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BRANCHINECTA READINGI, NEW SPECIES NAME FOR A WELL-KNOWN FAIRY SHRIMP FROM EAST OF THE NORTH AMERICAN CONTINENTAL DIVIDE

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A B S T R A C T

Branchinecta mackini Dexter, 1956 (Crustacea, Anostraca) has been thought to occur both east and west of the Continental Divide of North America for more than 30 years. My study revealed that individuals from east of the Divide are morphologically distinct from those found west of the Divide. Males consistently differed in the shape of the distal end of the antenna. The eastern taxon is described and given the name *Branchinecta readingi* new species.

The taxon I describe herein as a new species is one of the most-studied fairy shrimps in Canada. It was first reported from Alberta and Saskatchewan by Hartland-Rowe (1965) misidentified as *Branchinecta mackini* Dexter, 1956. To his credit, Hartland-Rowe cautioned that there were taxonomic problems with species in the genus *Branchinecta* and had Dr. James E. Lynch examine some of his specimens from Alberta. Hartland-Rowe quotes Lynch as saying, "I would consider your specimens a distinct subspecies of *B. mackini*." However, Hartland-Rowe did not follow-up on Lynch's observation.

Thanks to the enthusiasm of Ken Reading and George Langstaff for collecting large branchiopods, I accumulated samples of 14 populations of the questionable "*B. mackini*" from two areas east of the Continental Divide. Ken is a Canadian mineral prospector, and George was a graduate student in geology at the time he was sending me fairy shrimp from his study area in Wyoming. I obtained additional specimens from east of the Rocky Mountains for study from the Science Museum of Minnesota and the Museum of Zoology at the University of Alberta. Comparison of these specimens with specimens of *Branchinecta mackini* in my personal collection taken from 50 populations west of the Continental Divide in British Columbia, Washington, Oregon, California, Baja California, and Nevada convinced me that the eastern taxon is a new species, which I describe below.

MATERIALS AND METHODS

Linder (1941) considered the two fused genital segments to be part of the anostracan abdomen in his influential work on fairy shrimp morphology. However, Walossek (1993) presents convincing evidence that the genital segments of anostracans should be counted as part of the thorax, not the abdomen. Thus, in the following description I number the abdominal segments starting with the first post-genital segment and ending with the telson as abdominal segments 1–7.

Specimens of New Species Studied.—DB (Denton Belk's collection) 560: pool of opaque, coal-black water in an extensive series of rangeland ponds northeast of Calgary, Alberta, Canada (51°12′N, 113°32′W), collector K. A. L. Reading, 15 May 1983. DB 811: pool in sagebrush desert, elev. 2,132 m, Antelope Hills, Sweetwater County, Wyoming (42°15′19″N, 108°26′46″W), collector George D. Langstaff, 10 June 1987. DB 812: pool in sagebrush desert, elev. 2,126 m, Antelope Hills, Sweetwater County, Wyoming (42°14′51″N, 108°24′32″W), collector G. D. Langstaff, 8 June 1987. DB 813: pool in sagebrush desert, elev. 2,130 m, Antelope Hills, Sweetwater County, Wyoming (42°15′02″N, 108°26′15″W), collector G. D. Langstaff, 10 June 1987. DB 941: Circle Bar Lake, sagebrush desert, elev. 2,150 m, Antelope Hills, Fremont County, Wyoming (42°16′50″N, 108°30′15″W), collector G. D. Langstaff, 29 May 1989. DB 1236: Brannan Reservoir, desert, elev. 2,074 m, Great Divide Basin, Sweetwater County, Wyoming (42°09′34″N, 108°30′31″W), collector G. D. Langstaff, 12 June 1993. DB 1238: a borrow pit in greasewood desert about 400 m east of Soda Lake, elev. 1,979 m, Great Divide Basin, Carbon County, Wyoming, collector G. D. Langstaff, 13 June 1993. DB 1243: Coyote Lake, sagebrush steppe, elev. 2,069 m, Antelope Hills, Fremont County, Wyoming (42°22′35″N, 108°14′53″W), collector G. D. Langstaff, 11 June 1993. DB 1244: pond 1 km northwest of Scotty Lake, sagebrush desert, elev. 2,130 m, Antelope Hills, Sweetwater County, Wyoming (42°15′02″N, 108°26′15″W), collector G. D. Langstaff, 12 June 1993. DB 1245: pond about 100 m east of DB 1244 in sagebrush desert, elev. 2,130 m, An-

