	13
<i>C. praecisum</i>	forma	<i>C. praecisum</i>	sensu Coesel 1991	396	<i>C. pseudopraecisum</i>	
<i>C. praemorsum</i>		<i>C. praemorsum</i>	sensu Coesel 1979	428	<i>C. praemorsoides</i>	14
		<i>C. pseudiformosulum</i>	morpha	458	<i>C. pseudoaquasillum</i>	
<i>C. pyramidatum</i>	p.p.	<i>C. pyramidatum</i>		313	<i>C. pyramidatiforme</i>	15
<i>C. quadratulum</i>		<i>C. quadratulum</i>		377	<i>C. leursii</i>	16
<i>C. regnellii</i>	p.p.	<i>C. regnellii</i>	p.p. (photo 10)	376	<i>C. subregnellii</i>	
<i>C. regnellii</i>	p.p.	<i>C. regnellii</i>	p.p. (photos 1, 7)	376	<i>C. neoregnellii</i>	17
<i>C. regnellii</i>	p.p.	<i>C. regnellii</i>	p.p. (photo 5, 8)	376	<i>C. parviregnellii</i>	
<i>C. regnellii</i>	p.p.	<i>C. regnellii</i>	p.p. (photo 9)	376	<i>C. regnelliforme</i>	
		<i>C. regnesi</i> var. <i>tritum</i>		404	<i>C. tritum</i>	
<i>C. reniforme</i> var. <i>reniforme</i>	p.p.	<i>C. reniforme</i>	morpha a	438	<i>C. stratiotocola</i>	18
<i>C. reniforme</i> var. <i>reniforme</i>	p.p.	<i>C. reniforme</i>	morpha b	439	<i>C. alteroreniforme</i>	
<i>C. scenedesmus</i>		<i>C. scenedesmus</i>		320	<i>C. achondrum</i>	19
<i>C. septentrionale</i>		<i>C. septentrionale</i>		490	<i>C. septentrionaliforme</i>	
<i>C. sexnotatum</i> var. <i>bipunctatum</i>		<i>C. sexnotatum</i> var. <i>bipunctatum</i>		347	<i>C. subsexnotatum</i>	
<i>C. polygonatum</i>	p.p.	<i>C. sinostegos</i> var. <i>obtusius</i>		410	<i>C. obtusius</i>	
		<i>C. spec. 'Bergierslanden'</i>		445	<i>C. tetraophthalmoides</i> aff.	20
		<i>C. spec. 'Doldersum'</i>		345	<i>C. balcerense</i>	21
		<i>C. spec. 'Eexterveld'</i>		500	<i>C. tristriatum</i>	
		<i>C. spec. 'Langelo'</i>		371	<i>C. illipense</i>	
		<i>C. spec. 'Wijster'</i>		365	<i>C. ardearum</i>	
		<i>C. spec. 'Terhorsterzand'</i>		427	<i>C. anisochondroides</i>	
<i>C. laeve</i>		<i>C. spec. A</i>	p.p. (photos 2-4)	378	<i>C. pseudolaeve</i>	22
		<i>C. speciosum</i>	'forma minor'	464	<i>C. givrineense</i>	
<i>C. subadoxum</i>		<i>C. subadoxum</i>	p.p.	397	<i>C. subadoxiforme</i>	23
<i>C. subcostatulum</i>	p.p.	<i>C. subcostatulum</i>	p.p.	471	<i>C. subcostatiforme</i>	24
<i>C. subcucumis</i>	p.p. (pl. 73: 1)	<i>C. subcucumis</i>	p.p.	315	<i>C. subcucumiforme</i>	
<i>C. subcucumis</i>	p.p. (pl. 73: 2-3)	<i>C. subcucumis</i>	p.p.	315	<i>C. subcucumoides</i>	25
<i>C. subexcavatum</i> var. <i>ordinatum</i>		<i>C. subexcavatum</i> var. <i>ordinatum</i>		420	<i>C. chriscaerti</i>	
<i>C. subgranatum</i> var. <i>borgei</i>		<i>C. subgranatum</i> var. <i>borgei</i>		384	<i>C. neocosandeyi</i>	26
		<i>C. suborthogonum</i>	p.p.	380	<i>C. pseudosuborthogonum</i>	27
<i>C. subquadrans</i> var. <i>minus</i>		<i>C. subquadrans</i> var. <i>minus</i>		386	<i>C. joostenii</i>	
<i>C. subspeciosum</i>		<i>C. subspeciosum</i>	morpha	461	<i>C. pseudovalidius</i>	
<i>C. tenue</i>	p.p.	<i>C. tenue</i>	morpha	391	<i>C. utricularicola</i>	28
<i>C. tetraophthalmum</i>		<i>C. tetraophthalmum</i>		446	<i>C. tetraophthalmoides</i>	29
		<i>C. tinctum</i>	morpha	388	<i>C. tinctiforme</i>	
<i>C. dickii</i>		<i>C. triomphalum</i>		469	<i>C. triomphalum</i>	
<i>C. truncatellum</i>		<i>C. truncatellum</i>		390	<i>C. pseudotruncatellum</i>	
<i>C. undulatum</i>		<i>C. undulatum</i>		382	<i>C. undulatiforme</i>	
<i>C. vexatum</i> var. <i>lacustre</i>		<i>C. vexatum</i> var. <i>rotundatum</i>		460	<i>C. vexatiforme</i>	30
<i>C. canaliculatum</i>	p.p. (pl. 73: 6)				<i>C. perpyramidatum</i>	31
<i>C. connatum</i>	p.p. (pl. 66:2)				<i>C. meneghinianum</i>	32
<i>C. fastidiosum</i>					<i>C. confusopraemorsum</i>	
<i>C. pseudoexiguum</i>					<i>C. exiguum</i>	33
<i>C. pseudoretusum</i> var. <i>inaequalipellucum</i>					<i>C. moerlianum</i>	34
<i>C. pyramidatum</i> var. <i>stenonotum</i>					<i>C. pseudostenonotum</i>	
<i>C. subbroomei</i> f. <i>isthmochondrum</i>					<i>C. subbroomeiforme</i>	
<i>C. taxichodrifforme</i> var. <i>nudum</i>					<i>C. pseudonudum</i>	
<i>C. trilobulatum</i> f. <i>retusum</i>					<i>C. kinhemense</i>	

