

**BRANCHINECTA MEXICANA, NEW SPECIES
(BRANCHIOPODA: ANOSTRACA), A FAIRY SHRIMP
FROM CENTRAL MEXICO**

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A B S T R A C T

Branchinecta mexicana, new species, a fairy shrimp from central Mexico, is described and figured. Its principal diagnostic characteristic is a squamate appendix on the median side of the basal antennal article. The proximal peglike part of this appendix extends into a posterodorsally directed tip, while its distal part shows 2-5 incisions. Differential features between the new species and the related species *B. packardii* Pearse are discussed on the basis of a SEM analysis.

Branchinecta mexicana, new species, represents the southernmost record of a branchinectid in North America. No other phyllopod species were found at the time of its collection.

Five Branchinectidae have been reported from Mexico: *Branchinecta lindahli* Packard, 1883, found on the peninsula of Baja California and Guadalupe Island (Belk and Lindberg, 1979; Belk, 1983; Maeda-Martínez, 1991); *B. packardii* Pearse, 1912, collected from the north-central part of the country in San Luis Potosí (Strenth and Littleton, 1990), Coahuila, Durango, and Zacatecas (Maeda-Martínez, 1991); *B. belki* Maeda-Martínez *et al.* (1992), and *B. cf. lindahli*, which are endemic to south Coahuila; and, finally, an undescribed species which occurs in the center of Mexico (Maeda-Martínez, 1991). Its description is the subject of the present paper.

In July 1985, A. M. Maeda-Martínez and three colleagues found specimens of *Branchinecta mexicana*, new species, in temporary ponds in a grass prairie bordered by coniferous forest, approximately 8 km north of Tlaxco, Tlaxcala, a mountainous area. In January 1986, Dr. D. Belk found the same species in collections deposited at the National Museum of Natural History (USNM). This material was collected in August 1965 by P. J. Splangler, 5 miles (8 km) north of Tlaxco, Tlaxcala, which seems to be the same locality as ours. However, 5 miles north of Tlaxco is actually in the state of Puebla, just near the border of the state of Tlaxcala.

After an analysis of both samples, Splangler's collection was used as a source of type material, due in part to the larger size of its specimens. The male holotype, female allotype, and 28 paratypes have been depos-

ited in the Smithsonian Institution. Paratypes of both sexes were deposited in the Escuela Superior de Biología, Universidad Juárez del Estado de Durango, Mexico (UJED), and in the Institute of Animal Ecology, University of Ghent, Belgium (UG).

The description is based on the type material. All measurements given are mean values with range. For scanning electron micrographs, specimens and cysts (from females originally fixed in 70% isopropyl alcohol) of *B. mexicana*, new species, and *B. packardii*, were critical-point dried, coated with gold (9 nm, Balzers Union SCD 040), and analyzed under a JEOL JSM 840 (SEM) at 10 kV. Terminology of cyst shell structures is according to Gilchrist (1978). Material of *B. packardii* for comparative SEM analysis was collected on 27 October 1985 by A. M. Maeda-Martínez from an ephemeral roadside pond at El Refugio bridge, 70 km east of Torreón, Coahuila, Mexico, Federal highway No. 40 (UJED 214).

***Branchinecta mexicana*, new species**
Figs. 1A, B, 2A, B, 3A, B, and 4A-E

Material Examined.—Holotype ♂ (USNM 251912), allotype ♀ (USNM 251913), and 28 paratypes (13 ♂♂, 15 ♀♀) (USNM 251914); 6 paratypes (3 ♂♂ and 3 ♀♀) (UG 182) and 14 paratypes (7 ♂♂ and 7 ♀♀) (UJED 287) collected 26 August 1965 by P. J. Splangler. Specimens of 1985 series from type locality: pond no. 1, 38 ♂♂, 65 ♀♀ (UJED 138), 10 ♂♂, 10 ♀♀ (USNM 251915); pond no. 2, 3 ♂♂, 11 ♀♀ (UJED 140); pond no. 3, 4 ♀♀ (UJED 139), collected 21 July 1985 by G. García-Martínez, O. Montañez-Ríos, H. García-Velazco, and A. M. Maeda-Martínez.

