

Research Advances

New Phenotypes of *Limnocythere inopinata* from Lakes in Badain Jaran Desert, Northern China

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Objective

Limnocythere inopinata (Baird, 1843) is an ostracod widely distributed in recent non-marine waters and in Quaternary sediments, where it comprises various phenotypes (Yin et al., 1999; Zhang et al., 2015). Based on the nodation patterns, five phenotypes were described in previous publications, namely, the unnoded, the phenotype with one node in the postero-ventral part of the valve, one with two nodes in the antero-ventral and postero-ventral parts of the valve, another with three nodes in the antero-ventral, postero-ventral and postero-dorsal parts of the valve, and the phenotype with one node in the postero-dorsal part of the valve (Yin et al., 1999; Zhai et al., 2010; Zhai and Zhao, 2014). The ecological differences between these phenotypes have not been well documented, and their taxonomic relationships are still under debate (Yin et al., 1999; Hou et al., 2007). In this study, we report two novel phenotypes of *L. inopinata* from lakes in Badain Jaran Desert, western Inner Mongolia, China, with their ecological preferences described. Our discovery provides new data for studying the taxonomy of *L. inopinata* and the niche differentiations of its various phenotypes.

Methods

Surface-sediment samples were collected from 21 lakes of Badain Jaran Desert with a 200-mesh sieve (pore size = 75 µm) in September 2018. The pH and TDS (total dissolved solids) of the habitat waters were measured using a hand-held water quality analyzer. For each sample, approximately 10 g of wet sediment was soaked in 10% H₂O₂ for 24 h and then wet sieved with a 200-mesh sieve. The residue was dried at room temperature. The *Limnocythere inopinata* shells in the sample were picked and observed under an Olympus stereomicroscope. All the treatment processes were done in the Key Laboratory of Quaternary Chronology and Environment Evolution, China Geological Survey, Shijiazhuang, China.

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Results

Previous work described five phenotypes of *Limnocythere inopinata* based on the number and location of nodes on the valve (Yin et al., 1999; Zhai et al., 2010, 2014). In this study, two new phenotypes of *L. inopinata* were found from lakes in Badain Jaran Desert. The first has one node, which is located in front of the median transverse sulcus of the valve, and thus also in front of the adductor muscle scars; therefore, it differs from the previously reported 1-noded phenotypes, where the node is located either in the postero-ventral part (Fig.1; Zhai et al., 2010) or in the postero-dorsal part of the valve (e.g., Zhai and Zhao, 2014). The second new phenotype has two nodes, which are located in the postero-ventral and postero-dorsal parts of the valve, respectively; it therefore differs from the previously known 2-noded phenotype, where the nodes are situated in the antero-ventral and postero-ventral parts of the valve, respectively (Fig. 1; Zhai et al., 2010).

In Badain Jaran Desert, *L. inopinata* is found mainly in lakes with TDS below 23 g/L and pH of 8.5–10.1, and the unnoded phenotype makes up more than 95% of the populations. Nodose individuals, including the two new phenotypes, mainly occur in lakes with TDS below 4.6 g/L and pH of 8.7–10.0. The new phenotypes co-occur with other nodose phenotypes and account for up to 5% of the populations in some lakes, although the unnoded phenotype dominates populations. In general, the nodose phenotypes occur in lower salinities compared with the whole salinity tolerance of the species. We detect no obvious niche differentiation among the different nodose phenotypes in Badain Jaran Desert.

Conclusions

From lakes of Badain Jaran Desert in North-Central China, two new phenotypes of the ostracod *Limnocythere inopinata* are reported, the nodation patterns of which differ from previously known phenotypes. The new phenotypes co-occur with other nodose phenotypes, and

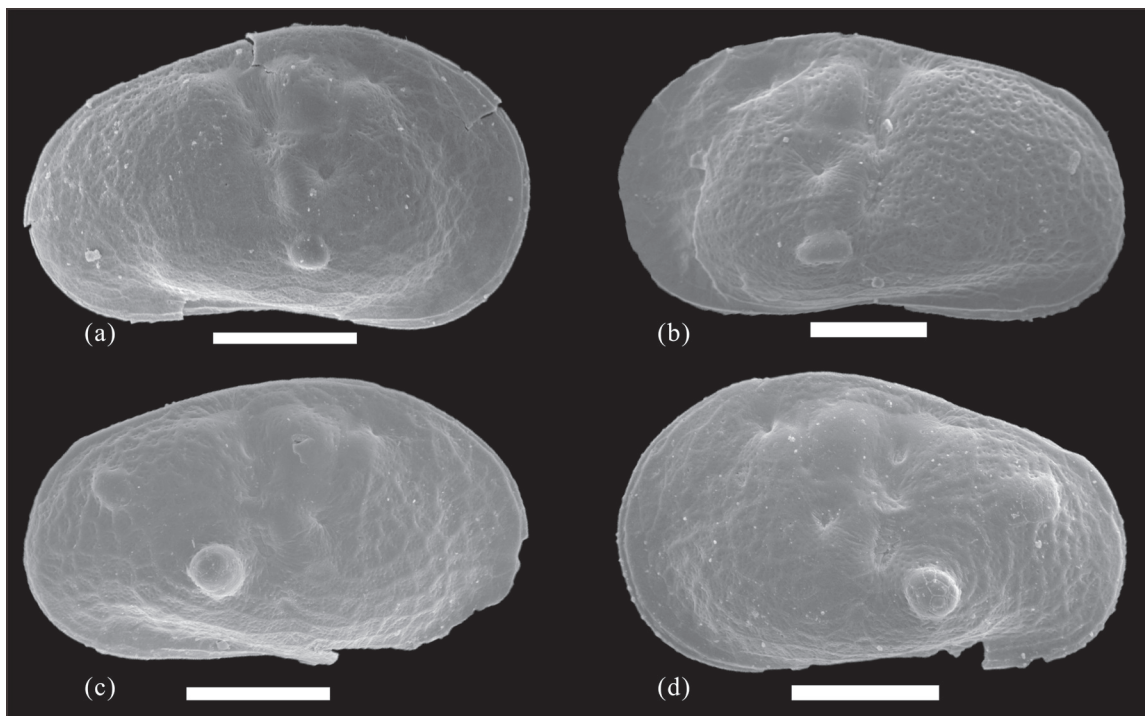


Fig. 1. Two new phenotypes of *Limnocythere inopinata* from lakes in Badain Jaran Desert, female juveniles, probably A-1 or/and A-2 instars.

(a, b), phenotype with one antero-ventral node, right valve (a) and left valve (b); (c, d), phenotype with one postero-ventral node and one postero-dorsal node, right valve (c) and left valve (d). All scale bars represent 100 μm .

all these nodose phenotypes colonize lakes with comparatively low TDS. This implies that different nodose phenotypes have similar ecological requirements, supporting the view that they belong to the same species. In the future, investigations involving more ecological parameters (in addition to TDS and pH) in more areas should be undertaken to characterize habitat preferences of the different phenotypes of *L. inopinata*. The discovery of new phenotypes adds new information to the taxonomy and ecology of *L. inopinata*, which is significant for the ostracod-based paleoenvironmental reconstruction in Quaternary sediment sequences.

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