Table 1. The table shows the different species concepts between the three authors. For the meaning of the different colours, see table 2. For the annotations, referred to in the last column, see table 3.



p.p.	Pro parte, "in part": term used to indicate that an author considers only some of the forms collected by another author under a given name as reliably recognizable or correctly determined. For example: only one of the cells figured by Van Westen under <i>C. angulosum</i> var. <i>concinnum</i> (his figure 8) is considered by Kouwets to be identical to the two figures given by Coesel & Meesters (Pl. 75: 18-19). However, the identification is considered incorrect since <i>C. angulosum</i> is a very dubious species and the form in question has been renamed <i>C. subangulosum</i> .		The name refers to a completely different (but already described) species than that mentioned in the columns of Coesel & Meesters 2023 and Van Westen 2024; the determinations of those authors has been considered incorrect
morpha	Term used to indicate that a form identified as a specific taxon deviates slightly from the typical form of that taxon without a better alternative name being available; it should rather be described as a new species (see also forma)		The name refers to a newly described species: the names listed in the columns of Coesel & Meesters 2023 and Van Westen 2024 refer to poorly known or doubtful species so that the identification is considered uncertain and the form in question has been described as new
forma	Term incorrectly used to indicate that a form identified as a specific taxon deviates slightly from the typical form without a better alternative name. The term forma points to a taxonomic level and by using it in this way it is suggested that the aberrant form should be classified at an infraspecific level without giving it a specific epithet (see also morpha)		Homotypic synonym: the name is a correct alternative to a name that doesn't comply with the rules or of a taxon that changes taxonomic level. For example, Coesel & Meesters correctly classified the var. <i>planctonicum</i> of <i>C. abbreviatum</i> as a separate species. However, they incorrectly used the epithet <i>planctonicum</i> for that species, but that name was already in use for a completely different species, so a new name had to be chosen: <i>C. subabbreviatum</i> . It should be noted that <i>C. subabbreviatum</i> is thus based on the same original type material as <i>C. abbreviatum</i> var. <i>planctonicum</i> (collected by W. & G.S. West in 1905), hence the term
sensu	In the sense of: term, followed by the name(s) of (an) author(s), used to indicate that an author adopts a different concept for a particular species compared to the original description. The identification is therefore considered incorrect and an alternative (new) name is given		Heterotypic synonym: this synonymy results from the same form being described by a different author under a different name using different material: only one name can be valid. For example, Coesel newly described the species <i>C. dickii</i> in 1989, but the very same form had already been described at species level as <i>C. triumphalum</i> by Schmidle in 1898, so this name has priority.