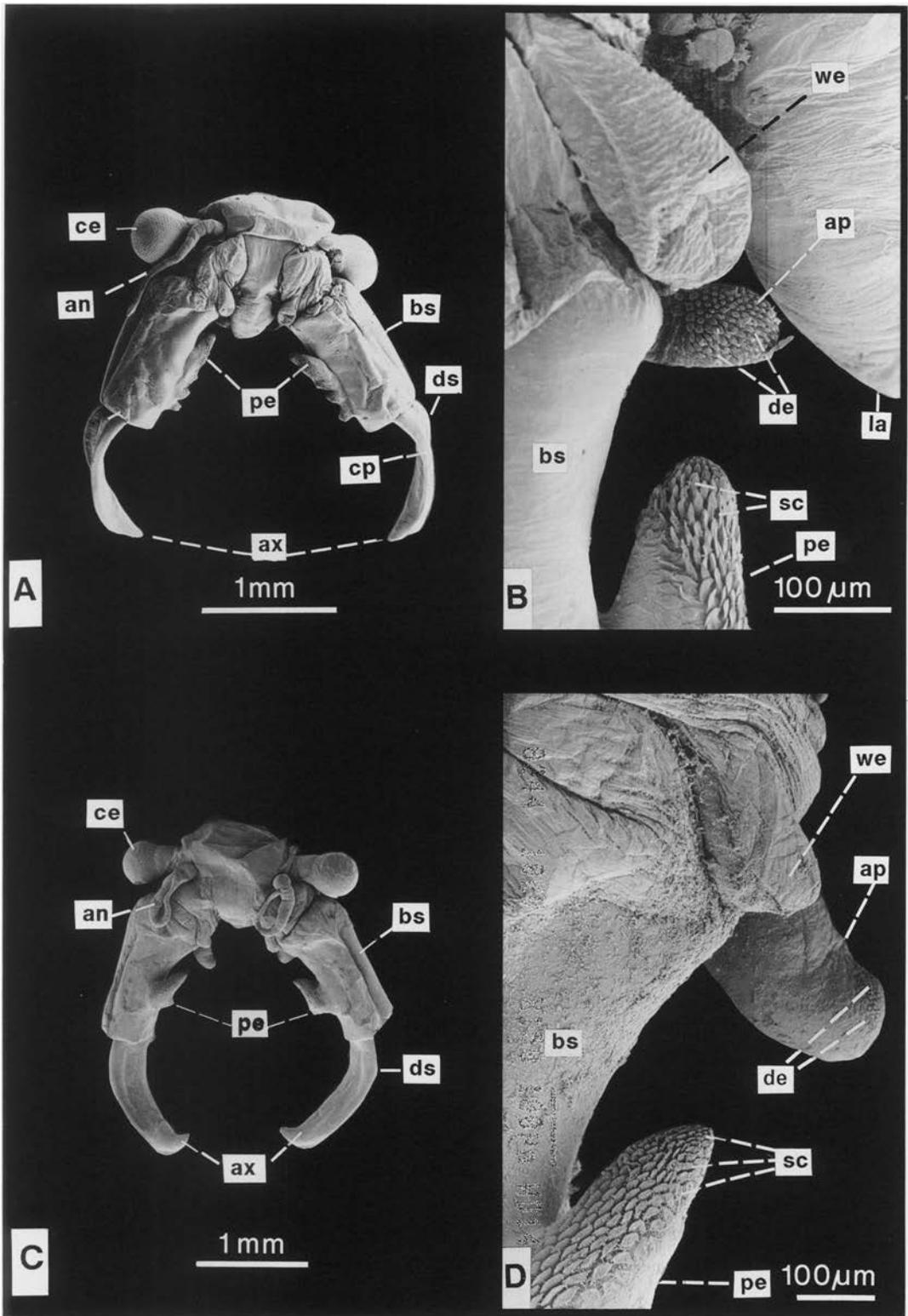


Fig. 1. A, B, *Branchinecta mexicana*, new species; C, D, *Branchinecta packardii*. A, C, head in anterior view; B, D, detail of median base of proximal article of antenna in anterior view. an = antennule, ap = apophysis,

