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Short distance wind transport of microfauna in maritime Antarctic (King George Island, South Shetland Islands)

ABSTRACT: Traps to catch microfauna transported by wind were installed on already colonised by plants area, in the vicinity of the glacier. After 6-week-exposition 859 individuals of microfauna were caught, of which Nematoda constituted 71%, Tardigrada 22% and Rotifera 7%. Number of microfauna individuals caught depended on distance from the already colonised areas and presence of plant parts, together with which animals can be transported more easily. Microfauna connected with vegetation, which is transferred together with plant parts, was transported in higher numbers. Probably these taxa (*i.e.* *Diphyscon* within tardigrades and Dorylaimidae within nematodes) colonise new habitats at first, but other species dominate later in freshwater bodies.

Key words: Antarctic, wind transport, colonisation, microfauna.

Introduction

Global warming processes have gained recently a lot of notification in scientific publications. The recession of the glaciers creates new bare areas, where the process of colonisation can be observed from its beginning. This is probably the reason why, the process of colonisation in the Antarctic have become recently a subject of increasing scientific interest (Smith 1982, Walton 1990, Ellis-Evans and Walton 1990, Kappen and Straka 1990). According to Ellis-Evans and Walton (1990) for successful colonisation the propagules, alive and able to survive in new environment, as well as suitable mechanism of their transport are necessary. Propagules are generally transported by wind, birds and, especially now, by humans. Smaller propagules are mainly transported by wind, while bigger by birds and humans (Cameron *et al.* 1977). Smith (1982) suggested that skuas and dominican gulls in Antarctic are responsible for spreading of a plant *Deschampsia antarctica*.

