

Three new species of *Salpingoeca* (Chrysophyceae) from Southern Brazil

Denise de C. BICUDO and Carlos E. de M. BICUDO

*Secção de Ficologia, Instituto de Botânica, Caixa postal
4005, 01000-São Paulo, SP. BRASIL*

BICUDO, D. C. and BICUDO, C. E. M. 1983. Three new species of *Salpingoeca* (Chrysophyceae) from southern Brazil. Jap. J. Phycol. 31: 16-20.

Three new species of *Salpingoeca*, *S. ampullacea* D. BICUDO and C. BICUDO, sp. nov., *S. brevicollis* D. BICUDO and C. BICUDO, sp. nov., and *S. caudiculata* D. BICUDO and C. BICUDO, sp. nov. are described on the grounds of their lorica morphology and based on material collected from "Lago das Ninféas" (Lily Pond) in the City of São Paulo, southern Brazil. This is the first record of the occurrence of this genus of epiphytes in Brazil.

Key Index Words: Brazil; Chrysophyceae; epiphytes; Monosigales; *Salpingoeca ampullacea* sp. nov.; *Salpingoeca brevicollis* sp. nov.; *Salpingoeca caudiculata* sp. nov.; *Salpingoecaceae*; taxonomy.

In July of 1980, we began a survey of the epiphytic algae of the "Lago das Ninféas" (Lily Pond), located in the "Parque Estadual das Fontes do Ipiranga", in the City of São Paulo, southern Brazil. During the course of our investigation we came across three very distinct populations, each very homogenous, of *Salpingoeca* (Salpingoecaceae, Monosigales, Chrysophyceae), that we could identify with none of the species already described. They are thus proposed as new to science. Furthermore, this is the first record of the occurrence of *Salpingoeca* in Brazil.

Description of the Species

1. *Salpingoeca ampullacea* D. BICUDO and C. BICUDO, sp. nov. (Figs. 2-3)

Solitarii individui vel gregarii; lorica sessili, forma ampullacea, basi subglobosa, continuans abrupte longo collo, circa duos tertius longitudinem ab lorica, latetibus ab initio parallelis, post divergentes ample ad apicem cujus latitudinis proxime aequa parte subglobosa, 12.2-17.3 μm long, 6.2-8.0 μm lat.,

6.4-8.3 μm lat. apert. celula implens totam lorica ad median colli, 14.0 μm long. 7.3-8.0 μm lat.; collo membranaceo lateribus rectis vel levissime convexis, modice divergentibus ad apicem, 6.6 μm long., 6.5 μm lat. apert.; flagello tres vel quattuor longitudinem cellulae, 50.0 μm long.; unos vel duobus contractis vacuolis.

Origo: Brasilia, Status Sancti Pauli, Municipium Sancti Pauli, Sancti Pauli, "Parque Estadual das Fontes do Ipiranga", Hortus Botanicus, lacus Nimpharum, super pilos foliares et folia modificata *Salvinia herzogii* de la Sota, lectus D. C. Bicudo, 30. IV. 1981.

Holotypes: Figurae nostrae 2-3.

Individual solitary or gregarious; lorica sessile, vase-like, base subglobose, suddenly projecting into a long neck about 2/3 of the total length of the lorica, sides at first parallel, then broadly divergent toward the apex whose width is approximately the same as that of the subglobose portion, 12.2-17.3 μm long, 6.2-8.0 μm broad at base, 6.4-8.3 μm broad at opening; cell completely filling the lorica to half way up the neck, 14.0 μm long, 7.3-8.0 μm broad; collar with straight