Diagnosis.—Male: Proximal article of antenna with welt or pulvillus in superior position and apophysis in inferior position, distal part of which covered by cuticular denticles. Proximal article of antenna, along median side, with appendix covered by scales. Its proximal, peglike part extending into posterodorsally directed tip; distal part marked by 2–5 incisions. Base of squamate appendix approximately 47% of total length of median side. Distal article of antenna compressed, curved inward, median proximal part curved most strongly; greatest anteroposterior width situated at proximal half; anterior and medial borders of apex joined and extended, tapering, but lateral side concave and tip in same sense as distal part of article; last quarter of posterior border with rasplike surface, ending rounded, and stopping before reaching tip.

Female: Antenna cylindrical, ending in long, sharp tip. Thoracic segments 2–7 usually with, on both sides, dorsolateral conical lobe, rounded at tip, covered by small cuticular denticles, decreasing in size posteriorly. Trunk segments III–XII usually with, on both sides, laterodorsal conical lobe, sharp at its tip, posteriorly directed, increasing in size posteriorly.

Cyst spherical, 0.25 mm (0.21–0.26 mm) in diameter; outer surface wrinkled, with conspicuous ridges forming large polygonal areas; tertiary shell lacking subcortical space between alveolar layers.

Description.—Male: Total length from front to end of last abdominal segment (telson) between cercopods 10.6 mm (8.5–12.3 mm). Antennule 1.6 mm (1.2–2.2 mm), filiform, with 3 subapical setae and 5–10 aesthetascs. Antenna biarticulate; proximal article 1.9 mm (1.7–2.5 mm), with 2 protuberances on median side near proximal end welt, in superior position, inflated and enlarged anteroposteriorly; apophysis, in inferior position, 0.40 mm (0.32–0.50 mm), distally covered with denticles (Fig. 1B). Proximal article with principal diagnostic characteristic, on its median side, consisting of distinctive appendix, covered with scales (Fig.

1A). Base of appendix 0.91 mm (0.64–1.16 mm), approximately 47% of total length of median side. In front and behind of squamate appendix, free surface of 0.92 mm (0.76–1.18 mm) and 0.26 mm (0.20–0.34 mm) in length. Total length of squamate appendix 1.10 mm (0.74–1.40 mm); proximal peglike part extending into posterodorsally directed tip; distal part with 2–5 incisions (Fig. 2A, B).

Distal article of antenna compressed, inwardly curved, median proximal part curved most (Fig. 1A); greatest anteroposterior width situated at proximal half. Length of article across arc 1.7 mm (1.1–2.3 mm), having deeply concave lateral side and slightly concave median side (Fig. 3A). Apex with anterior and medial borders joined, tapering, lateral side concave and tip in same sense as distal part of article (Fig. 3A, B); last quarter of posterior border with rasplike surface, ending rounded, and stopping before reaching apex.

Nuchal organ transversely oblong, 0.39 mm (0.34–0.44 mm) in line with body, and 0.47 mm (0.36–0.56 mm) perpendicular to axis. Diameter of compound eye, measured in parallel to longitudinal body axis, 0.64 mm (0.56–0.74 mm).

Rudimentary mandibular palp present. Maxillule with 1 median spine, and with 16 or 17 plumose setae. Maxilla with 2 basal and 11 or 12 distal setae. Phyllopodia typical of genus; preepipodite (branchial lamina) with edge sparsely serrated by cuticular papillae.

Genital segments with penes typical of genus; ventromedian outgrowth of basal nonretractile part slender hook, its tip pointing in posterior direction.

Cercopods, not including setae, 1.9 mm (1.4–2.4 mm) long, not converging, set with plumose setae along their median and lateral borders.

