

FRAGMENTA FAUNISTICA

Fragm. faun.

Warszawa, 30.06.2002

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The first record of the terrestrial polychaete *Hrabeiella periglandulata* PIŻŁ et CHALUPSKÝ, 1984, in Poland, with a note on anatomy and ecology¹

Abstract: Only a few of the 12,000 described species of *Polychaeta* inhabit land soils and litter. In Europe only two species of terrestrial polychaetes are known: *Parergodrilus heideri* REISINGER, 1925 and *Hrabeiella periglandulata* PIŻŁ et CHALUPSKÝ, 1984. No terrestrial *Polychaeta* have been recorded from Poland previously. Enchytraeids were investigated in a broad study of the Niepołomice Forest ecosystem functioning. The animals were collected from 40 plots in November 1999, half of them in oak-hornbeam (*Tilio-Carpinetum*) and half in mixed oak-pine (*Pino-Quercetum*) stands. Individuals of *H. periglandulata* were found in samples from five plots, all in oak-hornbeam stands, and were absent in the samples from mixed oak-pine forest plots.

Key words: *Hrabeiella periglandulata*, *Parergodrilidae*, terrestrial *Polychaeta*, *Annelida*, Niepołomice Forest

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INTRODUCTION

Polychaeta (*Annelida*) are common animals in the marine environments. Only a few of the 12,000 species so far described (ERSÉUS & ROTA 1998) inhabit land soils and litter. In Europe only two species of terrestrial polychaetes are known: *Parergodrilus heideri* REISINGER, 1925 and *Hrabeiella periglandulata* PIŻŁ et CHALUPSKÝ, 1984. These species were found during studies of other groups of soil fauna, the first during a study of terrestrial flatworms (REISINGER 1925), the second during a study of enchytraeids (PIŻŁ & CHALUPSKÝ 1984). The next findings of *H. periglandulata* were

¹The study was supported by grant KBN 0-900/P04/98/15

made by oligochetologists too, and data on distribution are still incomplete (Fig. 1). In Poland this species has not been found until now.



Fig. 1. Records of *Hrabeiella periglandulata* PIŻL et CHALUPSKÝ, 1984.

STUDY SITE

The Niepołomice Forest is located in Southern Poland (50°05'N, 20°21'E). It consists of two parts: northern (with three separate stands of 15.0, 2.6 and 2.2 km²) and southern (88.7 km²). The northern forest complex is confined to a flood plain terrace of the Vistula River and is characterized by high groundwater levels and Gleysols. The southern part is located on a higher terrace and has much drier conditions and prevailing Podzols. Those differences in habitat conditions are reflected in the prevalence of mixed oak-pine (*Pino-Quercetum*) and mesic oak-hornbeam (*Tilio-Carpinetum*) in the southern part, while moist oak-hornbeam stand predominates in the northern part (GRODZIŃSKI *et al.*, 1984).

Enchytraeids were investigated in a broad study of the Niepołomice Forest ecosystem. The animals were collected in November 1999 using a soil corer (16.6 cm², 10 cm deep) from 40 plots, half of them in oak-hornbeam and half in mixed oak-pine stands. Twenty soil samples were taken from each plot. The animals were extracted from the soil in wet funnels for 5 hours. Only two samples from each plot were taken for species identification.

RESULTS

Distribution

The individuals of *Hrabeiella periglandulata* were found in samples from five plots (all oak-hornbeam) (Fig. 2):

- site no. 7 – 6 individuals of *H. periglandulata* in one of two samples from oak-hornbeam (*Tilio-Carpinetum caricetosum brizoides*). Soil: Gleysol, pH in litter 4.76
- site no. 17 – 3 individuals of *H. periglandulata* in one of two samples from degraded oak-hornbeam (*Tilio-Carpinetum*). Soil: Haplic Luvisol, pH in litter 4.79
- site no. 34 – 1 individual of *H. periglandulata* in one of two samples from oak-hornbeam (*Tilio-Carpinetum typicum*). Soil: Gleysol, pH in litter 4.66
- site no. 37 – 2 individuals of *H. periglandulata* in one of two samples from oak-hornbeam (*Tilio-Carpinetum stachyetosum*). Soil: Gleyic Dystric Cambisol, pH in litter 5.38
- site no. 42 – 6 and 3 individuals of *H. periglandulata* in two samples from oak-hornbeam (*Tilio-Carpinetum typicum*). Soil: Gleyic Dystric Cambisol, pH in litter 4.43.

