

Research Advances

Sub-Recent Sexual Populations of *Limnocythere inopinata* Recorded for the First Time from > 3500 m Altitude on the Tibetan Plateau

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The central and northwestern Tibetan Plateau region, also called “Qiangtang Plateau” (30°27'25"–35°39'13" N, 83°41'14"–95°10'46" E), is the highest and largest arctic-alpine area of the Earth covering approximately 600,000 km² with altitude ranging from 4600 to 5100 m a.s.l. (Song et al., 2012, Fig. 1). Ostracod species of *Limnocythere inopinata* (Baird, 1843) is known from the Pleistocene to the Recent from Europe and Asia (Diebel and Pietrzeniuk, 1975; Huang, 1984). It is a common Holarctic species with broad ecological tolerances. It is

widely distributed in different water body types such as ponds, swamps, ditches, rivers and lakes (Meisch, 2000). It is one of the most abundant species in water bodies of central Asia.

The species mainly occurs as a unisexual (parthenogenetic) population, while sexual populations are less abundant (Meisch, 2000). It is mostly occurred as a parthenogenetic population in central Asia (e.g. Mischke et al., 2008; Yang et al., 2008; Zhang et al., 2013). Sexual populations were only recorded from Lake Qinghai on the

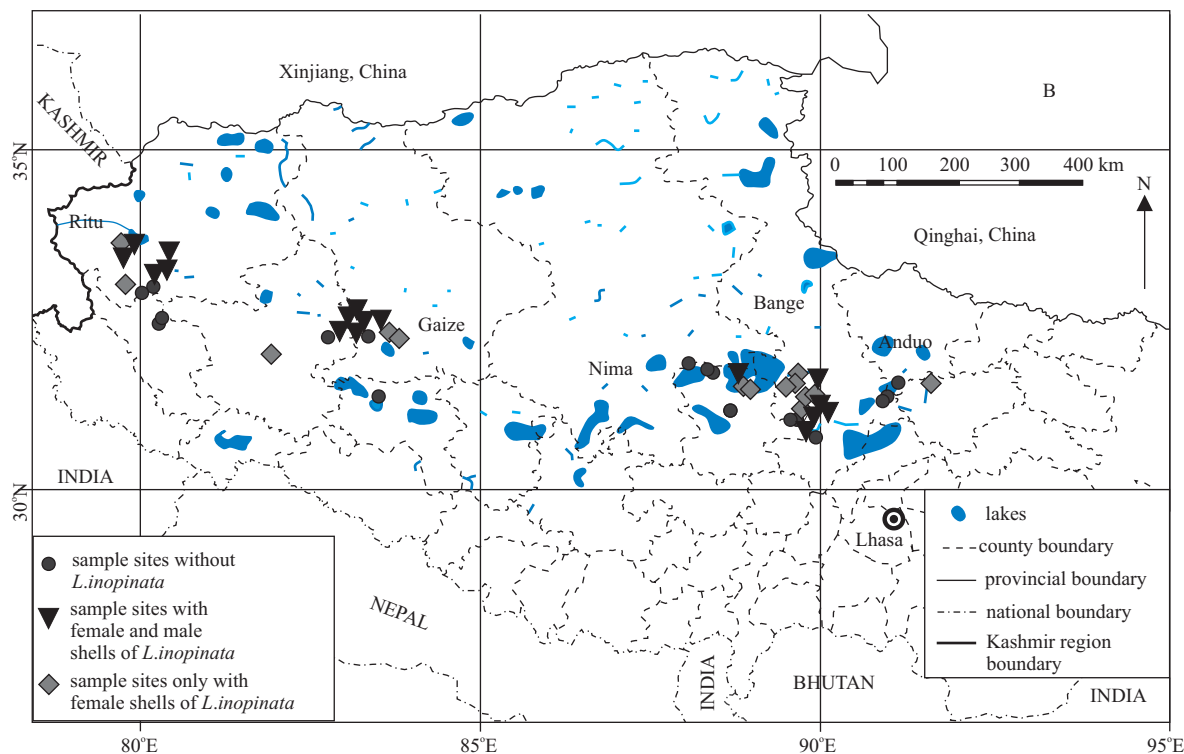


Fig. 1. Sample sites in the study region.

The inverted black triangles represent sites with both male and female valves; grey rhombuses represent sites with parthenogenesis population; black dots represent sites without *Limnocythere inopinata*.