telope Hills, Sweetwater County, Wyoming (42°15′04″N, 108°26′05″W), collector G. D. Langstaff, 12 June 1993. DB 1247, DB 1248, DB 1249: three ponds in sagebrush steppe at elevations of 2,209, 2,210, 2,211 m, South Pass area, Fremont County, Wyoming (42°26′39″N, 108°27′33″W), (42°27′05″N, 108°27′03″W), (42°26′56″N, 108°27′17″W), collector G. D. Langstaff, 11 June 1993. DB 1258: Lost Creek Lake, Sweetwater County, Wyoming (42°01′N, 108°12′W), collector G. D. Langstaff, 25 June 1995. Science Museum of Minnesota P050607: Salt Lake, a pear-shaped alkaline pool about 800 m wide by 1.6 km long, in Lac Qui Parle County, Minnesota (larger part) and Deuel County, South Dakota (smaller part), 1.5 km west of County Road 7 on an unnamed dirt road intersecting 7 at 4.9 km south of its intersection with State Highway 40 at Marietta, Minnesota (44°57′N, 96°26′W), collector Dale A. Chelberg, 6 May 1971. Museum of Zoology, University of Alberta 217, 222, 225–228, 234: Fleeinghorse Lake, Alberta, Canada (52°19′N, 110°11′W), collector Graham R. Daborn, May and June, 1971.

Branchinecta readingi, new species

Figs. 1A, B, D; 2A, B

Types.—Holotype male (CMNC 1998–0019), 32 male paratypes, and 17 female paratypes, (CMNC 1998–0020 and 0021) are at the Canadian Museum of Nature, Ottawa, Ontario, Canada.

Type Locality.—Fleeinghorse Lake, Alberta, Canada (52°19′N, 110°11′W). I chose this location because Daborn (1974, 1975, 1977) presents information detailing the limnology of the lake and the biology of its population of *Branchinecta readingi*, albeit misidentified as *B. mackini*.

Etymology.—This species is named in honor of my friend Kenneth A. L. Reading. For more than 17 years, Ken has been sending me large branchiopods from Canada, Mexico, Aruba, and Argentina. Ken is an ardent collector of aquatic organisms and Canadian flora. Being of generous spirit, he freely shares his treasurers with other interested naturalists. The specimens he provided me of *B. readingi* and *B. mackini* were central to my discovery of the differences between these two taxa.

Description of Male.—Length measured from front of head to tip of cercopods for 20 mature individuals ranged 18–23 mm. Antennae two segmented; segments approximately equal in length. Basal segment of antenna with an apophysis on posteromedial surface directed medially and slightly down; and with 0–5 small, inconspicuous spines below center scattered on medial surface (Fig. 1A). Distal segment of antenna about twice as wide as thick; distal end projects forward, then curves lateral and tapers to a point (Fig. 1B); rasp-like area on posterior edge ends distally more than half its total length from tip of antenna (Fig. 1D). Penes protrude ventrolaterally far apart, basal segment of each penis with one medially directed thornlike process; retractile apical part of each penis short, length about equal to basal segment, with 2 similar, oval-shaped dentate warts, proximal wart on lateral side, distal wart on dorsal side. Cercopods separate, cone-shaped, and fringed with plumose setae along medial and lateral edges.

Description of Female.—Length measured from front of head to tip of cercopods for 20 mature individuals with resting eggs (cysts) in their brood pouches ranged 18–25 mm. Antennules about twice as long as antennae. Antennae not segmented, roughly round, tapering to spinelike tip developed off center in a posteromedial position. Brood pouch spindle-shaped, extending to below abdominal segment 3 or 4, and opening terminally. Ovary biramos, anterior branch extends into thoracic segment 7, 8, 9, 10, or 11, posterior branch reaches into abdominal segment 3 or 4. Pair of low, often only slightly elevated and inconspicuous, mound-like verrucose bosses on dorsal surface of each thoracic segment; bosses on segments 4 and 9 nearer middorsal line than those on other segments. Cyst round, surface with rounded ridges intersecting to form polygons of differing sizes and shapes (Fig. 2A, B). Cercopods separate, cone-shaped, and fringed with plumose setae along medial and lateral edges.

