

Planhoogenraadia liboica sp. nov. a new testate amoebae species from mountain forest soils in China

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Summary

The article presents a description of a new species of testate amoebae from the genus *Planhoogenraadia*, which belongs to the Gondwana-tropical group of testate amoebae. The species was found in the mountain forest of the subtropical zone of Central China (Hubei Province).

Key words: testate amoebae, *Planhoogenraadia liboica* sp. nov., China

Introduction

Testate, or shell, amoebae inhabit almost all types of biotopes and have a global distribution. They are a key component of soil ecosystems and are actively involved in the biogenic cycles of carbon, nitrogen, phosphorus, silica and calcium. They play an important role in regulating the abundance of microorganisms in soils. Since late 19th century, a development of the micropaleontological method in paleoecology was known as a rhizopod analysis (Beyens and Bobrov, 2016).

The shell amoebae from the genus *Planhoogenraadia* in the eastern part of Eurasia, namely in the Far East, were first found in 2001 (Bobrov, 2001). Later they were also found in Thailand (Todorov and Golemansky, 2014). The genus *Planhoogenraadia* inhabits the forest soils. The genus belongs to the Gondwana-tropic group of shell amoebae and has a limited geographical distribution (Bonnet, 1984; Bonnet and Gomez-Sanchez, 1984). This is one of the most interesting genera in protozoology in view of biogeography (Foissner, 2006; Smith et al., 2018). The soil fauna of shell amoebas of the subtropics

and tropics is still poorly studied (Qin et al., 2011; Bobrov et al., 2015).

This study was conducted in a mountain subtropical forest near the city of Wuhan, Hubei Province, Central China.

Material and methods

The new species was found in soils of the Nanwangshan and Yujiashan Mountains near Wuhan City, central China. The vegetation was a forest dominated by *Cinnamomum camphora* (camphor tree). Ground floor included *Deyeuxia langsdorffii*. The climate of this territory is humid subtropical, affected by the East Asian monsoon (Qin et al., 2013). Mean air temperature in July is 29.3 °C, in January – 3 °C. Annual mean precipitation is 1205 mm, primarily occurring in the summer months.

The samples of the upper layer of soil (0–2 cm) were taken on the slopes and placed in plastic containers. In the laboratory, coarse mineral particles and large plant pieces were removed. Then the aqueous suspension was filtered through a 250

Table 1. Morphometric characteristics of *Planhoogenraadia liboica* sp. nov. testate amoebae from subtropical forest soils in Wuhan.

Taxa	Features	Min	Max	Mean	SD	CV (%)	N
1	shell length	83	93	89	3.5	3.9	12
2	shell width	56	69	64	3.7	5.8	12
3	shell height	48	64	59	4.4	7.4	12
4	aperture height	9	15	12	1.7	13.8	12
5	aperture width	29	41	36	3.4	9.6	12
6	cap length	15	19	17	0.9	5.3	12

Notes. Measurements in μm . SD - standard deviation; CV - coefficient of variation in %; Min - minimum; Max - maximum; N - number of individuals investigated.

μm sieve. Two or three drops of the suspension were analyzed using a Carl Zeiss Axioplan 2 microscope with magnifications of $\times 200$ and $\times 400$. Twelve shells of the new species were analyzed for morphometry in the samples, because *Planhoogenraadia* abundance was low, since they almost always belong to a minority group in soil communities of the amoebae (Bonnet, 1984). The subjects of morphometric analysis were: 1) shell length, 2) shell width, 3) shell height, 4) aperture height, 5) aperture width, and 6) cap length (Figs 1 and 2). Previously we have described a new species, *Planhoogenraadia wuchanica*, from this forest (Bobrov et al., 2019), which is morphologically and morphometrically different from *Planhoogenraadia liboica* sp. nov. described here (Table 1).

Results and discussion

DESCRIPTION OF *PLANHOOGENRAADIA LIBOICA* SP. NOV.

Description. The test is relatively flat, with a dorsal convexity (Figs 1 and 2). The shell is the widest in the center. The aperture is deep and narrow, with depth from 15 to 19 μm and width from 29 to 41 μm . The upper lip of the aperture has a distinct cap-like structure. The upper part of the shell of *P. liboica* is flattened, giving a distinctly different profile from other species of this genus. The posterior of the shell meets the ventral side at a blunt angle which is clearly distinct from the smooth transition in *Planhoogenraadia wuhanica*. The coefficients of variation of most measured variables are below 10% (Table 1).

