

## An interesting new species of *Sphaerocysta* (Heteroptera, Tingidae) from Argentina, with the description of its fifth instar nymph

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### Una interesante nueva especie de *Sphaerocysta* (Heteroptera, Tingidae) de Argentina, con la descripción del quinto estadio ninfal

**RESUMEN.** Se describe una nueva especie neotropical de *Sphaerocysta* (Hemiptera, Heteroptera, Tingidae). *Sphaerocysta costai* n. sp. fue colectada en las Yungas Argentinas, en las provincias de Jujuy (Calilegua) y Salta (Urundel). Se ilustran los principales caracteres diagnósticos de los adultos y del quinto estadio ninfal. Esta nueva especie brinda información relevante para comprender las tendencias evolutivas de la familia ya que la morfología de sus ninfas presenta caracteres únicos entre los Tingidae. Se brindan comentarios sobre la sistemática de *Sphaerocysta* y una clave para la identificación de sus especies.

**PALABRAS CLAVE.** *Sphaerocysta costai* n. sp. Yungas. Evolución. Caracteres morfológicos.

**ABSTRACT.** A new Neotropical species of *Sphaerocysta* Stål, (Hemiptera, Heteroptera, Tingidae) is described. *Sphaerocysta costai* n. sp. was collected in the Argentinian Yungas, in the provinces of Jujuy (Calilegua) and Salta (Urundel). The most important diagnostic characters are illustrated for adults and fifth instar nymphs. This new species provides relevant evidence for the understanding of evolutionary trends within the family as its nymphal morphology exhibits unique features among Tingidae. Comments on the systematics of *Sphaerocysta*, and an identification key to its species are provided.

**KEY WORDS.** *Sphaerocysta costai* n. sp. Yungas. Evolution. Morphological characters.

### INTRODUCTION

*Sphaerocysta* is a Neotropical genus composed of 12 species, ranging from Panama to Argentina. All species are recorded from Brazil, with the exception of *S. nosella* Drake & Hambleton, known exclusively from Ecuador. Two species were also collected in other countries besides Brazil: *S. globifera* (Stål), from Argentina and Paraguay, and *S. inflata* (Stål), from Argentina, Bolivia and Paraguay; both were originally described in

*Tingis* Fabricius, and transferred to *Sphaerocysta* with *S. globifera* designated as the type-species (Stål, 1873). This genus is characterized by the spheric hood, the absence of occipital spines, and by the two cysts, one on the posterior pronotal projection and one on the posterior region of the discoidal area of the hemelytra.

The most recent contribution to the systematics of the genus is the description of the fifth instar nymph of *S. inflata* and *S. angulata* Monte (Guilbert & Montemayor, 2010). Before this

contribution, the last work on the genus was almost 55 years ago (Drake & Davis, 1960). Host plants were recorded for *S. angulata*, *S. globifera* and *S. inflata*, as Bignoniaceae (Drake & Ruhoff, 1965). Biological, ethological, and reproductive data are also unknown for the genus, as they are for most of tingids. Neither a taxonomic revision nor an identification key to the species is available.

The bizarre Tingidae morphology of adults and nymphs has been subject of interest in evolutionary studies in which it has been hypothesized that adults and nymphs tend to evolve from simpler to more complex morphologies (Guilbert, 2001, 2004). According to this approach, plesiomorphic species have adults that do not exhibit paranota, hood, pronotal carinae and wide hemelytra, and nymphs without outgrowths. Moreover, nymphal outgrowths as well as adult exaggerated traits have been assumed to be adaptative rather than hypertelic (Guilbert, 2001, 2004, 2005).

In the present work, we describe a new Argentinian species of *Sphaerocysta* on the basis of adults and fifth-instar exuviae. We have found this new species particularly interesting as its nymphal morphology exhibits very peculiar characters that provide new key evidence on the evolutionary trends among Tingidae. We also provide an identification key to the species and comments on its systematics.

