

## FIRST RECORD OF *Daphnia lumholtzi* (SARS, 1885), EXOTIC CLADOCERAN, IN SÃO PAULO STATE (BRAZIL)

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*Daphnia lumholtzi* was recently found at Três Irmãos Reservoir, São Paulo State, Brazil (21°45'S e 49°47'W) (Fig. 1).

*Daphnia lumholtzi* is a species of the family Daphnidae, Cladocera, with natural geographic distribution restricted to Australia, southwestern Asia, and Africa. It has invaded the United States and rapidly dispersed during the last decade (Havel & Hebert, 1993) after its first appearance in 1989 (Havel *et al.*, 2000).

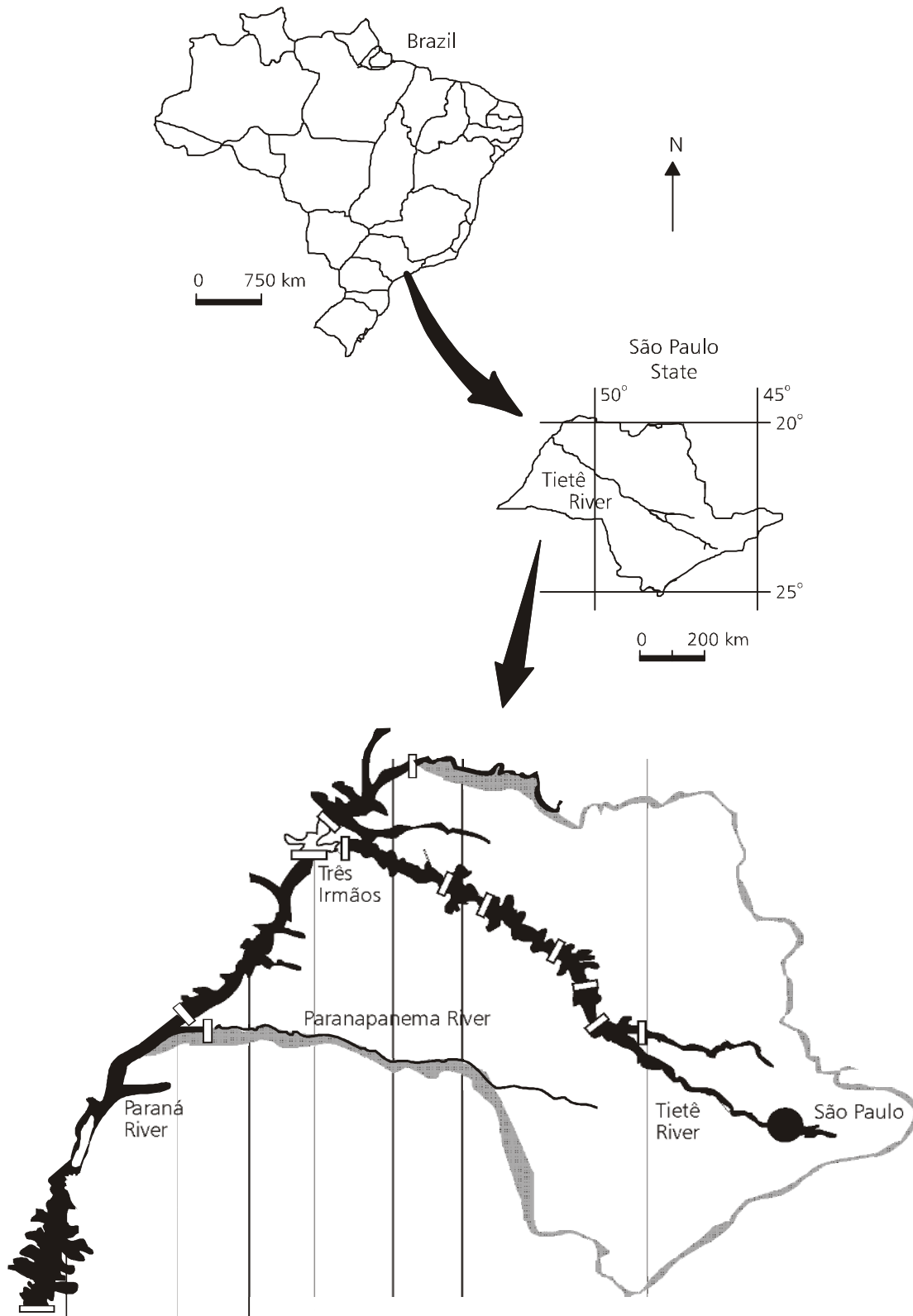
The occurrence of this species in the New World was considered peculiar. Some authors have suggested that intercontinental dispersion of cladocerans is rare, although the production of resting eggs and the parthenogenetic reproduction mode have been facilitating dispersion (Dodson & Frey, 1991). According to Havel & Hebert (1993), another dispersion agent could be the introduction into reservoirs of fishes for angling purposes. Once the species reaches the new continent, its dispersal could be by means of boats used for recreational activities.