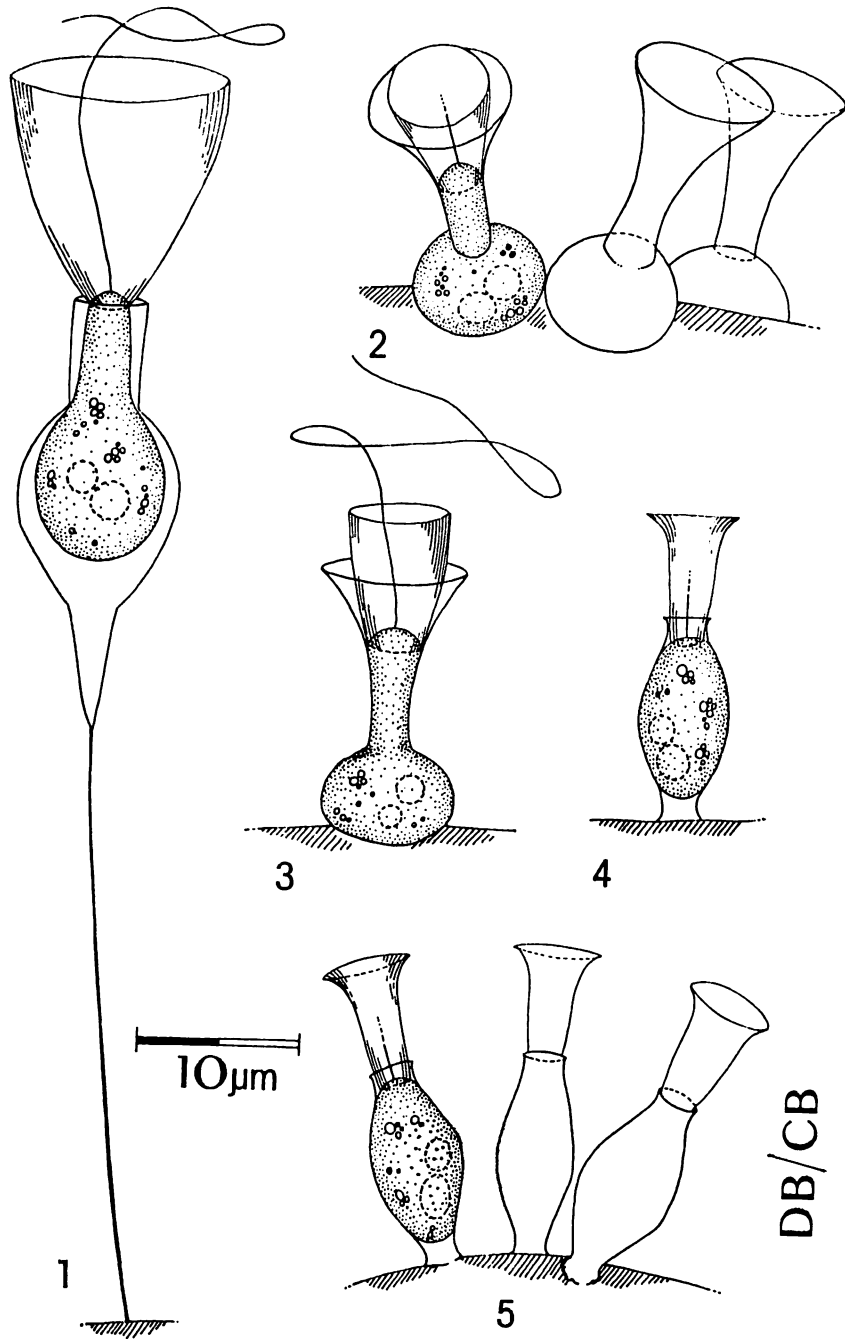


Fig. 1. *Salpingoeca caudiculata* D. BICUDO and C. BICUDO, sp. nov.; 2-3. *Salpingoeca ampullacea* D. BICUDO and C. BICUDO, sp. nov.; 4-5. *Salpingoeca brevicollis* D. BICUDO and C. BICUDO, sp. nov.

or slightly convex sides, moderately divergent toward the apex, $6.6\ \mu\text{m}$ long, $6.5\ \mu\text{m}$ broad at opening; flagellum 3-4 times as long as the cell, $50.0\ \mu\text{m}$ long; 1-2 contractile vacuoles.