## MATERIALS AND METHODS

Specimens were collected in 2007, in the Argentinian provinces of Jujuy (Calilegua at 800 m a.s.l.) and Salta (Urundel at 575 m a.s.l.). Photographs were captured with a digital camera attached to a stereomicroscope. Measurements were obtained using an ocular micrometer and are in millimeters; the mean is given outside the parentheses. Drawings were made with the aid of photographs, and vectorial image files were produced. Terminology follows Drake & Davis (1960), the identification key is based on the study of type-material and on the species original descriptions. The specimens were deposited in the Museo de La Plata (MLP – La Plata, Buenos Aires, Argentina) and in the Muséum National d'Histoire Naturelle (MNHN – Paris, Île-de-France, France); only material housed in the MLP was measured.

## RESULTS

### *Sphaerocysta costai* sp. n.

**Diagnose.** Blackish; uniformly punctate; humeri of paranota triangular and strongly projected, lateral carinae with two rows of areolae at the highest part, posterior pronotal cyst conspicuously low; costal area of hemelytra uniseriate. Pronotum of fifth-instar nymph flat; with small median tubercles on abdominal segments II-VI, and without lateral abdominal tubercles.

**Description of the holotype.** General color blackish (Fig. 1), yellowish in some parts of the hemelytra or completely yellowish (eneral specimens). Antennae longer than half of body length; scape and pedicel subequal in length; basiflagellomere four times the length of distiflagellomere, the last at least two times longer than the scape or pedicel; distiflagellomere black, yellow at base, other segments entirely yellowish. Head with a frontal pair of spines; bucculae closed in front, with several rows of areolae, outer margin convex; postero-orbital plate present. Rostrum long, reaching the anterior region of metasternum; apex darker. Pronotum black, except for the yellow paranota, lateral carinae, and the apex of the posterior pronotal cyst. Hood black, spherical; punctuations uniform, similar in size to those of the pronotal disc. Median carina low, almost absent on the pronotal disc, ending in a small and yellowish cyst on the posterior projection of pronotum, two times lower than the hood. Lateral carinae high, strongly sinuate, with two fully developed rows of areolae at the highest part, these large and complete (Fig. 2). Paranota areolate, slightly expanded; perpendicular to the pronotal disc anteriorly, subvertical, strongly projected and triangular at humeri (Fig. 3). Rostral channel as illustrated (Fig. 4). Legs pale yellow, with few short setae. Hemelytra narrow, light yellowish, with two large black stains: one on the hemelytra cyst, excluding the very top of the cyst, and the other on the sutural area; outer margin conspicuously widening anteriorly, then slightly narrowing through the rest of the hemelytral extension (Fig. 6); widest part at sutural area; costal area uniseriate, with sub-rectangular areolae anteriorly, half the size of the posterior ones, these rectangular; subcostal area with three rows of areolae in the widest part, which

is located at the higher region of the hemelytral cyst; discoidal area anteriorly biseriate, with five rows of areolae at widest part, located at the same position as the widest part of the sub-costal area; radius-median vein sinuous; sutural area with small areolae anteriorly, similar in size as those of the distal part of the discoidal area;

larger and pentagonal areolae posteriorly, same size as the larger ones of costal area; outer row with large, square areolae, inner edge slightly rounded. Abdomen narrow and brownish, with few short setae, its widest part between the fourth and fifth segment.

Measurements (2♂-1♀): scape length, 0.18 (0.15-0.20-0.19); pedicel length, 0.11 (0.12-0.10-0.10); basiflagellomere length, 1.22 (1.20-1.27-1.18); distiflagellomere length, 0.35 (0.37-0.37-0.32); discoidal area length, 0.92 (0.88-0.92-0.95); body length to apex of abdomen, 2.13 (2.13-2.20-2.07); body length to apex of hemelytra, 2.70 (2.70-2.67-2.73); body width, 0.92 (0.92-0.92-0.93).



Fig. 1. *Sphaerocysta costai* n. sp. dorsal habitus (Scale bar = 0.5 mm).