Resistance to predation might be a determinant factor in the successful invasion of this species because the carapace spine and helmet of *D. lumholtzi* protect against invertebrate predation (Kolar & Wahl, 1998), although this is still a matter of speculation because the real protective potential of such structures is not well known (Dzialowski *et al.*, 2000). Many invaders are successful because, besides resistance to predation (Crawley, 1986), either native competitors are ineffective or other species do not take advantage of existing opportunities.

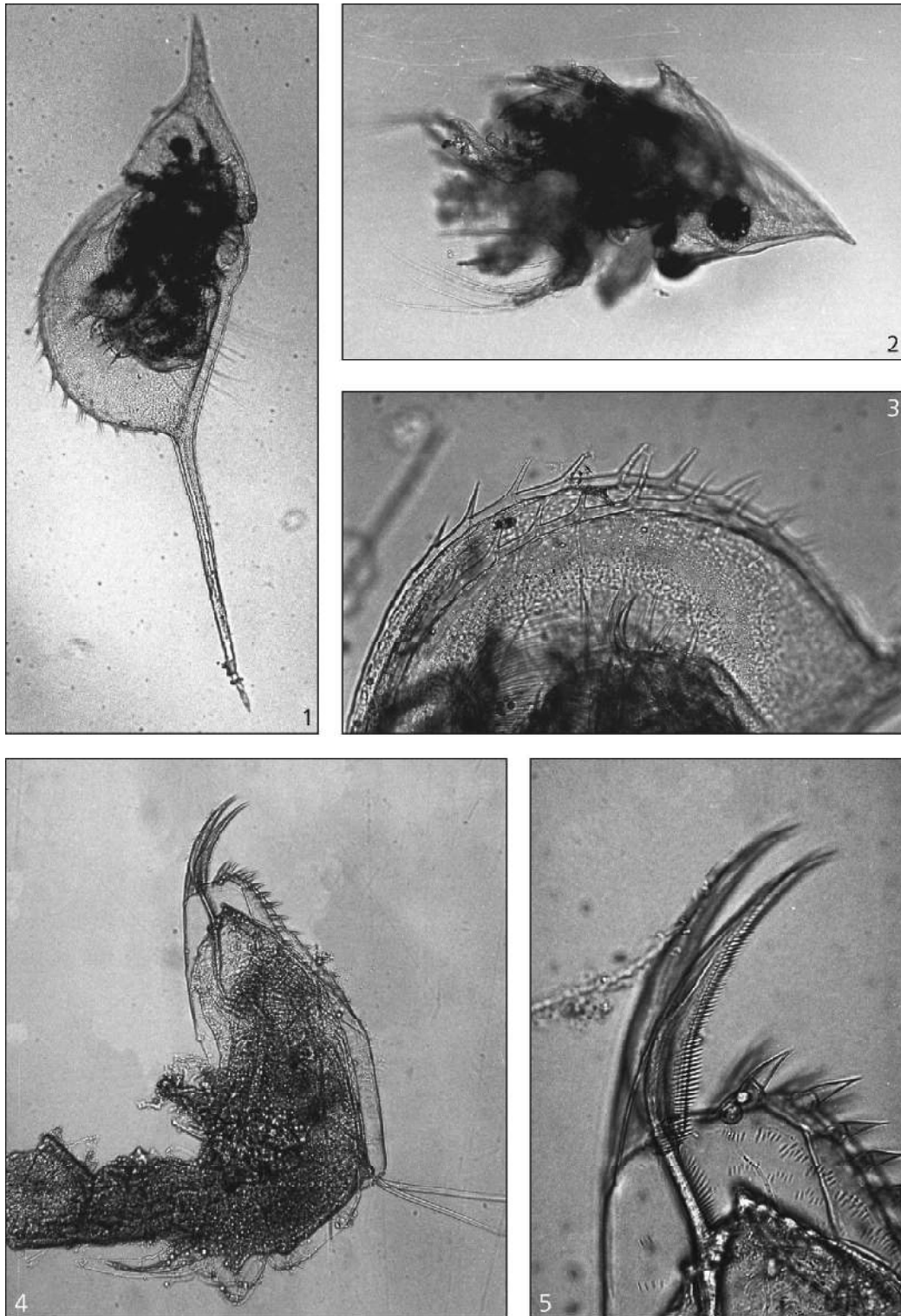
The morphology of *D. lumholtzi*, as described by Sars (1885), clearly shows great differences when compared to the three species of *Daphnia* occurring in Brazilian water bodies: *D. laevis*, *D. gessneri*, and *D. ambigua* (Matsumura-Tundisi, 1984). The distinctive features are the presence of lateral fornices, ventral margin of carapace with 12 strong spines, and post-abdomen with characteristic processes (Korínek, 1999; Korínek, 2002; Smirnov & Timms, 1983). According to Sars (1885), adult females can reach 1.3 mm mean length and adult males 1.0 mm, with variations depending on environmental conditions. The species diagnosis includes: head usually with a narrow, anterior projecting crest, but may be absent in dense populations; antennular mounds very well developed and situated close to the rostrum; tail varying from one-half to slightly more than carapace length.