Female: Total length 10.6 mm (5.5–13.9 mm). Antennule 1.2 mm (0.6–1.4 mm), filiform, with 3 subapical setae. Antenna 1.6 mm (0.8–2.0 mm), cylindrical, ending in long, sharp tip. Nuchal organ transversely

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ax = apex of distal article of antenna, bs = proximal article of antenna, de = cuticular denticles, ds = distal article of antenna, ce = compound eye, cp = most curved part of distal article, la = labrum, pe = peglike appendix, sc = scales, we = welt.

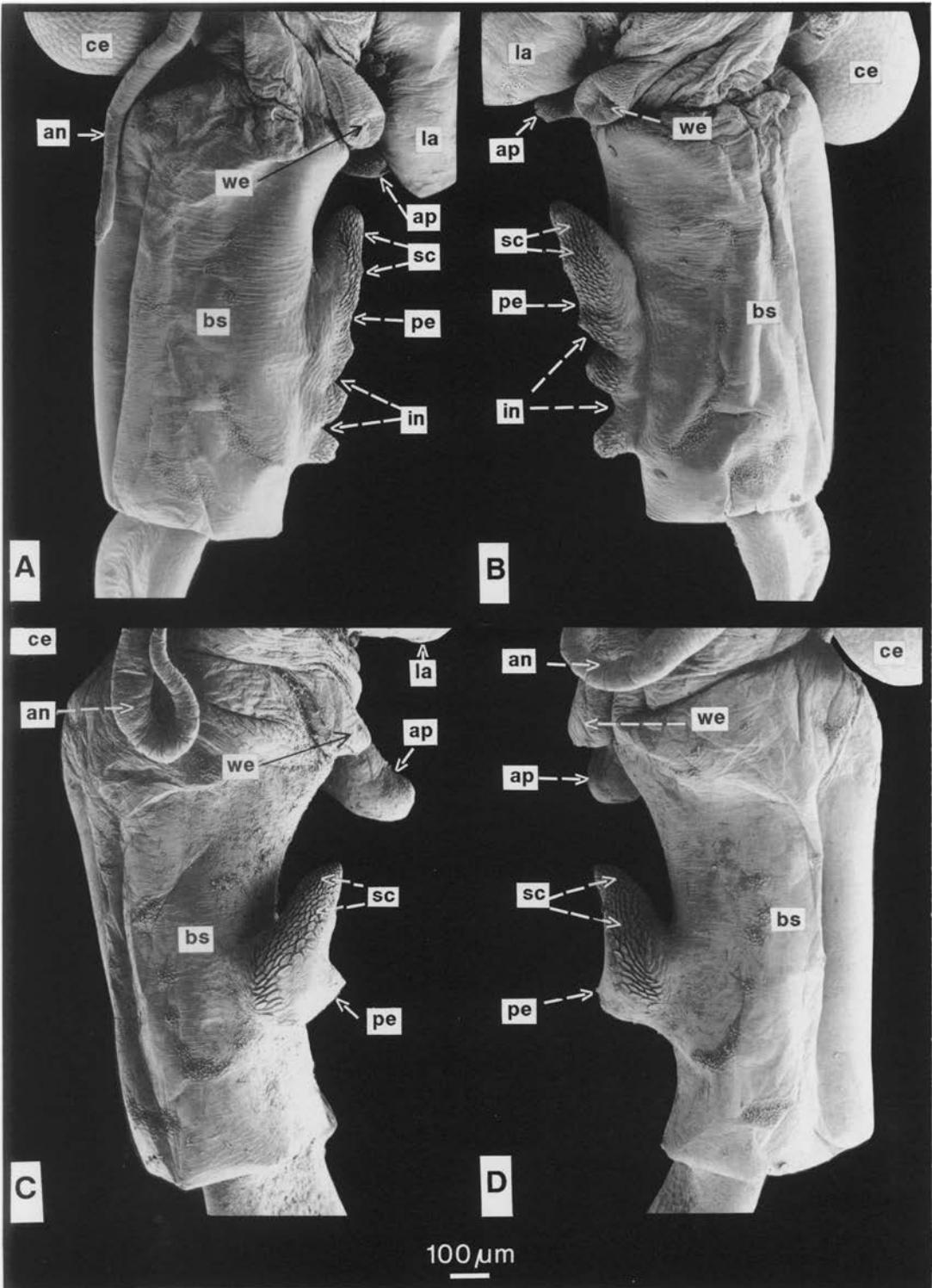


Fig. 2. A, B, *Branchinecta mexicana*, new species; C, D, *Branchinecta packardi*. A, C, right proximal article of antenna in anterior view; B, D, left proximal article of antenna in anterior view. an = antennule, ap = apophysis, bs = proximal article of antenna, ce = compound eye, in = incisions on squamate appendix, la = labrum, pe = peglike appendix, sc = scales, we = welt.