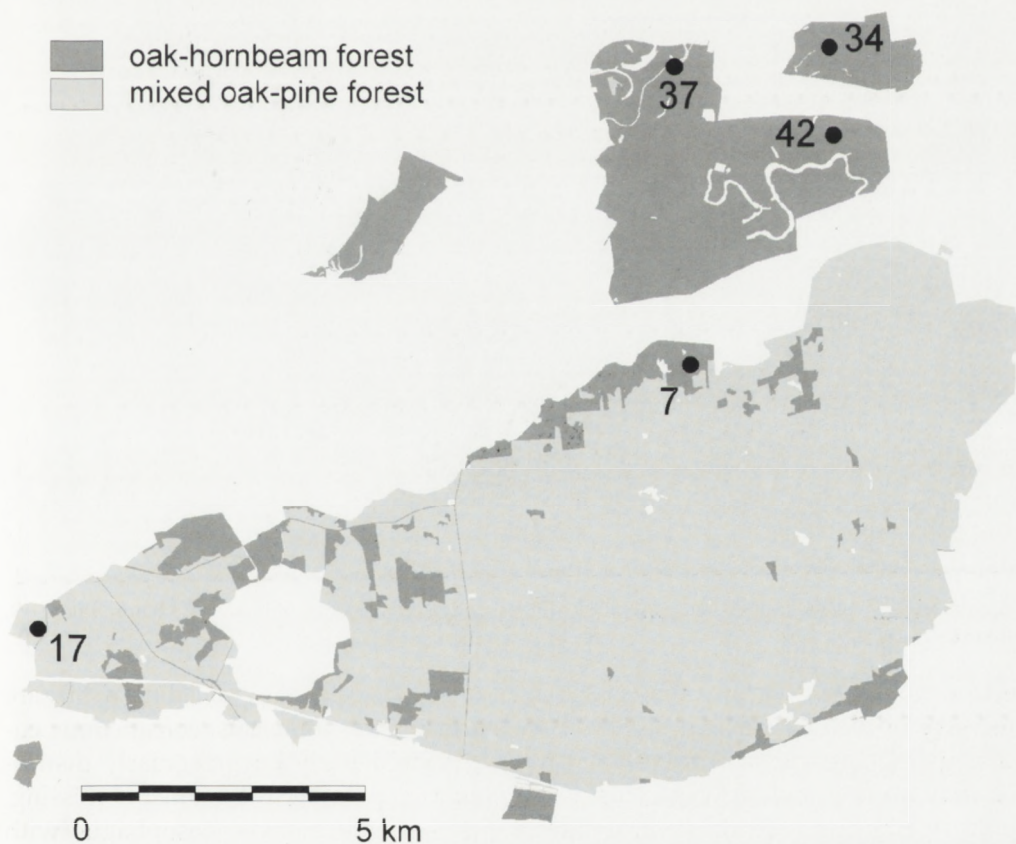


Fig. 2. Study plots in Niepolomice Forest where *Hrabeiella periglandulata* was found.

Morphology and anatomy

Small species, body length up to 2 mm, width up to 300 μm (Fig. 3). Number of segments constant (16 in mature specimens). Four bundles of setae present in all segments (except first and last ones), located near each other on the ventral side of the body; two or three setae per bundle, all of one kind, very characteristic shovel-shaped (Fig. 4).



Fig. 3. *Hrabeiella periglandulata* Pižl et CHALUPSKÝ, 1984, in a light microscope, animal size 1.5 mm. Photo. W. Witaliński.

Electron micrographs show the ectal blades of mature chaetae, revealing a bizarre brush-like ultrastructure (ROTA 1998). Body surface with numerous, conspicuous cuticular glands, arranged in transversal rows; glands densely but irregularly distributed only on first and last segments. Dissepiments separating the segments missing. Mouth opening located on ventral side of first segment; narrow oesophagus with lobed oesophageal glands situated dorsally. Intestine consists of two parts: first part broad with some chloragogen cell-like structures; second part narrow and irregularly

coiled. Organization of circulatory system and nervous system simple and typical of the majority of *Annelida*. A pair of nephridia (rarely single ones) present in almost all segments. *H. periglandulata* is hermaphroditic. Male genital apparatus in VI segment, but testes can reach VII or VIII segment. Seminal vesicles sack-like, sperm irregularly located. Penial bulb spherical, small, located ventrally, male pore on the setae line. Female genital apparatus in XII and XIII segments, but the structural details are not known. Spermathecae absent, 2–3 eggs present at a time. Clitellum or any swelling or gland concentration absent on segments with eggs.