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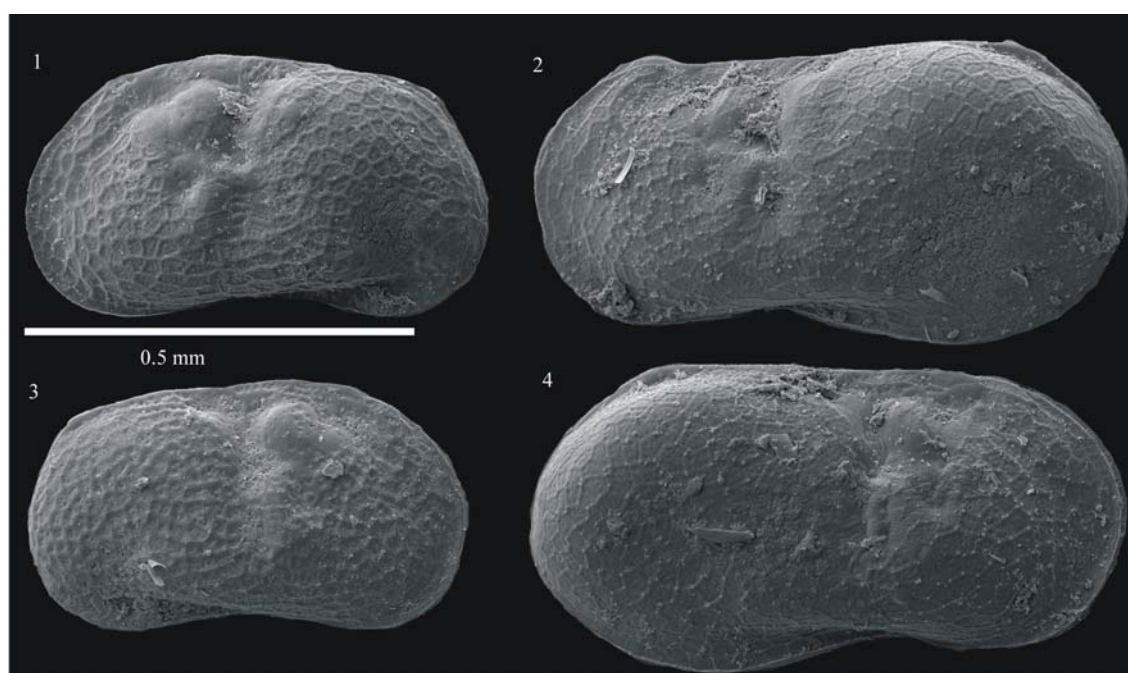


Fig. 2. Male and female valves of *Limnocythere inopinata* Baird from the study area.

1 female specimen (♀), left valve (l), external view (e), length (L) = 593.7 μm , height (H) = 336.3 μm . 2 male specimen (♂), l, e, L = 772.1 μm , H = 398.4 μm . 3 ♀, right valve (R), e, L = 561.7 μm , H = 321.4 μm . 4 ♂, R, e, L = 766.8 μm , H = 403.7 μm (all specimens kept at Institute of Geological Sciences of Freie Universität Berlin).

Tibetan Plateau, Lake Bosten in Xinjiang, Lake Dali in Inner Mongolia and three lakes in western Mongolia (Yin et al., 1999; Mischke and Wünnemann, 2006; Poberezhnaya et al., 2006; van der Meeren et al., 2010; Zhai et al., 2010). Occasional appearances of male valves were recorded from the Eastern Juyan Section in Inner Mongolia and Lake Keluke in the Qaidam Basin (Mischke et al., 2005; Yang et al., 2008). Thus, no records of sexual populations exist from altitudes > 3500 m on the Tibetan Plateau or in Asia in general.

We investigated surface samples from 48 water bodies in the Naqu and Ali regions of Tibet (Fig. 1). Valves of *Limnocythere inopinata* occurred in 31 samples from 29 lakes, one pond and one river, of which 17 samples (16 from lakes, one from a pond) contain both valves of female and male specimens. It is the first time to discover abundant valves of male *L. inopinata* in water bodies of high elevation (> 3500 m) on the Tibetan Plateau.

Valve abundances for male specimens range from 2 to 90 per 100 gram sediment. Valve abundances for female specimens range from 2 to 277 per 100 gram sediment. Abundant ($n > 40$) valves of male and female specimens of *L. inopinata* were recorded in eleven lakes. Valves of male specimens were abundant ($n > 40$) in three lakes. The ratio between the number of male valves and the sum of male and female valves ($\delta / (\delta + \text{♀})$) ranges from 0.02 to

0.55 (mean 0.35). All *L. inopinata* specimens are sub-rectangular and reticulated on valve surface without nodes. Female valves are almost sub-rectangular with a straight to slightly round dorsal margin in lateral view (Fig. 2). The length of female valves ranges from 434 to 675 μm and the height from 267 to 383 μm . The centro-ventral margin of female valves is distinctly concave. The transvers vertical groove in the muscle scar region is located at about mid-length. The surface of female valves has round pits and a reticulate pattern of ridges. Male valves are longer and distinctly more elongated in lateral view than those of female with a length from 581 to 824 μm and a height from 290 to 434 μm (Fig. 2). The mechanisms controlling the occurrence of sexual populations of *Limnocythere inopinata* in the Naqu and Ali regions at high altitudes on the Tibetan Plateau remain open questions for future research.

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