2. *Salpingoeca brevicollis* D. BICUDO and C. BICUDO, sp. nov. (Figs. 4-5)

Solitarii individui vel gregarii; lorica sessile, ellipticus-fusiformis, polo posteriore constituens unam structuram fixam subcylindricam, brevem, lateribus concavis, polo anteriore formans collum brevem, circa unus decimus longitudinis loricae, lateribus rectis vel levissime concavis, $10.0\text{-}13.6\ \mu\text{m}$ long. $5.5\text{-}6.7\ \mu\text{m}$ lat. $2.5\text{-}4.0\ \mu\text{m}$ lat. apert.; cellula elliptica, implens quasi totam lorica, $10.0\text{-}11.2\ \mu\text{m}$ long., $5.5\text{-}6.7\ \mu\text{m}$ lat.; collo membranaceo lateribus rectis, parallelis vel quasi maiore longitudine, ample divergens in apice, $5.1\text{-}7.0\ \mu\text{m}$ long., $2.1\text{-}3.3\ \mu\text{m}$ lat., $4.3\text{-}6.5\ \mu\text{m}$ lat. apert.; flagello non mensurato; duobus contracti vacuolis.

Origo: Brasilia, Status Sancti Pauli, Municipium Sancti Pauli, Sancti Pauli, "Parque Estadual das Fontes do Ipi-ranga", Hortus Botanicus, lacus Nimpharum, super pilos foliares et folia modificata *Salvinia herzogii* de la Sota, lectus D. C. Bicudo, 30. XI. 1980.

Holotypes: Figurae nostrae 4-5.

Individual solitary or gregarious; lorica sessile, elliptic-fusiform, posterior end forming a very short, cylindrical attaching structure with concave sides, anterior end an extremely short neck, about 1/10 of the total length of the lorica, sides straight or slightly concave, $10.0\text{-}13.6\ \mu\text{m}$ long, $5.5\text{-}6.7\ \mu\text{m}$ broad at base, $2.5\text{-}4.0\ \mu\text{m}$ broad at opening; cell elliptic, almost completely filling the lorica, $10.0\text{-}11.2\ \mu\text{m}$ long, $5.5\text{-}6.7\ \mu\text{m}$ broad; collar with sides straight, parallel or almost so for the major part of its length, broadly divergent at the apex, $5.1\text{-}7.0\ \mu\text{m}$ long, $2.1\text{-}3.3\ \mu\text{m}$ broad, $4.3\text{-}6.5\ \mu\text{m}$ broad at opening; flagellum not measured; 2 contractile vacuoles.

3. *Salpingoeca caudiculata* D. BICUDO and C. BICUDO, sp. nov. (Fig. 1)

Solitarii individui; pedicellata lorica, basi napiforme, elongata, continuans in collo circa unus tertius longitudinis loricae, lateribus rectis, subparalleli, $24.0\text{-}24.6\ \mu\text{m}$ long., $10.0\text{-}10.5\ \mu\text{m}$ lat., $5.0\text{-}5.1\ \mu\text{m}$ lat. apert.; cellula obpyriforme, locata ab mediam superiorem basis loricae, $15.1\ \mu\text{m}$ long., $9.0\ \mu\text{m}$ lat.; collo membranaceo lateribus convexis, ample divergentibus ad apicem, $15.0\ \mu\text{m}$ long., $13.0\text{-}14.0\ \mu\text{m}$ lat. apert.; flagello minime bis longitudinis cellulae; uno vel duobus contractis vacuolis; pediculus $25.0\text{-}40.0\ \mu\text{m}$ long.

Origo: Brasilia, Status Sancti Pauli, Municipium Sancti Pauli, Sancti Pauli, "Parque Estadual das Fontes do Ipirange", Hortus Botanicus, lacus Nimpharum, super pilos foliares et folia modificata *Salvinia herzogii* de la Sota, lectus D. C. Bicudo, 30. IV. 1981.

Holotypes: Figurae nostrae 1.

Individual solitary; lorica pedicellate, base napiform, elongate, suddenly projecting to form a relatively short neck, about 1/3 of the total length of the lorica, sides straight, nearly parallel, $24.0\text{-}24.6\ \mu\text{m}$ long, $10.0\text{-}10.5\ \mu\text{m}$ broad at base, $5.0\text{-}5.1\ \mu\text{m}$ broad at opening; cell obpyriform, filling from the upper half of the base of the lorica up, $15.1\ \mu\text{m}$ long, $9.0\ \mu\text{m}$ broad; collar with convex sides, broadly divergent toward the apex, $15.0\ \mu\text{m}$ long, $13.0\text{-}14.0\ \mu\text{m}$ broad at opening; flagellum at least twice as long as the cell; 1-2 contractile vacuoles; pedicle straight, $25.0\text{-}40.0\ \mu\text{m}$ long.