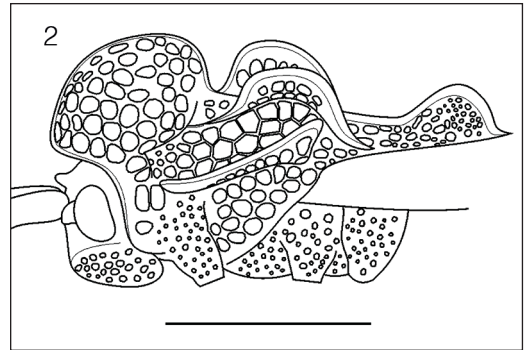
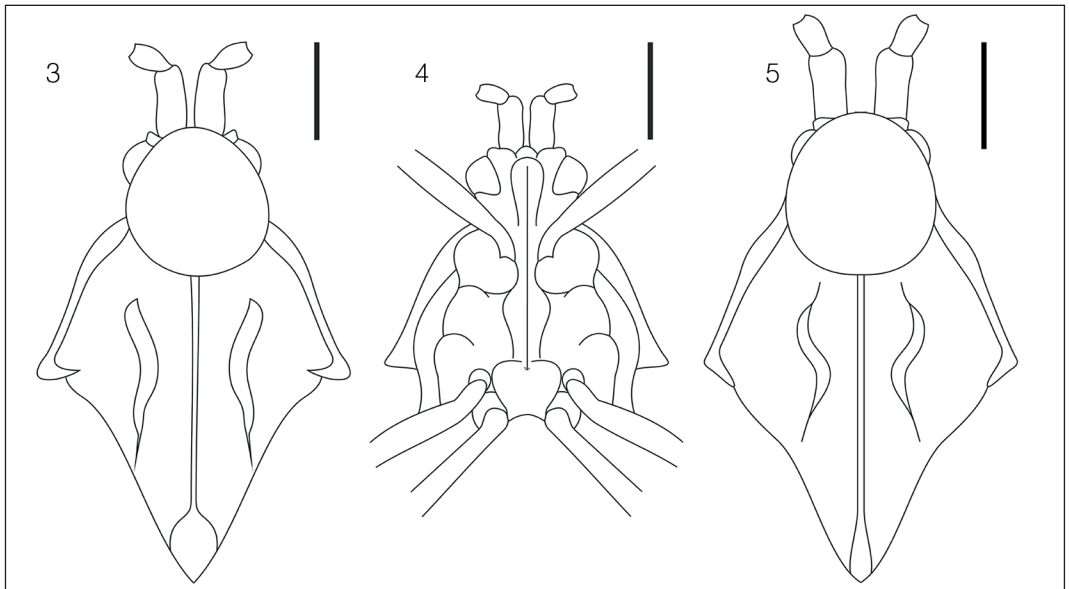
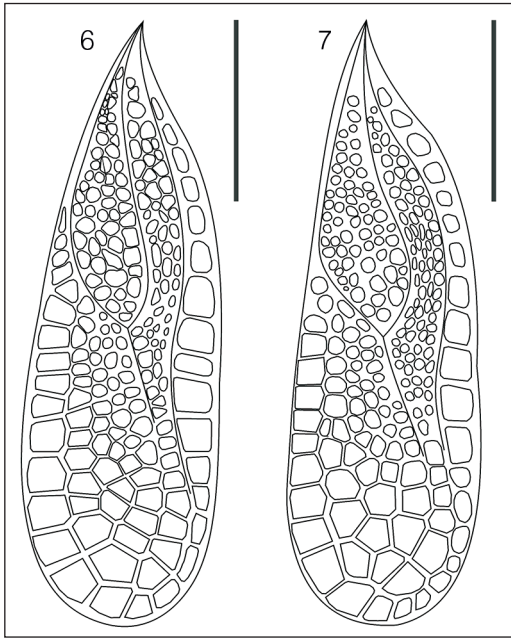


Fig. 2. *Sphaerocysta costai* n. sp. lateral view of the head and pronotum (Scale bar = 0.5 mm).