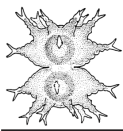
Table 2. Explanation of the terms and colours used in table 1.

that in these tables, besides the "classic" species, only those renamed or new species from Kouwets' flora are included that could lead to confusion in the identification. In addition, in the *C. pyramidatum* complex the nine species included are grouped into four clusters.

We hope these tables are useful and contribute to the correct naming of *Cosmarium* taxa encountered.

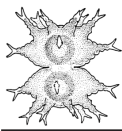
References

- Coesel, P.F.M. & J. Meesters, 2023.** Desmids of the Lowlands, 2nd ed., KNNV Publishing, Zeist, the Netherlands.
- Kouwets, F.A.C., 2025a.** European flora of the desmid genus *Cosmarium*, Part 1 Text and Part 2 Plates. 24bookprint, Rotterdam.
- Kouwets, F.A.C., 2025b.** Replacement names for *Cosmarium oliveri* (Croasdale) Kouwets, nom. illeg. and *Cosmarium pseudomagnificum* Kouwets nom. illeg. (Desmidiaceae, Zygnematophyceae). *Notulae Algarum* No. 387: 2 pp.
- Van Westen, M.C., 2024.** Sieralgen in Drenthe. Uitgave in eigen beheer, Assen.



- 1 Concept of *C. abbreviatum* in Coesel & Meesters unclear
- 2 Concept of var. *concinnum* in Van Westen unclear
- 3 Probably synonymous
- 4 Relation with the form in Coesel & Meesters unclear
- 5 *C. angulosum* var. *angulosum* is a doubtful species
- 6 N.B.: Pl. 74: 1 in Coesel & Meesters represents the true *C. eichlerianum*
- 7 *C. furcatospermum* is a doubtful species
- 8 *C. impressulum* is a doubtful species
- 9 *C. meneghinii* var. *meneghinii* is a doubtful species
- 10 *C. norimbergense* is a doubtful species
- 11 Refers to *C. parvulum* var. *undulatum*; var. *parvulum* is a doubtful taxon
- 12 Concept of *C. phaseolus* in Coesel & Meesters unclear
- 13 Central ornamentation not or weakly developed
- 14 *C. praemorsum* is a doubtful species
- 15 *C. pyramidatum* forms part of a species-complex (see table 4)
- 16 Probably synonymous
- 17 *C. regnellii* is a doubtful species
- 18 N.B.: none of the figures in Coesel & Meesters seem to represent the true *C. reniforme* var. *reniforme*; var. *compressum* sensu Coesel & Meesters is considered doubtful (see also Van Westen)
- 19 *C. scenedesmus* is a doubtful species
- 20 This form is a bit smaller than *C. tetraophthalmoides* with lower L/B
- 21 *C. balcerense* on the average is smaller
- 22 *C. laeve* is a doubtful species; Van Westen photo 1 shows *C. laeviforme*
- 23 Concept of *C. subadoxum* in Van Westen unclear
- 24 See discussion in Kouwets
- 25 The dimensions presented by Van Westen for *C. subcucumis* suggest that *C. subcucumoides* was included
- 26 *C. subgranatum* is a doubtful species
- 27 Probably Van Westen shows more than one species
- 28 Probably synonymous
- 29 The new name concerns the form presented by Coesel & Meesters; the form in Van Westen has more resemblance with the typical *C. tetraophthalmum*
- 30 Kouwets considers var. *lacustre* and var. *rotundatum* synonymous
- 31 Pl. 73: 5 in Coesel & Meesters represents an unknown species
- 32 Plate 66:2 in Coesel & Meesters represents a true *C. connatum*
- 33 Var. *exiguum* f. *exiguum*
- 34 Probably synonymous; *C. pseudoretusum* is a doubtful species

Table 3. Annotations to table 1. The numbers refer to the numbers in the last column of table 1.