Discussion

The genus *Salpingoeca* was proposed by JAMES-CLARK (1868: 199) to accommodate some solitary or sometimes gregarious (but never colonial), non-pigmented, choanoflagellate individuals that possess a fixed, either sessile or pedicellate lorica. The protoplast corresponds in form and aspect to those of *Codosiga* and *Monosiga*, indicating in the great plasticity of their protoplast, as also in their solitary or at most gregarious habit, their closer affinity with the latter. The protoplast is mostly freely movable within and not permanently attached to the lorica,

but sometimes is united to the lorica by means of a pedicle-like extension of the cell body, or by several pseudopodes. The flagellum is single, and terminal, laterally encircled by a well-developed, membranous collar. Usually two or sometimes more very conspicuous contractile vacuoles are seen located in the posterior half of the protoplast.

The lorica wall is made of a single layer of chitin, or is calcareous, in the latter case sometimes impregnated with iron salts from the environment. This is the only solid difference between *Salpingoeca* and *Diploeca* ELLIS (ELLIS 1930: 78), in which the lorica wall is made of two concentric layers. Thus circumscribed, the genus *Salpingoeca* includes *Pachysoeca* ELLIS (ELLIS 1930: 80), where the lorica is brown and sessile. BOURRELLY (1981: 138) considers *Lagenoeca* SAVILLE-KENT (SAVILLE-KENT 1880: 359) synonymous with *Salpingoeca*. The free-swimming habit of the individuals of *Lagenoeca*, however, as far as we can judge guarantee its position as a distinct genus from *Salpingoeca*.

According to JAMES-CLARK (1868), reproduction is usually by transverse division, rarely by longitudinal division of protoplasts, or by subdivision of the entire protoplast into a small number of spores. ELLIS (1930: 66), however, described and illustrated that reproduction is by longitudinal division of protoplast, by its partial emergence at the collar of the lorica with the formation of a bulge from which, by fission, the young cell is produced; it is clumsy and often simulates, more or less closely, both gemmation and transverse division. Gemmation is of very rare occurrence, and sporulation has not been confirmed.

The definition of *Salpingoeca* species is mostly based on the shape of the lorica, but also on its colour, the presence or absence of a pedicle, the presence or absence of short pseudopodial filaments attaching the protoplast to the lorica, the shape and the size of the collar, and the shape of the cell.

Salpingoeca ampullacea D. BIC. and C. BIC., by the shape of its lorica resembles

Salpingoeca longicollis (ELLIS) BOURR., but it is readily distinct in the broadly divergent (flaring) sides of the neck, the very thin wall, and the much larger dimensions, also, because the cell completely fills the basal globose part of the lorica, never extending beyond the extreme upper limit of the neck. It could also be compared with the original figure of *Salpingoeca amphoridium* JAMES-CLARK var. *amphoridium* in JAMES-CLARK (1868: fig. 37), from which it differs in the broadly divergent (flaring) sides of the neck, the sudden, very conspicuous constriction in about the lower third of the lorica establishing a well-marked limit for the neck, the ratio between the maximum breadth of the lorica and its breadth at the opening, the ratio between the total length of the lorica and that of the neck, and the much smaller dimensions of the lorica. Furthermore, the cell completely fills the globose basal portion of the lorica and most of the neck, but never extends beyond the extreme upper limit of the neck. The circumscription of *Salpingoeca amphoridium* JAMES-CLARK, however, has been somewhat drastically altered along the years, up to a certain point in which some overlapping occurs between the latter, *Salpingoeca longicollis* (ELLIS) BOURR., and *Salpingoeca ampullacea* D. BIC. and C. BIC.