Remarks.—As pointed out in the introduction, the described species most similar to *Branchinecta readingi*, and the one with which it has been confused, is *Branchinecta mackini* Dexter, 1956. Males of both species have very similar antennae with a posteromedial apophysis located proximally on the basal segment and 0–5 small, inconspicuous spines scattered over the medial surface of the basal segment just below its center. However, the distal end of the antenna is clearly and consistently different. The antenna of *Branchinecta mackini* ends bluntly with the anterior edge extending a little longer than the posterior edge (Fig. 1C). By contrast, the an-

Fig. 1. *Branchinecta readingi,* new species. (A) Frontal view of head of a male paratype showing apophysis and spines (center most of three at arrow) on basal (first) segment of right antenna, scale = 1.0 mm. (B) Frontal view of distal end of second segment of male's antenna, tip points lateral. (C) Lateral view of distal end of second segment of antenna of a male *Branchinecta mackini* for comparison with D. (D) Lateral view of distal end of second segment of male's antenna. Scale in B, C, D = 0.3 mm.

tenna of *Branchinecta readingi* projects forward and then curves laterally and tapers to a point (Fig. 1B, D). The rasplike region at the end of the antenna is more extensive in *B. mackini* reaching almost to the tip (Fig. 1C). By contrast, the rasplike region in *B. readingi* is less extensive, ending at a distance equal to about half of its length from the apex of the antenna (compare Fig. 1C, D). The unique shape of the distal end of the antenna in *B. readingi* can easily be seen in a picture of a live male that Chelberg (1972: 9) called an unnamed species of *Branchinecta*.

Lynch (1960) illustrated the thoracic bosses of the female of *Branchinecta campestris* Lynch, 1960 (fig. 4a, page 553) and pointed out that the thoracic bosses of *B. mackini* follow the same pattern but are much less elevated above the surface of the thorax. The same may be said for the thoracic bosses of