Figs. 3 - 5. *Sphaerocysta costai* n. sp. and *S. angulata* pronotum and paranota. 3, *S. costai* n. sp., dorsal view; 4, *S. costai* n. sp., ventral view; 5, *S. angulata*, dorsal view (Scale bar = 0.25 mm).

**Fifth-instar exuvie.** Body glabrous (Fig. 8). Whitish to yellowish; pronotum medially, anterior and posterior parts of wing pads, and abdo-

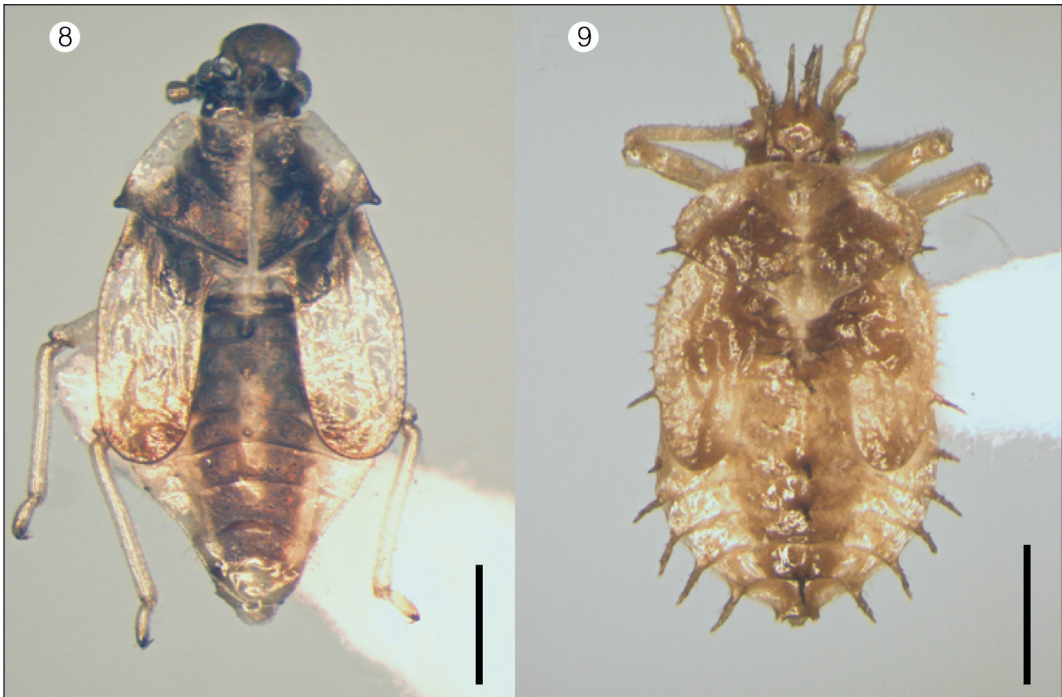


**Figs. 6 - 7.** *Sphaerocysta costai* n. sp. hemelytra. 6, male; 7, female. (Scale bar = 0.5 mm).

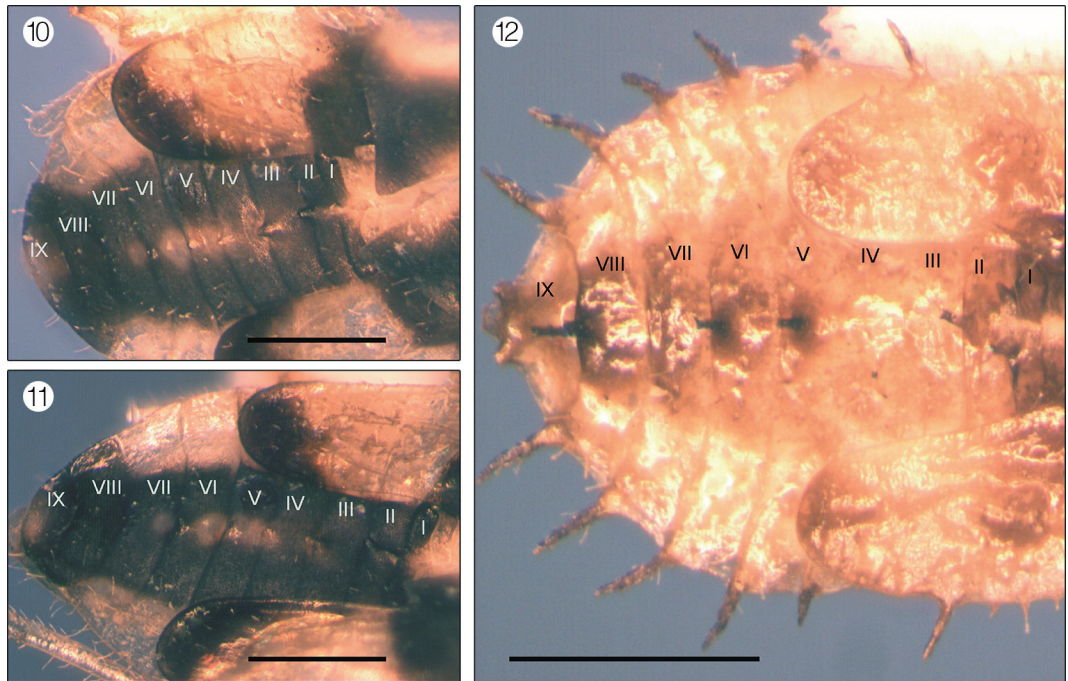
men dorso-medially black. Occipital tubercles on head present and simple with no ramifications, the rest of the head broken. Pronotum flat; laterally with a few scattered long setae and a simple posterior tubercle; without median tubercles. Wing pads slightly wider than pronotum, lateral margins with a few scattered long setae. Mesonotum and metanotum without tubercles. Abdomen (Figs. 10, 11) without lateral tubercles, lateral margins with very long scattered setae; tergites with central part slightly swollen, tergites II-VI each one bearing a posterior middle central tubercle, these becoming smaller posteriorly.

Measurements: scape length, 0.14 (0.14-?-?-0.13); pedicel length, 0.09 (0.10-?-?-0.08); pronotal length, 0.61 (0.62-0.56-0.62-0.65); pronotal width, 0.86 (1.10-1.10-1.13-1.08); wing pad length, 1.05 (1.09-1.08-1.07-0.95); wing pad width, 0.45 (0.44-0.43-0.45-0.46); abdominal length, 1.38 (1.36-1.53-1.40-1.23).