oblong, 0.41 mm (0.32–0.51 mm) measured in line with body, and 0.56 mm (0.45–0.64 mm) perpendicular to body axis. Diameter of compound eye in dorsal view and parallel to longitudinal axis 0.44 mm (0.22–0.51 mm). Rudimentary mandibular palp present. Maxillule and maxilla as in male.

Thoracic segments 2–7 with, on both sides, dorsolateral conical lobe, rounded at tip, covered by small cuticular denticles. These lobes decreasing in size posteriorly. In 31% of females, lobes only on segments 2–6 and, in 8%, on 2–5. In 96% of females, trunk segments III–XII (thoracic 3–11 and first genital-abdominal segments) bearing on each side laterodorsal conical lobe with sharp tip, posteriorly directed. These lobes increasing in size posteriorly.

Ovisac fusiform, tip ending under seventh abdominal segment in 70% of females, under sixth in 30%. Ovaries extending from trunk segments V (fifth thoracic) to XVII (sixth abdominal). Number of cysts in ovisac 162–260 ($N = 5$). Cercopods, not including setae, 1.7 mm (0.8–2.2 mm) long, not converging, with plumose setae along median and lateral borders.

Cyst spherical, 0.25 mm (0.21–0.26 mm) in diameter ($N = 200$); outer surface wrinkled, with distinctive ridges forming large polygonal areas (Fig. 4A, B); tertiary shell approximately 10 μm thick, consisting of 2 alveolar layers; inner alveolar layer more dense than outer cortex (Fig. 4C–E). Subcortical space between alveolar layers lacking (Fig. 4D, E).