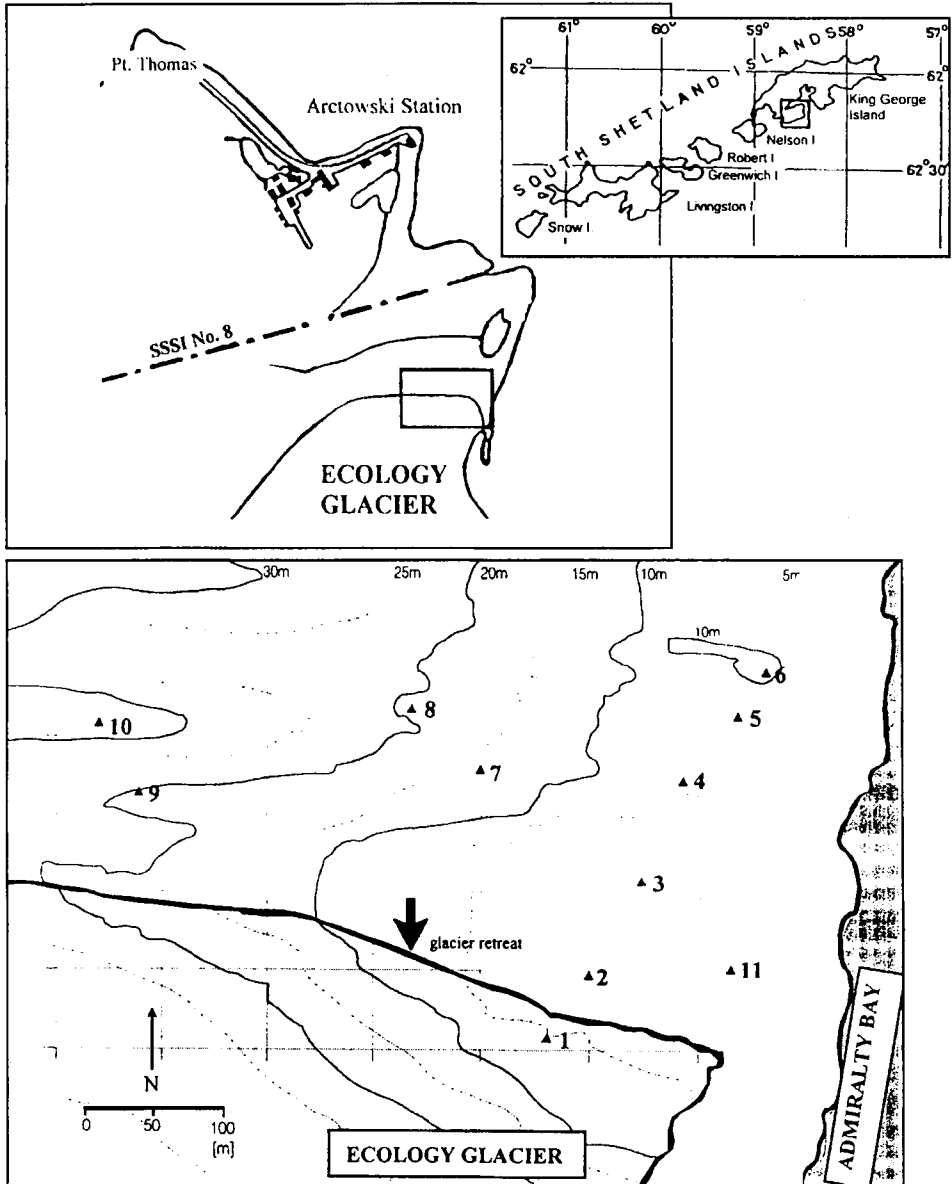


Fig. 1. The study area.

Invertebrate microfauna can be transported as adult individuals, sometimes in a state of desiccation, or as eggs. Microfauna itself can be also a vector for bacteria or protozoans (Ellis-Evans and Walton 1990). According to Walton (1990) most successful for transport are such mixed propagules, *i.e.* protozoan cyst glued to the algae cells.

In our experiment we tried to find out whether, and in what amount, microfauna is transported for short distance by wind to colonise new areas.

Materials and methods

The experiment lasted for 6 weeks, between 10th January and 21st February 1991, in the vicinity of Polish Antarctic Station Henryk Arctowski, on the western shores of Admiralty Bay on King George Island, South Shetland Islands. The study area were two rows of moraine hills, colonised intensively in its northern part by mosses and lichens (Olech 1993), and only in a small degree in its southern part (having lichens on the top of the hills and mosses between the hills, Olech, *pers. commun.*) (Fig. 1). This area is bordered to the East by the sea, and to the South west by Ecology Glacier.

Eleven identical plastic bowls (30 cm in diameter) served as traps and were placed in the study area, on two directions: from the glacier toward the moraine hills and from the sea up the moraine hills. (Fig. 1). The bowls were filled with filtered fresh water with the addition of 40% formaldehyde to attain 4% formaline solution. Every week all water from the bowls was taken to the laboratory and filtered through the plankton net of 30 μm mesh size. All the samples were

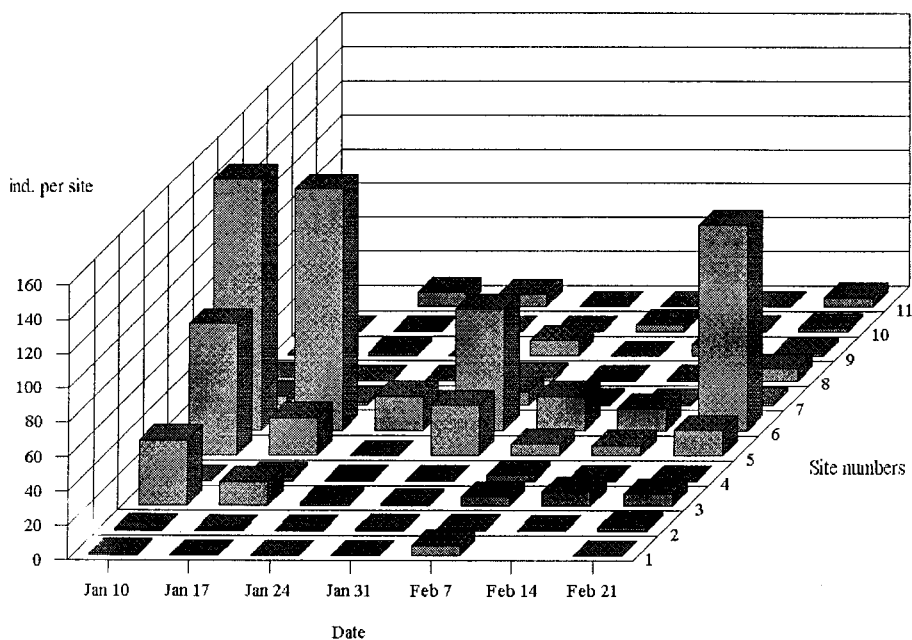


Fig. 2. Numbers of individuals per site during the experiment.