Measurements. Shell length 89 ± 3.5 μm ; shell width 64 ± 3.7 μm .

Habitat. Soil of subtropical forest dominated

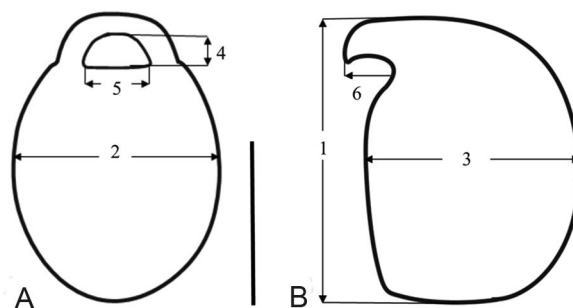


Fig. 1. Outline of *Planhoogenraadia liboica* sp. nov. in ventral (A) and lateral (B) views. Scale bar – 50 μm .

by *Cinnamomum camphora* (camphor tree) and the grass *Deyeuxia langsdorffii*.

Etymology. The species name ‘liboica’ is in reference to the Tang dynasty poet ‘Li Bai’ (also known as Li Bo), who lived in the province of Hubei for ten years.

Type locality. The type locality of the species is surface soil in *Cinnamomum camphora* dominated subtropic forest in the Nanwangshan and Yujiashan mountains and behind the campus of China University of Geosciences in Wuhan, central China.

Type specimens. The holotype specimens of *Planhoogenraadia liboica* on which morphometric analyses were based, are stored at China University of Geosciences, Wuhan, China (reference YJS17-2).

Ecology. Individuals described here were located in subtropical soils in the forest dominated by *Cinnamomum camphora* and *Deyeuxia langsdorffii*.

Geographical distribution. Central China.

Taxonomy

Arcellinida Kent 1880

Plagiopyxidae Bonnet 1984

Genus *Planhoogenraadia* Bonnet 1977a, 1977b

Planhoogenraadia liboica Bobrov et Qin (Fig. 1)

Comparison with similar species

The ventral region of *Planhoogenraadia liboica* is flat. This species differs from the most similar previously described species *Planhoogenraadia alta* by smaller shell size, specifically smaller shell length and narrower shell width. *P. liboica* has a broader shell than other similar taxa; the mean shell length/shell width ratio is 1.4 compared to 2.2 for *Planhoogenraadia acuta*, 1.5 for *P. alta*, and 1.9 for *Planhoogenraadia asturica*. *P. liboica* is similar in morphology to *P. alta* with the exception of the blunt angle between the posterior end and ventral side of the shell. The size of *P. liboica* shell is smaller than

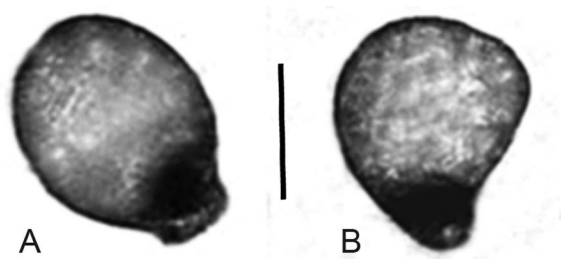


Fig. 2. Light microscopical image of *Planhoogenraadia liboica* sp. nov. A – Ventral view; B – lateral view. Scale bar - 50 μ m.

in *Planhoogenraadia wuchanica* with shell length Min - 106, Max - 134 μ m and shell width Min - 60, Max - 92 μ m (Bobrov et al., 2019).

Conclusions

The fauna of testate amoebae in China, considering the diversity of habitats of the country, is poorly studied. The history of the formation of these zones is also different. This means that the discoveries of new species of shell amoebas in China's soils will not be limited to subtropics. Of special interest are the populations of water bodies, primarily lakes, as well as wetlands (Qin et al., 2016). Expansion of the studies of soil biota could have significantly enhanced the understanding of the biogeography of the microbiota of this vast and diverse region of Asia.

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