Figure 2 shows morphological characteristics of *D. lumholtzi* found in Três Irmãos Reservoir. Male characteristics are: head usually unhelmeted, with a small spike-shaped crest occasionally present; dorsal postabdominal margin strongly sinuate; tail about two-thirds of carapace length.

*D. lumholtzi* has not been previously reported in the Neotropical region. In Brazil, in October 2000 it was found in both transition and lacustrine regions in Três Irmãos, a large reservoir (81.700 ha) located in the Tietê River, in samples concentrated in a plankton net (30 µm mesh size) collected by pumping water of the entire water column. In the transition zone the population density was 55 ind.m<sup>-3</sup>, whereas in the lacustrine region near the dam, it occurred at densities of 100 ind.m<sup>-3</sup>.



**Fig. 1** — The location of Três Irmãos Reservoir in São Paulo State, Brazil.



**Fig. 2** — *Daphnia lumholtzi* collected in Três Irmãos Reservoir, São Paulo State, Brazil. 1. General view of female (x 320); 2. fornix (x 200); 3. spines in the ventral carapace (x 640); 4. postabdomen (x 400); and 5. claw (x 640).

The observed densities suggest that the species population is in the colonization phase in Três Irmãos Reservoir. In the Great Lakes in North America, the average number in the initial colonization phase was 30 ind.m<sup>-3</sup> (Muzinic, 2000). According to Dzialowski *et al.* (2000), *D. lumholtzi* has a wide ecological tolerance, but the reservoirs where invasion has been successful tend to be large, deep, with high Secchi Disk transparency and low levels of phosphorus, nitrogen, and chlorophyll *a*. Maximum concentrations of total phosphorus and total organic nitrogen in Três Irmãos Reservoir were 75.74 µg.L<sup>-1</sup> and 0.43 mg.L<sup>-1</sup>, respectively. The euphotic region has a 14.1m extension and a mean chlorophyll *a* concentration of 5 µg.L<sup>-1</sup>. It therefore appears that the limnological characteristics of Três Irmãos Reservoir are favorable to the successful colonization of *D. lumholtzi*. Temperature is also considered an important factor in this species' survival. Work & Gophen (1999) point out that *D. lumholtzi* is originally a subtropical species reaching peak abundance at high temperatures (27 to 30°C) in many freshwater systems in the United States. Water temperature at Três Irmãos reservoir in October 2000 varied between 21.6 to 26.2°C, close to the range considered ideal by those authors.

It is a matter of great concern that, in Brazilian freshwaters, the establishment of an exotic zooplankton species such as *D. lumholtzi* might drive the extinction of other native daphnids. Efforts must be directed to closely following the interaction between the native and the exotic species.

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