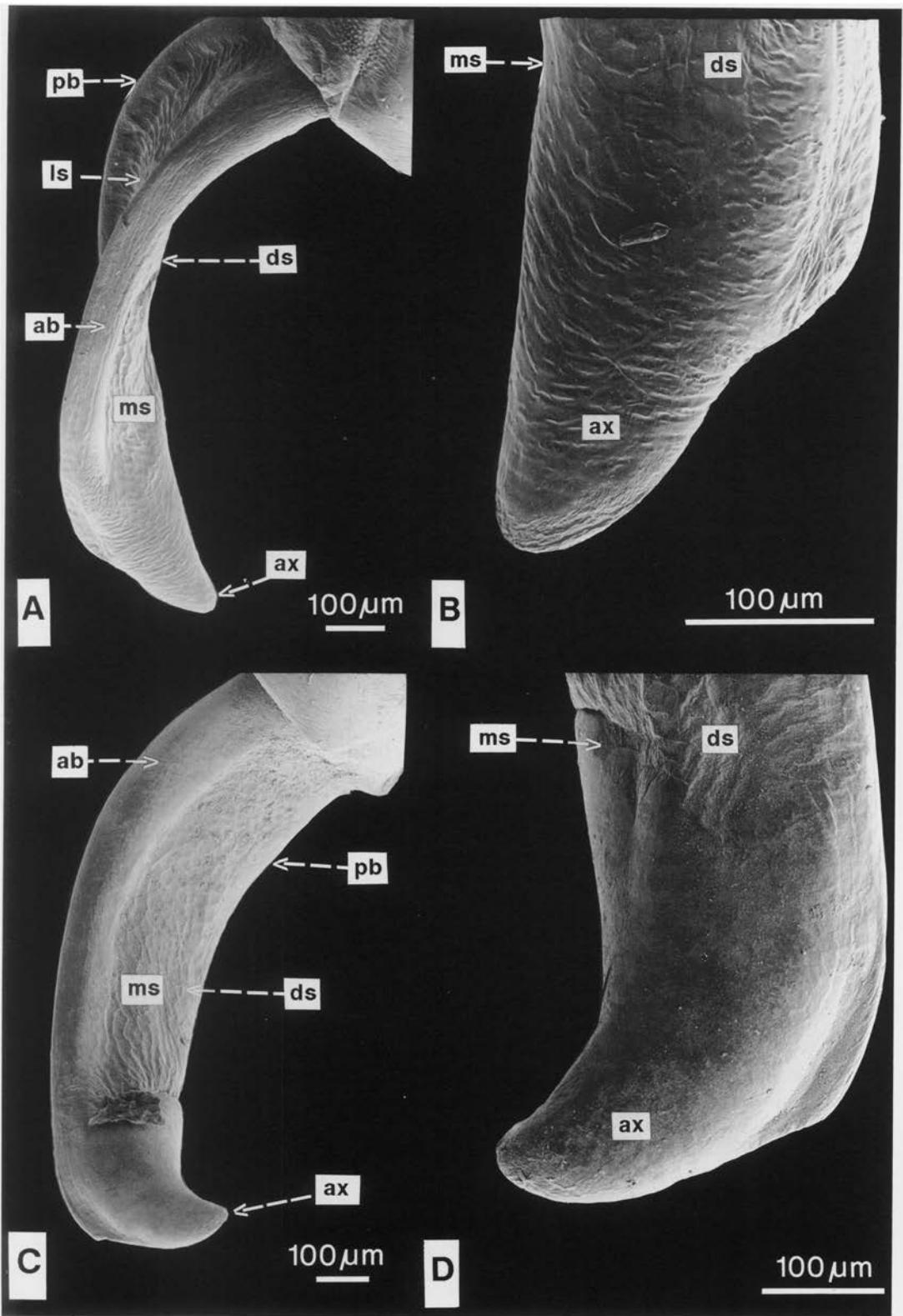
Differential Diagnosis.—*Branchinecta mexicana*, new species, is closely related to *B. packardii*. Males of both species present a welt, an apophysis, and a squamate peglike appendix on the proximal antennal article (Lynch, 1964; Maeda-Martínez *et al.*, 1992). Females of both species have two types of conical lobes on the thoracic segments and on the first genital segment. However, by SEM, we established the following differences. In *B. mexicana*, the base of the squamate peglike appendix extends distally along the median side of the article, to cover approximately 47% of the total length of the median surface (Fig. 2A, B); in *B. packardii*, the base is shorter (approximately 22% of the total length of the median surface) (Fig. 2C, D). In *B. mexicana* the squamate part of the process is also marked with 2–5 in-

cisions. The apical part of the apophysis of *B. mexicana* is covered with thick, long cuticular denticles (Fig. 1B); in *B. packardii* this structure carries a reduced number of short denticles (Fig. 1D). The proximal half of the distal article is similar in both species; however, the apex of the article in *B. packardii* is notably inflexed (Fig. 3C, D), while in *B. mexicana* it is not (Fig. 3A, B).

The females differ in the number of pairs of the two types of conical lobes. Although this characteristic may be size-related, Lynch (1964) showed that of approximately 20 females of *B. packardii*, with 15.3-mm average length (including cercopods), 78% had sharp lobes on trunk segments IX–XII (4 pairs) (from 80 females, only six had the maximum number of 6 pairs), while 90% bore rounded lobes on trunk segment II, and 21% on trunk segments II and III (2 pairs). In comparison, 96% of the females of *B. mexicana*, with 12.3-mm average length (including cercopods), presented sharp lobes on trunk segments III–XII (10 pairs), while rounded lobes occurred on trunk segments II–VII (6 pairs) in 61% of the specimens, on segments II–VI (5 pairs) in 31%, and on segments II–V (4 pairs) in 8%.