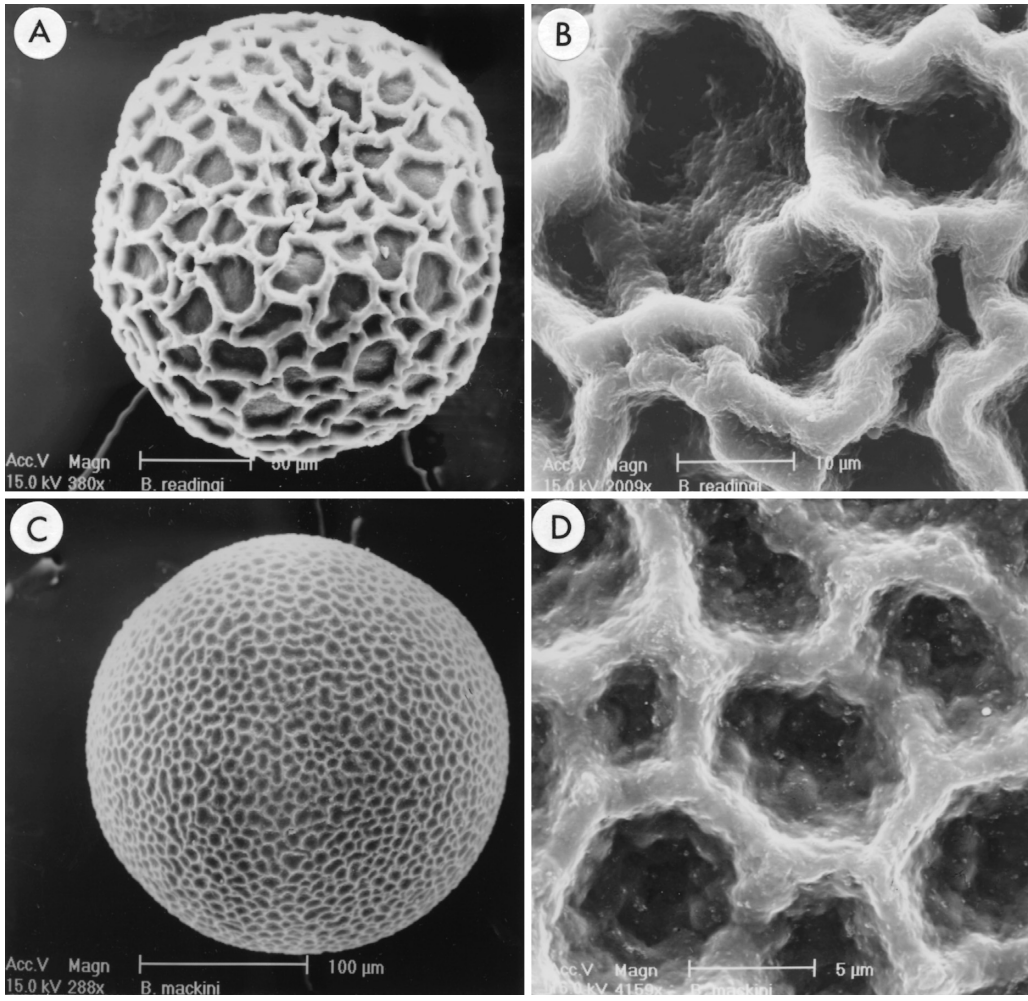

Fig. 2. Cysts. (A) *Branchinecta readingi,* new species, whole view of a mature-looking cyst removed from the brood pouch of a female paratype. (B) *Branchinecta readingi,* new species, close-up view of above cyst showing ridges and pitted or catered surface between the ridges. (C) *Branchinecta mackini,* whole view of a mature-looking cyst removed from the brood pouch of a female collected by Ken Reading at mile marker 73 on the old Caribou Highway in British Columbia, Canada (DB 904). (D) *Branchinecta mackini,* close-up view of above cyst showing ridges and bubbly surface between ridges.

B. readingi. A fourth species with the same pattern of thoracic bosses is *Branchinecta potassa* Belk, 1979. Those of *B. potassa* are intermediate in elevation between the prominent bosses of *B. campestris* and the low ones of *B. mackini* and *B. readingi*. The females of both *B. readingi* and *B. mackini* can be distinguished from females of *B. campestris* by the fact that their antennules are about twice as long as their antennae, whereas the antennules of females of *B. campestris* are from shorter than to about equal in length to their antennae. The antennules of *B. potassa* are about one and a half times as long as their antennae. I found no morphological characters useful in distinguishing *B. readingi* and *B. mackini* females; however, the cysts they produce differ. The polygons on the shell of *B. readingi* are considerably larger and fewer in number relative to the diameter of the cyst than are those on the shell of *B. mackini* (Fig. 2A, C) and fig. 17 in Hill and Shepard (1997). The ridges are about twice as thick on the shell of *B. readingi* as they are on the shell

of *B. mackini* (Fig. 2B, D). The valleys of the polygons have a pitted or catered appearance in cysts of *B. readingi*, whereas, the valleys appear bubbly in cysts of *B. mackini* (Fig. 2B, D).

Previous Misidentifications.—Hartland-Rowe (1965, 1966), and Daborn (1974, 1975, 1977, 1979) present considerable natural-history and ecological data about *B. readingi* misidentified as *B. mackini*. The following publications also present information about what I assume to be *B. readingi* misidentified as *B. mackini*. Retallack and Clifford (1980) reported finding a few individuals in Sounding Creek about 400-km southeast of Edmonton, Alberta, Canada. White and Hartland-Rowe (1969) present habitat and biological data for a population in Wanek Lake, one of the Chain Lakes located about 230-km northeast of Calgary, Alberta, Canada. Hartland-Rowe (1966) examined approximately 300 ephemeral pools in Alberta and Saskatchewan and found *B. readingi* to occur in a broader range of salinity than any of the other species he encountered. McCarraher (1970) found what he identified as *B. mackini* in a pond near Lakeside, Sheridan County, Nebraska. He most likely sampled a population of *B. readingi*. Unfortunately he did not deposit voucher specimens in a museum, and when I contacted him by telephone stated that he did not have any specimens.

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