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HOW DOES INSECT DIVERSITY DRIVE ECOSYSTEM SERVICES IN ORGANIC LANDSCAPE?

The transformation of natural habitats into agricultural lands leads to significant biodiversity losses, particularly affecting insects that are essential for ecosystem services like pollination and pest regulation. Organic farming promotes more sustainable practices, offers a potential solution to mitigate biodiversity loss. However, organic landscapes require careful management to fulfil ecosystem services. This study investigates the diversity and ecological role of the entomological complex in organic forest shelterbelts in the forest-steppe zone of Ukraine.

The research was conducted from 2019 to 2021 in the forest shelterbelts surrounding organic fields at the Skvyra experimental station of organic production. These fields were cultivated with crops such as winter wheat, buckwheat, soybeans, and oats. Insect samples were collected using the entomological sweeping method (number of individuals per 100 sweeps) from late May to mid-July. The total insect population was categorized into different taxonomic groups. Insects were identified at the family level using entomological literature and microscopy, and classified into taxonomic and ecological groups based on their habitat and roles in the ecosystem.

Our fundings show presence in the fields insects from orders Orthoptera, Hemiptera, Thysanoptera, Coleoptera, Neuroptera, Hymenoptera, Diptera, Lepidoptera, Mecoptera. The most abundant insect orders in the forest shelterbelts were Coleoptera and Hemiptera, which were found in significant numbers across all the study sites. The abundance of Hymenoptera (including ants and bees) was also notable (40,5 individuals per 100 waves). The most dominant insect families across all shelterbelts were *Formicidae* (ants), *Chalcididae* (parasitic wasps), *Cicadellidae* (leafhoppers), *Curculionidae* (weevils), and *Miridae* (plant bugs).

Insects found in the shelterbelts were grouped into five ecological categories based on their habitats and functions within the ecosystem (table 1):

Table 1. **Ecological groups of insects and key ecosystem services they provide**

Ecological group	Dominant species examples	Number of species	Dominance level (%)	Key ecosystem services
Forest shelterbelts residents	*Beosus maritimus* (Scopoli, 1763), *Dromius* spp.	15	25%	pest regulation, biodiversity
Meadow species	*Agapanthia villosoviridescens* (De Geer, 1775), *Lagria hirta* (Linnaeus, 1758)	12	20%	biodiversity, food source for predators
Agrocenosis residents	*Coreus marginatus*, *Dolycoris baccarum*	10	18%	pest regulation, crop health
Open habitat mesophiles	*Gryllus* spp., *Himacerus* spp.	8	15%	soil health, nutrient cycling
Pollinators	*Bombus pascuorum* (Scopoli, 1763), *Hylaeus* spp.	6	22%	pollination, supporting plant reproduction

1. Forest shelterbelts residents (inhabit the undergrowth and tree trunks of forest shelterbelts): *Beosus maritimus* (Scopoli, 1763) (Lygaeidae), *Dromius* spp., *Kleidocerys resedae* (Panzer, 1797), *Pentatoma* spp., *Palomena prasina* (Linnaeus, 1761), *Dinoptera collaris* (Linnaeus, 1758), *Xylotrechus* spp., *Leptura* spp., *Melolontha melolontha* (Linnaeus, 1758), *Rhagio tringarius* (Linnaeus, 1758) (Rhagionidae), *Dioctria* spp. (Asilidae), *Tipula* spp. (Tipulidae), *Calliopum aeneum* Maigen, 1838; *Sapromyza* spp.; *Ceroxys munda* (Loew, 1868) (Kameneva, 2020) (Ulidiidae).

2. Meadow Species (in open grassy areas adjacent to the shelterbelts): *Agapanthia villosoviridescens* (Degeer, 1775), *Agapanthia* spp. (Cerambycidae), *Lagria hirta* (Linnaeus, 1758) (Tenebrionidae), *Dasytes niger* (Linnaeus, 1761), *Dasytes* spp.

3. Agrocenosis residents (associated with agricultural crops): *Coreus marginatus* (Linnaeus, 1758), *Dolycoris baccarum* (Linnaeus, 1758), *Carpocoris* spp., *Lygus rugulipennis* (Poppius, 1911), *Lygus* spp., *Chaetocnema* spp., *Spermophagus sericeus* (Geoffroy, 1785), *Tanymecus (Tanymecus) palliatus* (Fabricius, 1787), *Tanymecus* spp.

4. Open habitat mesophiles (found in open, dry areas and fields): *Gryllus* spp., *Himacerus (Aptus) mirmicoides* (Costa, 1834), *Oxytherea funesta* (Poda, 1761) (Cetoniidae), *Cordylepherus viridis* (Fabricius, 1787).

5. Pollinators (insects that provide pollination services): bees – *Hylaeus* spp. (Colletidae), *Bombus pascuorum* (Scopoli, 1763) (Apidae), wasps – *Cerceris* spp. (Sphecidae), other pollinators – *Evyleus* spp., *Lasioglossum* spp. (Halictidae), *Anthophora borealis* Morawitz, 1865 (Apidae).

Many of the insects found in the shelterbelts act as natural predators or parasites of crop pests, helping to reduce the need for chemical pesticides. The dominance of this group was 25% among forest shelter residents and 18% among agrocenosis inhabitants. At the research site, we identified six species of pollinators, accounting for 22% of the insect population. Some insects, particularly mesophiles, contribute to the breakdown of organic matter and enhance soil formation, fostering a healthy soil environment essential for sustainable organic farming.

The results indicate that forest shelterbelts are crucial for supporting a diverse range of insects, which in turn contribute significantly to the ecosystem services necessary for maintaining organic farming systems.

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MODERN CONCEPT OF INTEGRATED PROTECTION OF FRUIT PLANTATIONS FROM PESTS

An important task of modern systems of plant protection, including fruit crops, is to develop and implement the integrated measures that preserve the crops from harmful organisms while being the safest for the