**Material studied. HOLOTYPE: ARGENTINA, Jujuy, Calilegua, 23° 44' 46" S 64° 51' 186" W, 800m, 04-VI-2007, Montemayor col., 1 male. (MLP). PARATYPES:** same data as holotype, Montemayor col., 1 male (MLP); same data as holotype, É. Guilbert réc., 1 female. (MNHN);



**Figs. 8 - 9.** Dorsal habitus of the fifth instar. 8, *S. costai* n. sp. (exuvie); 9, *S. angulata* (Scale bar = 0.5 mm).



**Figs. 10 - 12.** Median abdominal tubercles on fifth instar. 10-11, *S. costai* n. sp.; 12, *S. angulata*. (Scale bar = 0.5 mm).

**Salta**, Urundel, 23° 26 638' S 64° 30 428' W, 575m, 07-VI-2007, Guilbert & Montemayor col., 1 female (MLP). **IMMATURES EXUVIAE:** **Salta**, Urundel, 23° 26 638' S 64° 30 428' W, 575m, 07-VI-2007, Guilbert & Montemayor col., 1 exuvium (MLP); **Jujuy**, Calilegua, 23° 44 46' S 64° 51 186' W, 800m, 04-VI-2007, Montemayor col., 3 exuviae (MLP). The exuvium from Salta belongs to the female collected in this province, as they were found together and the female presents a lighter colour pattern, suggesting that it had recently emerged.

**Etymology.** The species is named after Luiz Costa (MNRJ – Museu Nacional, Rio de Janeiro, Brazil), a friend and talented illustrator who dedicated his professional career to contributions mostly on the taxonomy of Miridae and Tingidae and who has gone out of his way to help us in several projects.