In respect to cyst morphology, *Branchinecta mexicana*, like *B. packardii*, belongs to a North American group of species in which a system of ridges encloses large polygonal areas (Mura, 1991). However, two differences were noted. Firstly, ornamentation in *B. mexicana* consists of more prominent ribs (Fig. 4A, B) than in *B. packardii* (Gilchrist, 1978; Mura, 1991; Maeda-Martínez *et al.*, 1992). Secondly, the subcortical space between the outer cortex and the inner layer, characteristic of *B. packardii* (Gilchrist, 1978; Maeda-Martínez *et al.*, 1992), is lacking in *B. mexicana* (Fig. 4C–E).

Similarly to *B. mexicana*, the Argentinian species *Branchinecta valchetana* Cohen, 1981, and *B. prima* Cohen, 1983, present an appendix along the median side of the proximal antennal article. However, in *B. mexicana* this process is large, peglike, and covered with scales, while in *B. prima* and *B. valchetana* it is rounded, inconspicuous, and with isolated cuticular papillae (Cohen, 1981, 1983). These South American species also lack the apophysis near the base of the median side of the proximal antennal arti-



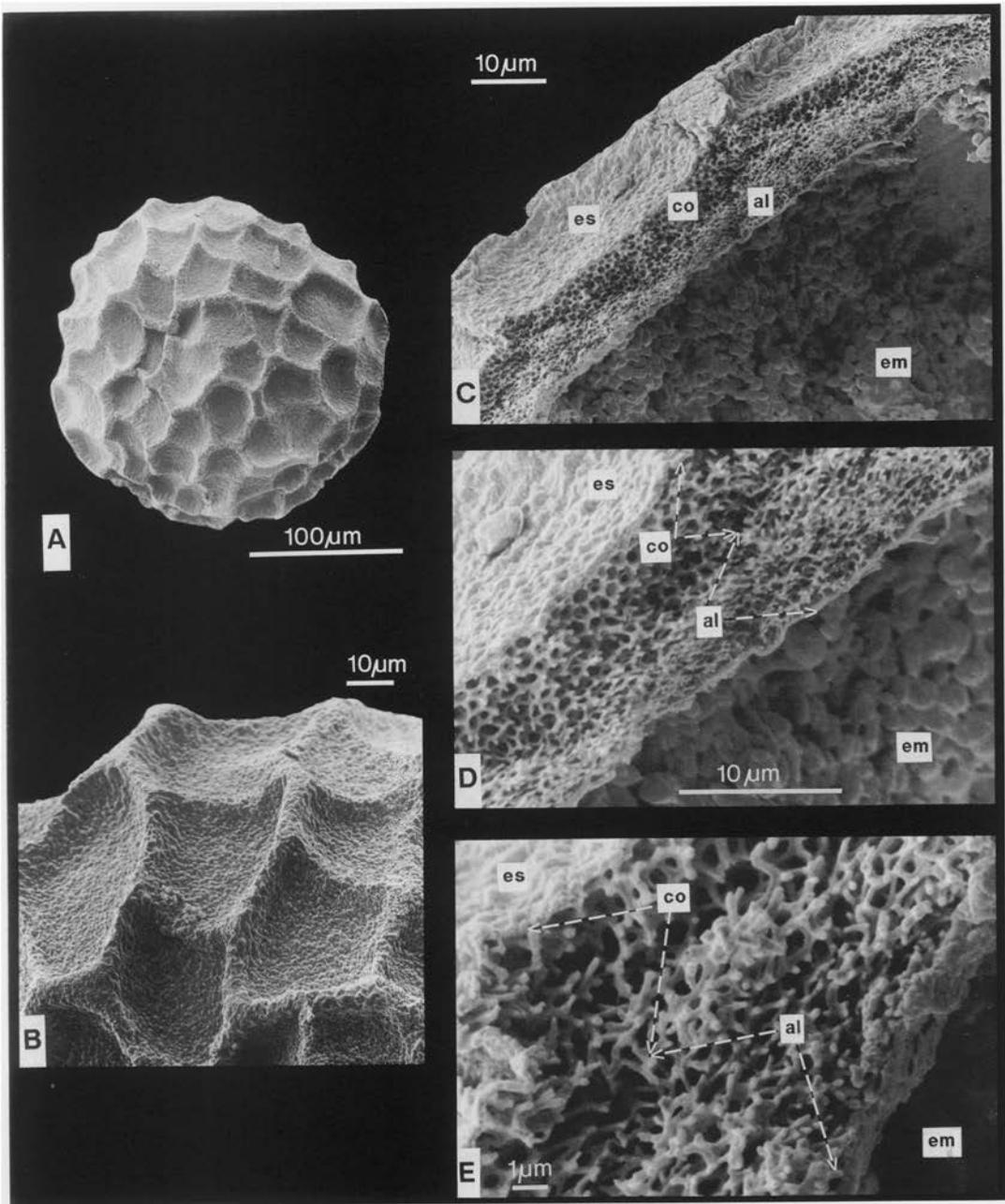


Fig. 4. Cysts of *Branchinecta mexicana*, new species; A, whole cyst; B, enlarged detail of external surface; C–E, detail of cross section of cracked cyst. al = inner alveolar layer, co = outer cortex, em = embryonic cells, es = external surface of cyst.

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Fig. 3. A, B, *Branchinecta mexicana*, new species; C, D, *Branchinecta packardi*. A, right distal article of antenna in anterior view; C, right distal article of antenna in anteromedian view; B, D, detail of apex of left distal article in anterior view. ab = anterior border, ax = apex of distal article of antenna, ds = distal article of antenna, ls = lateral side, ms = median side, pb = posterior border.

cle. At the site of the welt of *B. mexicana*, *B. prima* bears a round protuberance covered by isolated cuticular structures, while *B. valchetana* has a conical spine covered by small cuticular structures (Cohen, 1981, 1983). The apex of the distal antennal article in the Argentinian species is more inflexed than in *B. mexicana*.

Type Locality and Habitat.—A roadside ephemeral pond in front of the town of Rafael Avila Camacho, Puebla, Federal highway No. 119, approximately 8 km north of Tlaxco, Tlaxcala, Mexico, 19°41'27"N, 98°05'08"W.