Among all sessile species of the genus, *Salpingoeca brevicollis* D. BIC. and C. BIC. is unique in having an extremely short neck, elliptic cell, and subcylindrical collar, which is broadly divergent only at the apex. Regarding the length of the neck, *Salpingoeca brevicollis* D. BIC. and C. BIC. somewhat approaches the illustration of *Salpingoeca fusiformis* SAVILLE-KENT in LEMMERMANN (1914: fig. 120), from which it differs in the subcylindrical shape of the base of the lorica, the elliptical shape of the cell, and in the basically cylindrical collar, broadly divergent at the apex. LEMMERMANN's figure, however, is markedly distinct from the original concept of *Salpingoeca fusiformis* SAVILLE-KENT (SAVILLE-KENT 1880: 346; 1882: pl. 5, figs. 27-31). According to its original

concept, *Salpingoeca fusiformis* SAVILLE-KENT is very different from *Salpingoeca brevicollis* D. BIC. and C. BIC.

Finally, *Salpingoeca caudiculata* D. BIC. and C. BIC., by having a pedicellate lorica with a napiform base, is very characteristic, and cannot be confused with any of the species already described.

Acknowledgements

The authors acknowledge Mrs. Alzira Rossi MASCARENHAS for preparing the Latin diagnoses included in this paper; and Mr. Alasdair G. BURMAN for improving the English text. This study was supported in part by a "FAPESP, Fundação de Amparo à Pesquisa do Estado de São Paulo" Research Grant n^o 80/0691-8 given to the senior author.

Resumo

Três espécies novas de *Salpingoeca*—*S. ampullacea* D. BICUDO & C. BICUDO, sp. nov., *S. brevicollis* D. BICUDO & C. BICUDO, sp. nov., e *S. caudiculata* D. BICUDO & C. BICUDO, sp. nov.—são descritas com base na morfologia da lórica e em material coletado no Lago das Ninféas, situado no Parque Estadual das Fontes do Ipiranga, cidade de São Paulo, SP, Brasil. O trabalho é, também, o primeiro documento da ocorrência desse gênero de epífitas no Brasil.

ビクード D. C.・ビクード C. E. M.: 南ブラジル産 *Salpingoeca* (黄金色藻) の 3 新種

ブラジル南部サンパウロ市内の池で採集した *Salpingoeca* 属の 3 新種, *S. ampullacea*, *S. brevicollis*, *S. caudiculata* をロリカの形態に基づいて記載した。なおこの属はブラジル新産である。(Seção de Ficologia, Instituto de Botânica, Caixa postal 4005, 01000-São Paulo, sp. Brazil)

References

- BOURRELLY, P. 1981. Les algues d'eau douce, initiation à la systématique, 2: les algues jaunes et brunes—Chrysophycées, Phéophycées, Xanthophycées et Diatomées. Paris: Société Nouvelle des Éditions Boubée. vol. 2, (réimpression revue et augmentée).
- ELLIS, W. N. 1930. Recent researches on the Choanoflagellata (Craspedomonadines) (fresh-water and marine) with description of new genera and species. *Annl. Soc. r. zool. Belg., Bruxelles*, 60: 49-88, fig. 1-31.
- JAMES-CLARK, H. 1868. On the Spongiae ciliatae as Infusoria flagellata; or observations on the structure, animality, and relationship of *Leucosolenia botryoides*, Bowerbank. *Ann. Mag. nat. Hist.: ser. 4, London*, 1: 133-142, 188-215, 250-264, pl. 5-7.
- LEMMERMANN, E. 1914. Pantostomatinae, Protomastiginae, Distomatinae. In PASCHER, A. ed. *Die Süßwasser-Flora Deutschlands, Österreichs und der Schweiz*. vol. 1(1): Verlag von Gustav Fischer, Jena.
- SAVILLE-KENT, W. 1880. A manual of the Infusoria: including a description of all known flagellate, ciliate, and tentaculiferous Protozoa, British and foreign, and an account of the organization and affinities of the sponges. vol. 1: David Bogue. London.
- SAVILLE-KENT, W. 1882. A manual of the Infusoria: including a description of all known flagellate, ciliate, and tentaculiferous Protozoa, British and foreign, and an account of the organization and affinities of the sponges. vol. 3: David Bogue. London.