Ecology of testate amoebae of polygon tundra in NE Siberia

A. Bobrov[1]*, S. Wetterich[2], A. Schneider[3], L. Schirrmeister[2], L. Pestryakova[4]

I. BACKGROUND

The testate amoebae (testaceans) are a group of free-living shell-bearing protozoans. Being inherently aquatic, they restructure their communities in response to environmental changes in, e.g., ground water table, soil moisture, pH, content of biophilic elements (N, P, K, Ca, Mg), and organic matter.

Polygon tundra provides habitats for testate amoebae which are recently studied in several polar environments. However, species abundance and diversity along a depth gradient in soil profiles and spatial distribution within polygons have not been studied so far, and are presented here from a study site in the Indigirka lowland (Fig. 1)

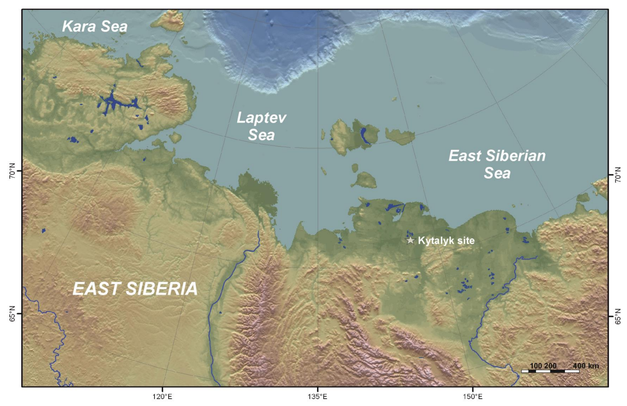
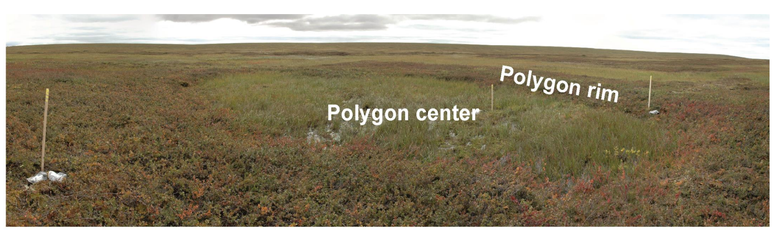
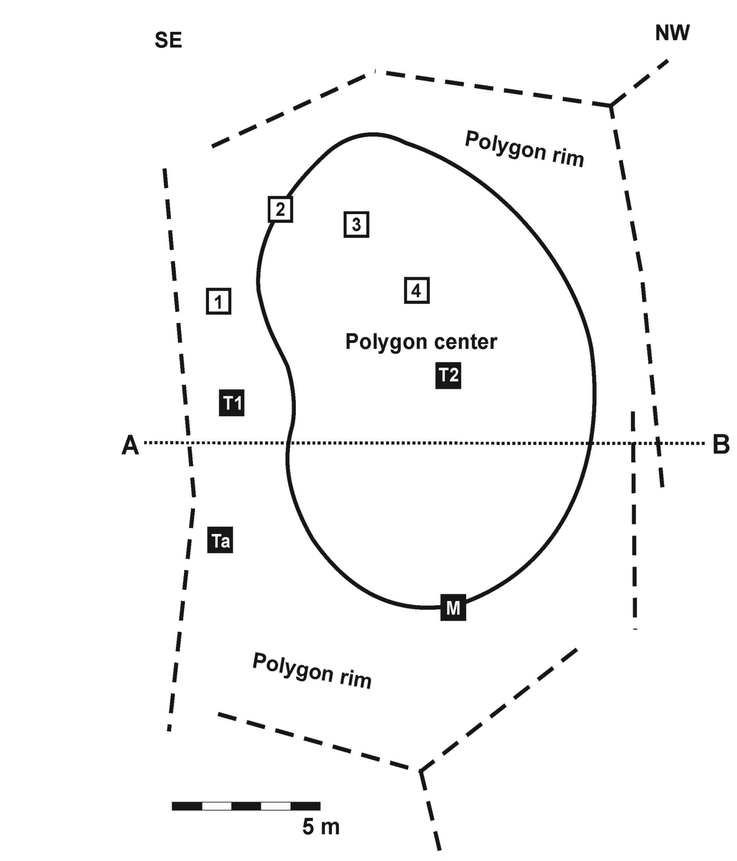