On 21 July 1985, at 0750, three small ponds (approximately 5 × 4 m surface area, maximum depth 15 cm) were so near to each other, that in the earlier phase of their filling they had formed only one pond. At the moment of sampling, we recorded a water temperature of 9°C (air temperature 10.5°C), conductivity 380 μS/cm, and pH 6.7. No other phyllopod species were found at the time of collection.

Etymology.—The new species is named for the Republic of Mexico, the country of origin of this species.

DISCUSSION

Branchinecta mexicana, from central Mexico, represents the southernmost record of the Branchinectidae in North America. The former southernmost record was *B. packardii* at San Luis Potosí, Mexico (Strenth and Littleton, 1990), about 22°39'N, 101°56'W.

Although the collections of the type material and the second series of the new species were made during summer (August and July), and from a relatively low latitude, the presence of a branchinectid in the mountains of the type locality is not unexpected, because the temperature there remains low as typically required by the genus *Branchinecta*. The average local temperatures in July and August are 13.4 and 13.6°C (Secretaría de Programación y Presupuesto, 1981).

With regard to the difference in cyst morphology between *B. mexicana* and *B. packardii*, the absence of a subcortical space in *B. mexicana* confirms the conclusions of De Walsche *et al.* (1991), that cross sections of the tertiary shell may reveal species-specific

differences in addition to those of external ornamentation and cyst diameter.

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ANNOUNCEMENT

A symposium on Blue Crab Recruitment—Environmental Control and Population Regulation will be held in conjunction with the 12th Biennial International Estuarine Research Federation Conference at Hilton Head, South Carolina, U.S.A., 14–18 November 1993.

This symposium will stress an understanding of processes that affect variation in population size of the blue crab *Callinectes sapidus*. Emphasis will be placed on environmental controls, such as stochastic events associated with transport and settlement of prerecruits at local and regional scales, and density-dependent processes, such as predation, cannibalism, and reproductive output.

Persons seeking further information about the symposium should contact either of the coconvenors:

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