

# Patterns in the horizontal structure of litter invertebrate communities in windbreak plantations in the steppe zone of the Ukraine

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**Abstract:** The article analyses the patterns in the horizontal structure of litter invertebrate communities in windbreak plantations in the Steppe zone of the Ukraine. The number of invertebrate species shows statistically insignificant changes depending on the extent of the litter horizon development. With an increase in litter mass from 300 to 900 g/m<sup>2</sup> the number of invertebrate species increases. An increase in the total number of macrofauna is observed in areas having a minimum and maximum thickness of the litter layer. Maximum values in the Shannon diversity index were observed in areas with sparse litter (50–150 g/m<sup>2</sup>). An observed increase in the variety of macrofauna species were seen where there was sparse grass cover in windbreak planted areas. The total number of litter invertebrate individuals related to the percentage of projective cover of herbaceous plants shows a significant increase in plots with 20–28% cover, though this factor does not affect the number of Aranei, Carabidae, and Staphylinidae. There is a decrease in the number of litter invertebrate species in areas with higher numbers of *Lasius platythorax* Seifert, 1991, while there is an insignificant change in the overall numbers of macrofauna. The abundance of *Myrmica scabrinodis* Nylander, 1846 does not show a significant influence on the number of litter macrofauna species. The minimum values of the Shannon biodiversity index for macrofauna were registered in plots with maximum numbers of *M. scabrinodis*. With an increase in the abundance of ants, the abundance of litter saprophages and phytophages decreases. There are also significant changes in the dominance structure of other taxonomic groups. Biotic factors have greater significance for the horizontal structure of litter macrofauna of steppe plantations than abiotic factors.

**Key words:** distribution structure of populations, diversity, forest plantation ecosystems, litter invertebrates

## Introduction

Maintaining biological diversity of anthropogenically transformed ecosystems in the Ukraine's steppe zone is not possible without a sufficiently high preservation level of the forest plantation animal populations. The communities of litter invertebrates of windbreak plantations are a highly complex and changeable system. The structure is defined by factors external to this community (texture and moisture of the soil, the type of plant community, intensity of anthropogenic pressure) and by the internal structure of the litter invertebrate communities (Bird *et al.* 2000; Jukes *et al.* 2001; Taboada *et al.* 2010; Brygadyrenko *et al.* 2012).

The priority in our research into the litter invertebrates of the Ukraine's steppe zone windbreak plantations was the distribution of certain species, particularly the pests of agricultural crops and forest plantations. The peculiarities of the trophic structure of forest plantation communities in the steppe zone have only been analysed in recent years (Komarov and Brygadyrenko 2011; Korablev and Brygadyrenko 2012). However, the distribution structure of litter macrofauna communities in most types

of forest plantations in the Ukraine's steppe zone has been insufficiently studied.

The dominant tree species, as defined by distribution, in the windbreak plantations of the Ukraine's steppe zone are *Robinia pseudoacacia* L. and *Fraxinus excelsior* L. They are the best adapted to conditions of insufficient moisture. In forest plantations, various communities of litter invertebrates are formed which are not significantly different from communities in natural forests (Malaque *et al.* 2008). The study of invertebrate distribution regularities in the forest ecosystems of the Ukraine's steppe zone has not only scientific, but also practical value for controlling the numbers agricultural crop pests in areas adjacent to windbreak plantations (Bird *et al.* 2000; Brygadyrenko and Komarov 2008; Kozłowski and Kozłowska 2008; Meena *et al.* 2013; Trzciński and Piekarska-Boniecka 2013).

Each particular plantation has its own specific mosaic of humidity and light conditions, and mosaic distribution of plants and different food resources available to the macrofauna. This patchwork of ecological conditions permits the coexistence in a single site of a variety of species of invertebrates, including those competing for the same

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