Figure 1 Location of the Kytalyk study site in the northeastern Siberian lowland

II. STUDY POLYGON

The KYT-1 study site is a typical low-centered polygon about 20 m in diameter located on the upper level of a thermokarst basin and covered on the polygon rim by dwarf shrubs (*Betula nana*), herbs (*Ledum palustre*, *Vaccinium vitis-idaea*), and mosses (*Aulacomnium palustre*, *Hylocomium splendens*), and in the wet polygon center by sedges (*Carex stans*, *Carex chordorhizza*, *Eriophorum angustifolium*) and herbaceous species (*Potentilla palustris*). A monitoring station collected environmental data between July 19th and August 27th, 2011 (Fig. 2).





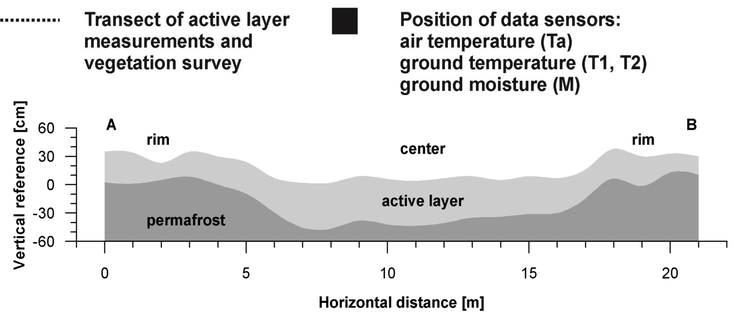


Figure 2 Overview of the monitoring setup in polygon KYT-1 that collected data between July 19 and August 27, 2011. The A-to-B transect across the polygon shows surface elevation data and active-layer

Measurements of pH, electrical conductivity (EC) of pore water, and water content, extractable nutrients (NH_4^+, NO_3^-, PO_4^{3-}), and C, N, C/N of soil samples from different depths and from rim to center provide environmental data that characterise the living conditions of testacean assemblages from the same sample set.

III. RESULTS

Temperature data

Air temperature (T_{air}) varied over the monitored season between -1.5 and 24°C (mean: 8.3°C) with daily amplitudes of up to 10°C and a general cooling trend toward the end of August. Ground temperatures (T_{ground}) in upper horizons (above 15 cm b.s.) of the active layer resembled daily T_{ground} variations while T_{ground} near the permafrost table (below 20 cm b.s.) remained rather stable between 0 and 4°C. The vertical thermal differentiation in the polygon center is more distinct than in the polygon rim.

Soil chemistry

The soils in the KYT-1 polygon were moderately acidic (pH 4–5.3) and the pH mostly increased with depth (Fig. 3). The EC was remarkably higher on the polygon rim than in the center. The water content decreased toward the permafrost table in each pit and increased from the rim toward the center, reaching 85 wt%. The lowest nutrient values were always found in the mineral Bg horizons. The highest concentrations of nitrogen and of extractable ammonium were identified in the subsurface horizon (Oe). Carbon concentrations and extractable nitrate and phosphate decreased with depth in each pit. Higher C/N ratios of up to 28 occurred in the Oi horizons of the better drained rim and decreased toward the center to about 19.

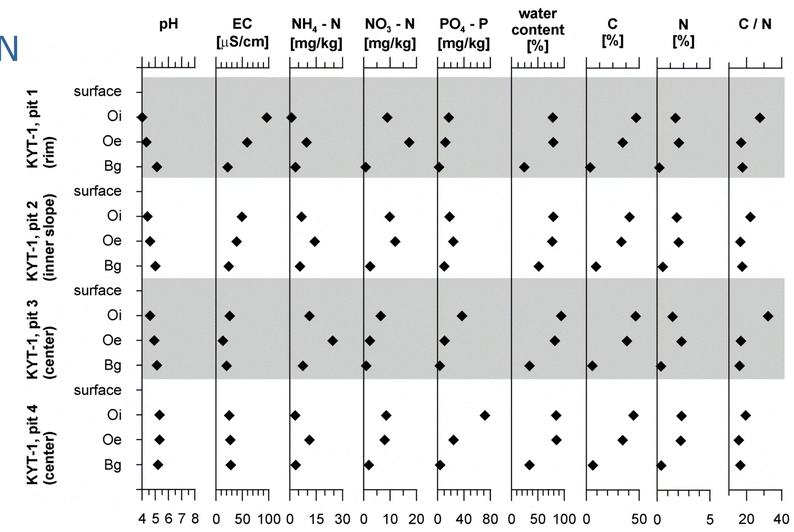


Figure 3 Pedochemical parameters in polygon KYT-1. Data provided by F. Beermann (Hamburg University).