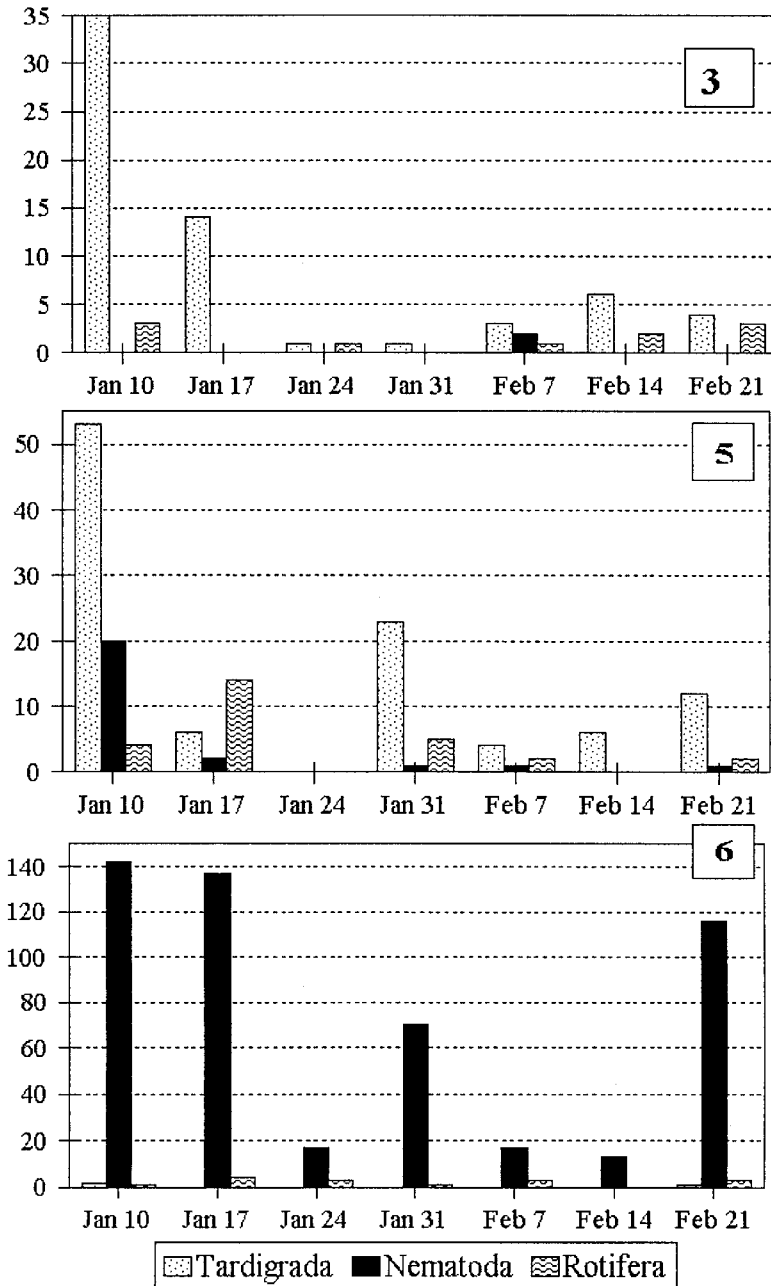


Fig. 3. Average number of Tardigrada, Nematoda and Rotifera caught per sites 3, 5 and 6.

surveyed under the microscope and all animals found were counted and identified. Bowls were filled with a new water.

Results and discussion

Inorganic and organic matter, including microfauna, was caught by traps. Numbers of animals caught at each site in every week of the experiment are plotted in Fig 2. Total number of animals caught was 859 microfauna individuals. Highest numbers caught were observed at sites 3, 5, 6 (Fig. 3). Dates with especially high numbers were 10th, 17th, 31st of January and 21st of February.

Sites 3 and 5 were characterised by relatively high numbers of Tardigrada. At site 6 very high numbers of Nematoda were noted. Rotifera were rare at all sites.