***Cosmarium pyramidatum* –complex**

Cell size	<i>Cosmarium</i>	L	B	I	T	L/B	Remarks
Rather large cells	<i>perpyramidatum</i>	(85–) 92–107	(53–) 57–65	(18–) 20–23	40–48	1.57–1.65	4–8 pyrenoids acid, not or very weakly buffered
	<i>pyramidatum</i>	73–89 (–98)	51–60 (–66)	17–22	33–37	1.37–1.50	2–6 pyrenoids acid, not or very weakly buffered
	<i>pyramidatiforme</i>	(58–) 64–74	41–48	13–16	29–32	1.45–1.56	3 (4–5) pyrenoids acid, not or very weakly buffered
	<i>parvipyramidatum</i>	60–63	40–44	13–14	28	1.41–1.5	2 pyrenoids acid, not buffered
Lateral sides of the cells convex	<i>fictopyramidatum</i>	59–76	41–52	15–20	28–33	1.34–1.55	2–4 pyrenoids acid, not or very weakly buffered
	<i>rootmoostalense</i>	70–82	46–55	(16–) 18–21	34–39	1.44–1.52	2–4 pyrenoids acid, not or very weakly buffered
Rather small cells	<i>pseudopyramidiforme</i>	49–60	34–39 (–45)	12–15	24–25	1.38–1.49	1 pyrenoid acid, not or weakly buffered
	<i>pseudopyramidatum</i>	(36–) 40–50 (–58)	(23–) 25–33 (–36)	9–11 (–14)	19–22 (–25)	1.45–1.61	1 pyrenoid, lateral side convex acid, not buffered
Cells larger than <i>C. pseudopyramidatum</i>	<i>carniolicum</i>	47–60	29–36	11–15	20–23	1.55–1.80	1 pyrenoid, lateral sides straight to concave acid, not buffered

***Cosmarium quadratum* –complex**

<i>Cosmarium</i>	L	B	I	T	L/B	Remarks
<i>quadratum</i>	50–71	29–37	20–26	25–30	1.65–1.92	Cell walls thickened acid, not or very weakly buffered
<i>pseudowillei</i>	58–67	34–39	19–21	27–28	1.6–1.9	Lateral sides straight, sometimes diverging acid, weakly buffered
<i>pseudoquadratum</i>	55–66	30–36	21–23	26–30	1.75–1.92	Lateral sides concave, sinus open acid? not or very weakly buffered
<i>quadratforme</i>	44–56	25–30 (–35)	15–19	22–24	(1.56–) 1.69–1.86	Smaller cells, narrower isthmus subatmophytic, not or very weakly buffered
<i>boreoquadratum</i>	71–80	40–46	24–30 (–34?)	30–33	1.78–2.0	Large cells. Arctic species?
<i>arcticoquadratum</i>	54–57	32–33	18–19	22–23	1.66–1.78	Arctic-alpine species?

***Cosmarium reniforme* –complex**

<i>Cosmarium</i>	L	B	I	T	L/B	Remarks
<i>reniforme</i>	45–56	44–55	14–18	22–23	0.99–1.13	acid to neutral, (weakly) buffered
<i>alterareniforme</i>	55–63	48–55	15–19	28	1.09–1.26	Semicells elevated compared to <i>C. reniforme</i> neutral–alkaline, (weakly) buffered
<i>stratitocola</i>	50–58	46–55	15–18	25	1.02–1.09	Semicells more depressed than <i>C. reniforme</i> acid tot neutral, weakly buffered

***Cosmarium regnellii* –complex**

<i>Cosmarium</i>	L	B	I	T	L/B	Remarks
<i>neoregnellii</i>	15–18	13.5–18	5–6	9–10	0.94–1.15	Largest form buffered
<i>parviregnellii</i>	10.5–13.5	9–12	3.5–4.5	6.5–7	1.04–1.26	Similar to <i>C. neoregnellii</i> but smaller (weakly) buffered
<i>regnelliforme</i>	(8.5–) 13–16	(8.5–) 11–14	3.5–5.0	7–8.6	1.06–1.16	Semicells with central swelling buffered
<i>subregnellii</i>	11.5–13	10–11.5	3–4	5–6	1.04–1.14	Semicells with large scrobiculi near apical and lateral angles, buffered

Table 4. Some species complexes and their morphological and ecological differences.

Key to the abbreviations: L = length of the cells, B = breadth of the cells, I = breadth of the isthmus, T = thickness of the cells, L/B = ratio between length and breadth. All measures are in micrometers (µm).