Testate amoebae

A total of 37 testacean taxa of 19 genera were identified in 16 samples from four pits in polygon KYT-1 (Fig. 4). From 136 to 487 specimens were counted per sample and up to 14 species were found per horizon (Fig. 4). Ecological groups of xerophilic, hygro-hydrophilic, sphagnobiontic, and soil-eurybiontic species were distinguished (Fig. 4).

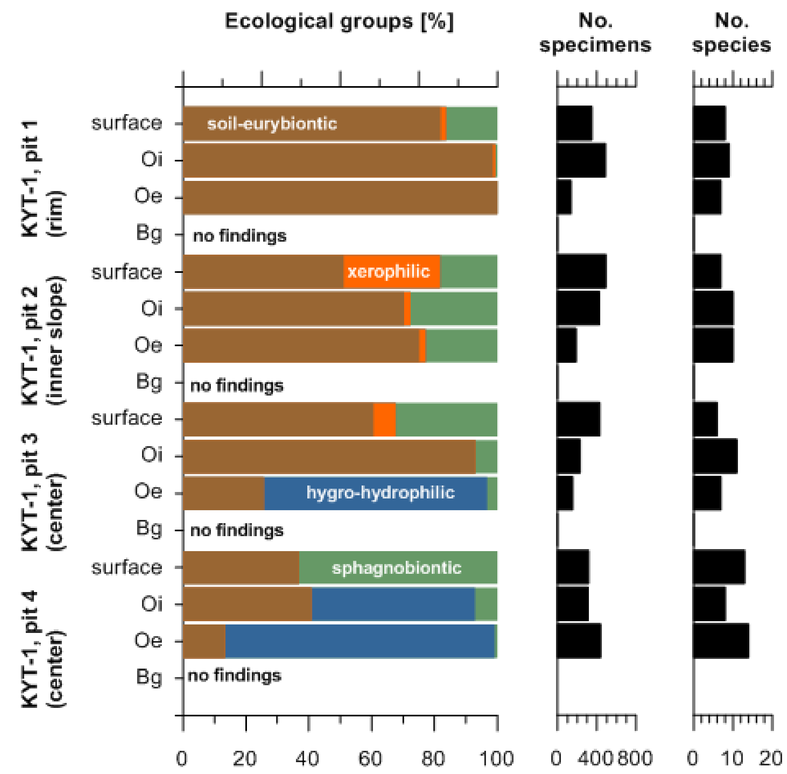


Figure 4 Distribution of ecological groups of testate amoebae assemblages in different horizons of four pits within polygon KYT-1

IV. CONCLUSIONS

(1) The most important controls on species distribution are the moisture regime and pH. **(2)** Along the rim-to-center gradient soil-eurybiontic and xerophilic testaceans are replaced by sphagnophiles in surface samples, and soil-eurybiontic species are replaced by hygro-hydrophiles in lower Oi and Oe soil horizons. Lowermost Bg horizons directly above the permafrost table lack testaceans. **(3)** Increasing soil moisture can be only observed for the Oi and Oe horizons.by testacean communities.

References
Bobrov et al. 2013. *Polar Biology* 36, 857–870.

Support
DFG-RFBR project *Polygons in tundra wetlands: State and dynamics under climate variability in polar regions (POLYGON)*; DFG HE 3622-16-1, RFBR 11-04-91332-NNIO-a

Contact
[1] Department of Soil Science, Moscow State University, Russia (e-mail: **anatoly-bobrov@yandex.ru**)
[2] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Potsdam, Germany
[3] Department of Physical Geography and Quaternary Geology, Stockholm University, Sweden
[4] Department for Geography and Biology, Northeastern Federal University, Yakutsk, Russia