Attempt was made to determine which factors affected the numbers of microfauna individuals caught.

Distance from the colonised area

Traps were positioned in a range of distances from the glacier and from the sea. Sites 5 and 6 with highest numbers of animals caught were situated farthest from the glacier and closest to the areas colonised by plants (*i.e.* moss banks), while traps situated closer to the glacier caught fewer individuals (*cf.* Figs 1–2 and 3). Relationship between number of animals caught and distance from the glacier can be described with exponential regression equation $y = (1.0245)^x$ (Fig. 4).

Distance from the potential source of colonisation is an obviously important factor for short distance wind transportation of microfauna.

Presence of plant parts

During microscopic observations it was noted that not only animals were transferred. Parts of grass, moss and algae which are characteristic of the regions with more advanced colonisation, for example moss banks neighbouring our sites to the north, were also transported. Attempt was made to determine whether the number of animals caught at the experimental sites was related to the number of particles moved to the same site.

Using the t-test for independent samples we found a very statistically significant difference between the numbers of animals caught together with plant parts and without them ($t = -4.5$, $df = 47$, $p < 0.001$). (Fig. 5). There is a positive correlation between the occurrence of animals and plant parts ($r^2 = 0.70$). We have observed “mixed” propagules in the Walton (1990) meaning: parts of moss or algae together with individuals of microfauna.

Presence of any plant parts is an important factor which can facilitate transport of microfauna, or its eggs. Small ponds in this region dry off very often, therefore aquatic vegetation is prone to be transported, with the animals, by the wind. These “mixed” propagules seem to be an effective mechanism of transport.

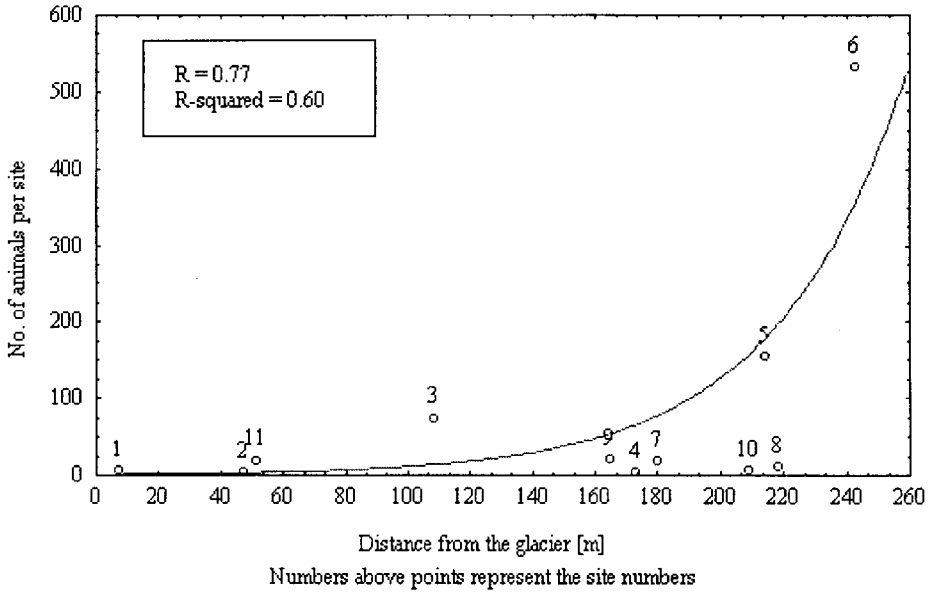


Fig. 4. No. of animals caught vs. distance from the glacier.
 Exponential regression equation $y = (1.0245)^x$, x — distance in m.