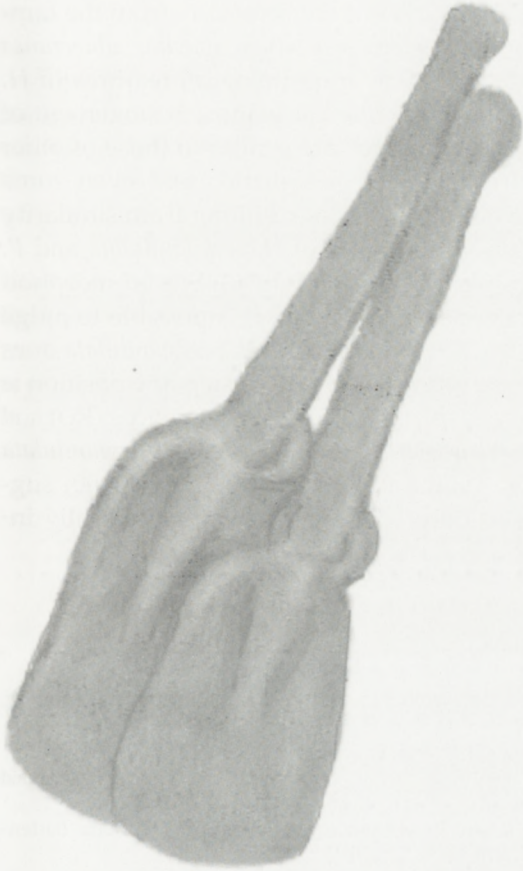


Fig. 4. Two chaetae of *Hrabeiella periglandulata*, photographed in a light microscope (approximately 0.03 mm long). Photo W. Witaliński.

DISCUSSION

Hrabeiella periglandulata was described from brown meadow soil (in a meadow and an apple orchard) in the Czech Republic (PIŽL & CHALUPSKÝ 1984). The next records originated almost exclusively from various forest soils in some European countries (Fig. 1): Germany – spruce and beech forests in Baden Württemberg (JANS & RÖMBKE, 1989), GRAEFE (1989, 1990, 1993a, 1993b cit. after ROTA & LUPETTI 1996), garden soil in Osnabrück (PURSCHKE 1999), Italy – coniferous, beech and chestnut forest in Tuscany (ROTA & LUPETTI 1996), southern Sweden – shady deciduous wood (ERSÉUS & ROTA 1998). This species avoids extreme environmental conditions because it is sensitive to both desiccation and flooding. GRAEFE & SCHMELZ (1999) describe this species as an indicator of fresh soil (absent in wet habitats), an indicator of slightly acid conditions, stress tolerant (adapted to acidity stress), inhabiting mull, mullmoder and moder humus forms. Our observations are similar. In the Niepołomice Forest *H. periglandulata* was found at sites with Gleyic soils with mull and moder humus and deciduous litter. However, all individuals were found in oak-hornbeam stands in Niepołomice Forest, and were absent from mixed oak-pine (*Pino-Quercetum*) stands.

Recently the morphology, anatomy and reproductive biology of *H. periglandulata* were intensively investigated (ROTA & LUPETTI 1996, 1997; ROTA 1998) but the systematic position of this species is not clear. It was verified that it belongs to non-clitellate *Annelida*, and usually it is classified as a representative of the *Polychaeta* from the family *Parergodrilidae* (together with *Parergodrilus heideri* and *Stygocapitella subterranea* KNÖLLNER, 1934 known from interstitial waters). Many morphological features of *H. periglandulata* (small number of segments, numerous cuticular glands, arrangement of the setae) and some anatomical features (intestine coiled) are similar to those of other interstitial annelids (marine polychaetes, freshwater aeolosomatids and even some enchytraeids), but those similarities seem to be convergences resulting from similarity of environments. Ultrastructural examination of the sperm of *H. periglandulata* and *P. heideri* showed big differences in anatomical structure (ROTA 1998). Sperm morphology is a very good character for studies of species relationship; it is possible to judge that these species are not closely related. ROTA (1998) thinks that *H. periglandulata* does not share any apomorphy with the family *Parergodrilidae*, and its systematic position is still not clear, which was confirmed by analysis of 18S rRNA gene sequences (ROTA *et al.* 2001). Hence the suggestion of PIŽL & CHALUPSKÝ (1984) that *H. periglandulata* should be allocated to a new annelid class is still valid. PURSCHKE (1999, 2000) suggested that at least two independent lines of polychaetous annelids successfully invaded the terrestrial environment.

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[Tytuł: *Hrabeiella periglandulata* PIŻL et CHALUPSKÝ, 1984 pierwsze doniesienie o lądowych *Polychaeta* w Polsce z informacją o ekologii i anatomii.]

Tylko nieliczne z opisanych dotąd 12 000 gatunków wieloszczetów (*Polychaeta*) zamieszkują glebę i ściółkę. W Europie znane są tylko dwa gatunki lądowych wieloszczetów: *Parergodrilus heideri* REISINGER 1925 i *Hrabeiella periglandulata* PIŻL et CHALUPSKÝ, 1984. Z Polski brak było dotąd informacji o występowaniu lądowych wieloszczetów.

Podczas badań nad funkcjonowaniem ekosystemu leśnego (Puszczy Niepołomickiej) pobrano próby gleby, z których wyekstrahowano wazonkowce (*Enchytraeidae*). Zwierzęta zebrano na 40 stanowiskach: 20 w grądach (*Tilio-Carpinetum*) i 20 borze mieszanym (*Pino-Quercetum*). W próbach z pięciu stanowisk w grądach stwierdzono występowanie *H. periglandulata*. Nie znaleziono tego gatunku w próbach ze stanowisk borowych.