**Distribution:** Argentina: Jujuy (Calilegua) and Salta (Urundel).

**Comments on the adults.** The new species resembles *S. angulata* in the general appearance, mostly because of the triangular humeri on the

paranota and the shape of the hemelytra. Besides the similarity in adult morphology and the sympatry of these species (Fig. 13), there are strong differences on the fifth-instar nymphal morphology. The adults are also different as *S. angulata* has a more oval hood, the lateral carinae shorter and with one row of areolae in the highest part and the paranota narrower with the humeri less projected (Figs. 3, 5).

We observed that the subcostal area is narrower in males (three rows of areolae in the widest part – Fig. 6) than in females (five rows – Fig. 7). Unfortunately, observations of the sexual dimorphism in this species are based on very few specimens (two males and two females). Apparently, *S. angulata* also has this same dimorphism based on the study of two paratypes (male and female). This sexual difference in the hemelytra has been observed in species of other tingid genera, such as *Pleseobyrsa* (Froeschner, 1991; Montemayor *et al.*, 2011).

**Comments on the nymph.** The presence of median tubercles on segments III and IV in *S. costai* n. sp. is a very unusual feature, as far as we know this is the first time these tubercles are observed within the family. The absence of the

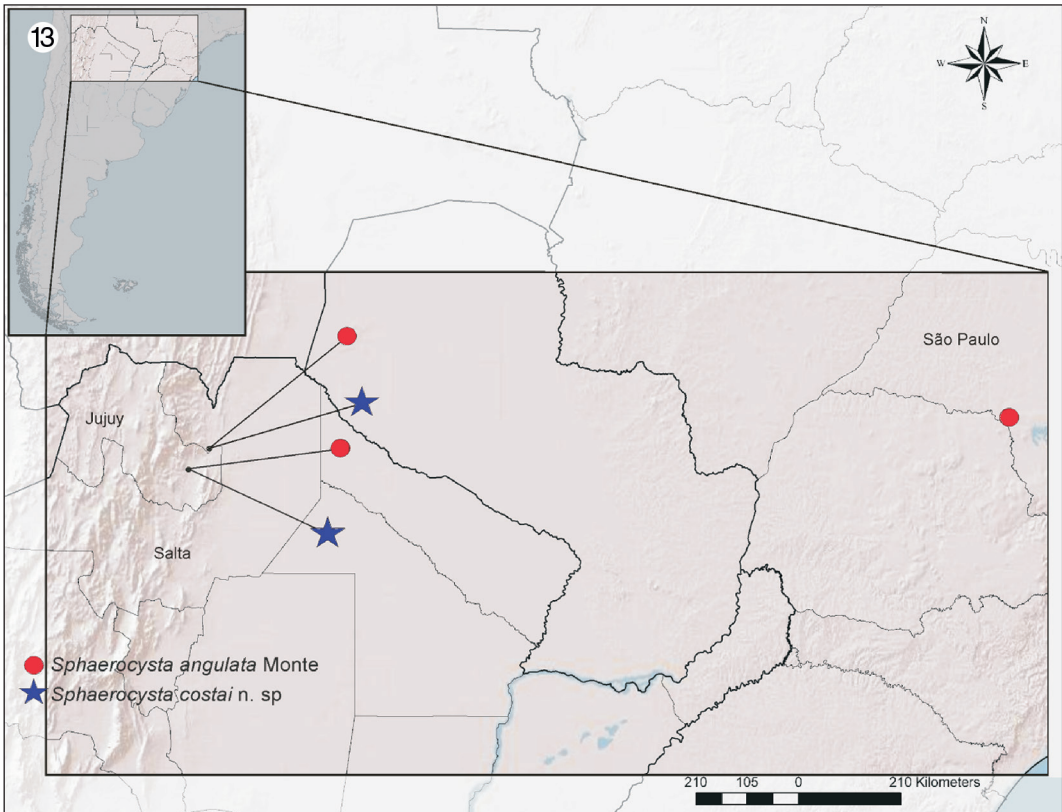


Fig. 13. Distribution map of *Sphaerocysta costai* n. sp. and *S. angulata*.

median tubercle on segment VIII is also very interesting, as it is present in the nymphs of *S. angulata* and *S. inflata*. In addition, species whose nymphs do not bear any lateral tubercle (*S. costai* n. sp.) generally do not occur in the same genus as species whose nymphs have them (*S. angulata* and *S. inflata*). To our knowledge, this is the first genus so far described with such intrageneric variation. Although it is important to emphasize that very few Tingidae nymphs are known, and that these tubercles could be present in earlier instars and thereby not completely absent in the species.