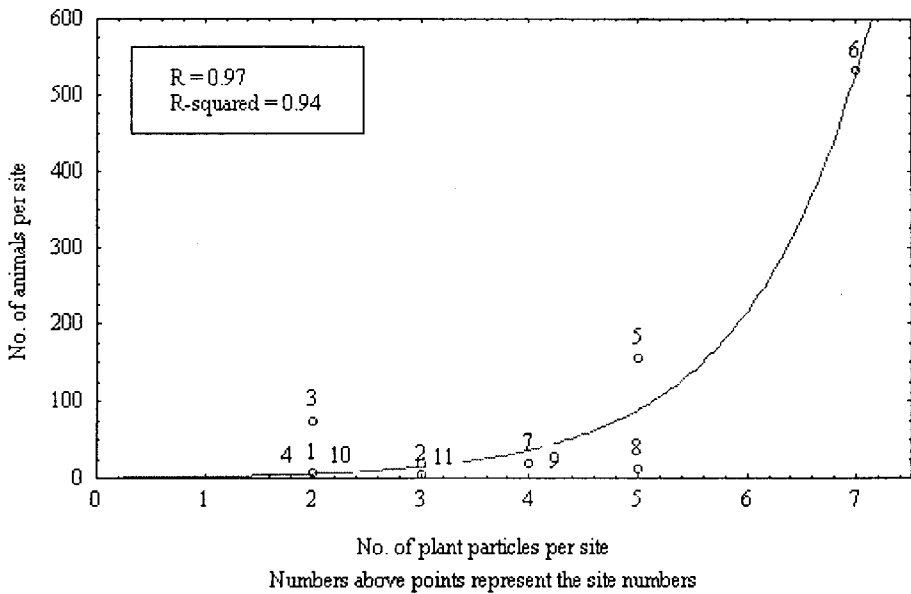


Fig. 5. Number of animals caught vs. number of plant particles per site.
 Exponential regression equation $y = (2.45)^x$, x — number of plant parts.

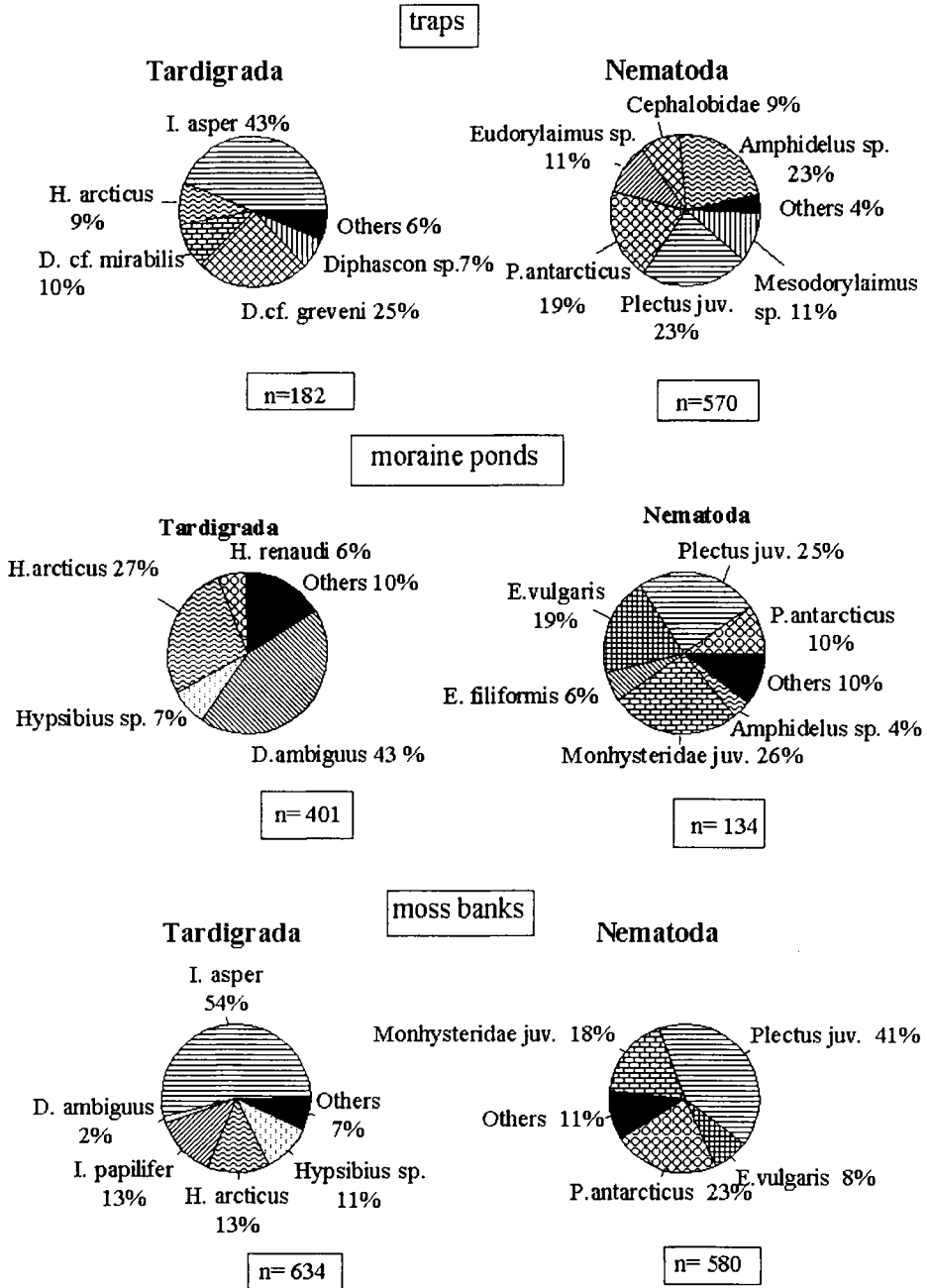


Fig. 6. Species composition of Tardigrada and Nematoda caught in traps during the experiment vs. species composition of these groups in natural habitats (according to Janiec 1996). n — number of individuals.

Species composition

Species composition of two surveyed groups (Nematoda and Tardigrada) in traps and in neighbouring natural, already colonised habitats occurring in the neighbourhood, was compared (Fig. 6), using the data obtained by Janiec (1996).

Within Tardigrada, *Isohypsibius asper* and *Diphascoen* sp. were most commonly transported by wind. *I. asper* is the dominating species in moss banks (Janiec 1996, cf. Fig. 6.), which explains its high percentage share within Tardigrada caught in traps together with moss parts. *Diphascoen* sp., common in traps, is a species generally widespread in moss banks, although in the compared natural habitats it was not common. Those species in moraine ponds, are substituted by typically freshwater *Dactylobiotus ambiguus* and *Hypsibius arcticus* (cf. Fig. 6.).

The same pattern was observed within Nematoda. Except Plectidae, genera *Amphidelus*, *Eudorylaimus* and *Mesodorylaimus* were most often carried by wind. Family Dorylaimidae (including *Eudorylaimus* and *Mesodorylaimus*) is typically connected with vegetation. These taxa do not dominate however in moraine ponds, which contain mainly families Monhysteridae and Plectidae.

Supposing that animals are transported together with plant parts (Fig. 5), we should expect in traps mainly those taxa which are connected with vegetation, rather than freshwater taxa. This seems to be confirmed by the presence in traps of *I. asper* and *Diphascoen* sp. within tardigrades and family Dorylaimidae within nematodes. Probably these taxa colonise new habitats at first, but other species dominate later in freshwater bodies.

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Streszczenie

Na morenie lodowca w okolicach Stacji im. H. Arctowskiego w Antarktyce (fig. 1), przeprowadzono eksperyment z użyciem pułapek mający stwierdzić, czy, i w jakich ilościach mikrofauna lub jej formy przetrwalne są przenoszone przez wiatr. W ciągu 6 tygodni trwania eksperymentu stwierdzono w pułapkach 859 osobników mikrofauny (fig. 2), z czego Nematoda stanowiły 71%, Tardigrada 22% a Rotifera 7% (fig. 3). Stwierdzono, że liczba schwytych w pułapki osobników zależała od odległości od terenów już skolonizowanych, o lepiej rozwiniętej roślinności (fig. 4), oraz od obecności fragmentów roślinnych, wraz z którymi mikrofauna mogła być przenoszona (fig. 5). Właśnie mikrofauna związana z roślinnością (*Diphascion* sp. wśród Tardigrada czy Dorylaimidae wśród Nematoda) była chwyтана w pułapki częściej niż typowa fauna słodkowodna zbiorników z tej okolicy (fig. 6). W/w gatunki kolonizują na początku nowe tereny, w tym nowo powstałe zbiorniki słodkowodne, ale później nie dominują w istniejących i zasiedlonych już zbiornikach w tym rejonie.