**Key to species of *Sphaerocysta***

- 1. Paranota with outer row of areolae larger than the ones in the inner row, or paranota with only one row of areolae ..... 2
  - 1'. Paranota with at least two rows of areolae, these subequal in size ..... 5
  - 2. Areolae of different sizes unequal on the dorsal part of the hood ..... *S. nosella*

- 2'. Areolae of subequal sizes on the dorsal part of the hood ..... 3
  - 3. Lateral carina absent *S. fumosa* Drake
  - 3'. Lateral carina present ..... 4
    - 4. Hemelytra with 11-12 rows of areolae in the costal area before the rounded posterior region; abdomen reaching the middle of the hemelytra ..... *S. biseriata* Drake
    - 4'. Hemelytra with 6-9 rows of areolae in the costal area before the rounded posterior region; abdomen conspicuously surpassing the middle of the hemelytra ..... *S. inflata*
  - 5. Cyst on the posterior pronotal projection absent ..... *S. egregia* Drake
  - 5'. Cyst on the posterior pronotal projection present ..... 6
    - 6. Cyst on the posterior pronotal projection almost as high as the hood, slightly higher or lower ..... 7
    - 6'. Cyst on the posterior pronotal projection conspicuously lower than the hood ..... 8
    - 7. Hood triangular anteriorly; paranota entire-

ly biseriated, with areolae of similar sizes; cyst on the posterior pronotal projection higher than the hood ..... *S. stali* Drake

7'. Hood rounded anteriorly; paranota irregularly biseriated, with areolae slightly different in size; cyst on the posterior pronotal projection lower than the hood ..... *S. globifera*

8. Humeri triangular ..... 9

8'. Humeri rounded ..... 10

9. Humeri triangular; areolae of lateral carina not fully developed ..... *S. angulata*

9'. Humeri strongly triangular; areolae of lateral carina fully developed, with two rows at the highest part ..... *S. costai* n. sp.

10. Paranota constricted at the middle line ..... *S. paris* Drake

10'. Paranota without any constriction ..... 11

11. Costal area of hemelytra regularly biseriate anteriorly ..... *S. brasiliensis* Monte

11'. Costal area of hemelytra irregularly biseriate anteriorly, or uniseriate ..... 12

12. Costal area of hemelytra irregularly biseriate anteriorly ..... *S. propria* Drake & Poor

12'. Costal area of hemelytra uniseriate anteriorly ..... *S. maculata* Monte

## DISCUSSION

*Sphaerocysta* is a complex genus. There are two very distinct morphological groups in the genus: the *S. inflata* group (which besides *S. inflata* includes *S. biseriata*, *S. fumosa*, and *S. nosella*) and the *S. globifera* group (includes *S. globifera*, *S. brasiliensis*, *S. egregia*, *S. maculata*, *S. paris*, *S. propria*, and *S. stali*). Each group can be recognized by the outer row of areolae on the paranota (areolae larger than those on the inner row in the *S. inflata* group, whereas these areolae are subequal in size in the *S. globifera* group) and by the shape of hemelytra (a strongly pronounced angle at the anterior region in the *S. inflata* group, which is lacking in the *S. globifera* group). *Sphaerocysta costai* n. sp. and *S. angulata* belong to the *S. globifera* group.

Although it is not expected that there should be remarkable intrageneric variations in nymphal morphology, the immatures of *Sphaerocysta* species described so far (*S. angulata*, *S. inflata* and *S. costai* n. sp.) are remarkably different. The evolutionary scenario proposed up to now indicates a tendency to evolve convergently from simple to complex morphologies in both

adults and nymphs (Lee, 1969; Guilbert, 2001, 2004). Considering the unequal morphological complexity of these *Sphaerocysta* nymphs, this scenario was not clearly observed. Possible explanations are that the genus is not monophyletic and all the nymphs described so far are not congeneric, or the evolution of such traits in Tingidae could be more intricate than previously thought. It is interesting to remark that there are other examples with some intrageneric variation, such as the Neotropical genus *Psilobyrsa* Drake & Hambleton where adults of its two known species are very similar, whereas the nymphs of *P. vriesiae* Drake & Hambleton have small, and simple tubercles instead of the larger and ramified ones observed in the nymphs of *P. aechemeae* Drake & Hambleton (Guidoti, personal observation).

Because nymphal characters can be included in phylogenetic analyses, as well as in the searching of evolutionary trends within the family, their descriptions should not be neglected (Guilbert *et al.*, 2008; Guidoti & Barcellos, 2013). Considering the complex scenario described here, the need for a comprehensive revision and phylogenetic analysis for the genus is undeniable.

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## LITERATURE CITED

- DRAKE, C. J. & N. T. DAVIS. 1960. The Morphology, Phylogeny, and Higher Classification of the Family Tingidae, Including the Description of a New Genus and Species of the Subfamily Vianaidinae (Hemiptera: Heteroptera). *Entomologia Americana* 39: 1–100.
- DRAKE, C. J. & F. A. RUHOFF. 1965. Lacebugs of the World: A Catalog (Hemiptera: Tingidae). *United States National Museum Bulletin, Washington D.C.* 243: 1–634.
- FROESCHNER, R.C. 1991. The lace bug genera *Pleseobyrsa* and *Stragulotingis*: reviews, keys, and description of one new species in each (Heteroptera: tingidae: tinginae). *Proceedings of the Biological Society of Washington* 93: 767–771.
- GUIDOTI, M. & A. BARCELLOS. 2013. On the nymphs of *lan-tana* lace bug *Teleonemia scrupulosa* Stål (Hemiptera: He-

- teroptera: Tingidae: Tinginae): ontogenetic features of integumentary structures highlighted. *Zootaxa* 3613: 289–296.
- GUILBERT, E. 2001. Phylogeny and evolution of exaggerated traits among the Tingidae (Heteroptera, Cimicomorpha). *Zoologica Scripta* 30: 313–324.
- GUILBERT, E. 2004. Do larvae evolve the same way as adults in Tingidae (Insecta: Heteroptera)? *Cladistics* 20: 139–150.
- GUILBERT, E. 2005. Morphology and evolution of larval outgrowths of Tingidae (Insecta, Heteroptera), with description of new larvae. *Zoosystema* 27: 95–113
- GUILBERT, E. & S. I. MONTEMAYOR. 2010. Tingidae (Insecta, Heteroptera) from the Argentinan Yungas: new records and descriptions of selected fifth instars. *Zoosystema* 32: 549–565.
- GUILBERT, E., L. DESUTTER-GRANDCOLAS & P. GRANDCOLAS. 2008. Heterochrony in Tingidae (Insecta: Heteroptera): paedomorphosis and/or peramorphosis? *Biological Journal of the Linnean Society* 93: 71–80.
- LEE, C. E. 1969. Morphological and phylogenetic studies on the larvae and male genitalia of the East Asiatic Tingidae (Heteroptera). *Journal of the Faculty of Agriculture* 15: 138–256.
- MONTEMAYOR, S. I., A. GÓNZALEZ-HERRERA & K. VILLALOBOS. 2011. Description of a new species of *Pleseobyrssa* (Heteroptera: Tingidae) from Costa Rica. *Revista Mexicana de Biodiversidad* 82: 475–80.
- STÅL, C. 1873. Enumeratio Hemipterorum. 3. *Kongliga Svenska Vetenskaps-Akademiens Handlingen* 11: 1–163.