



UDC 598.2 (477.41/42)

ECOLOGICAL SEGREGATION OF THRUSHES OF GENUS *TURDUS* IN TERMS OF VOLYN POLISSIA

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An ecological segregation of five species of thrushes (*Turdus pilaris*, *T. merula*, *T. iliacus*, *T. philomelos*, *T. viscivorus*) in Volyn Polissia was studied. For the overwhelming majority of ecological characteristics, the most similar are Song Thrush and Blackbird (DE = 38.36). They have similar biotopical preferences in forest and forest edges habitats, almost the same nesting height (1.58 and 2.00 m, accordingly), similar feed rations. All this gives us the reason to conclude minimal ecological segregation of Song Thrush and Blackbird in the forest ecosystems of Volyn Polissia. At the same time, they avoid high ecological competition due to different ratios in thrushes complexes in the certain territories [22, 23], structure of nesting habitats [23]. Fieldfare often settled near open habitats by meadows and forest edges, build the nests on the prevailing tree species within the habitat. Food preferences associated primarily with the composition of the feed, the majority of which is produced out of the forest habitats. Mistle Thrush prefers medieval pine forests without undergrowth (73 % of all habitats) with poor forest floor, that made different strategy of food use and obtaining among all presented thrushes species. It was established that among the five studied species of thrushes Redwing and Mistle Thrush has the highest value of ecological specialization and segregation.

Keywords: Thrushes, ecological segregation, interspecific differences, Volyn Polissia.

INTRODUCTION

In Volyn Polissia, avifauna of genus *Turdus* is represented by five species: *Turdus pilaris* (Fieldfare), *T. merula* (Common Blackbird), *T. iliacus* (Redwing), *T. philomelos* (Song Thrush) and *T. viscivorus* (Mistle Thrush). Various aspects of the biology and ecology of these species are well explored at this time. At the same time the question of environmental differences, the competitive relationship in terms of the coexistence of these species in forest ecosystems Volyn Polissia remained still open [2, 28]. In addition, the ecological specialization and segregation of closely related species of birds,

that inhabit sympatrical in particular ecosystems is still actual, what helps to understand the principles of distribution of ecological resources, development of lifestyle and the place and role of each species in the appropriate grouping [17, 22].

Mentioned *Turdus* species shared mutual environmental resources within their nesting range, particularly in conditions of Volyn Polissia forest ecosystems, so studying of their ecological specialization and segregation are important for the understanding of place, role and weight of each species as a structural element of a particular ecosystem. Therefore, we tried to investigate basic ecological mechanisms of thrushes coexistence and estimate the range and the character of their ecological segregation in Volyn Polissia.

MATERIALS AND METHODS

Materials of thrushes breeding ecology of Volyn Polissia were collected in April–July 2007–2015. Much of the data are taken from West-Ukrainian Ornithological Society data base of nests and clutches of the birds collected within the studied region during the 1984–2006.

Research of biotopical preferences performed relatively to the breeding habitat what recorded for each founded nest. Totally 11 habitats were found (coastal scrubs, roadways shelterbelts, deciduous woodlands, mixed forests, older forest plantations, middle-aged pine plantations, middle-aged spruce plantations, young-aged pine plantations, parks, orchards, black chokeberry plantations). For comparison, Thrushes trophic preferences used published data [2, 5, 6, 11, 12, 19, 25, 26, 30–32].

In a field, we described the height of nest placing, measured from the ground (L), and species of tree or shrub for each found Thrushes nest.

Analysis of the results was performed with standard statistical methods. Statistical calculation was made in Microsof Office Excel 2007 and “11.0 Statistics” programs.

RESULTS AND DISCUSSION

The Fieldfare, Blackbird and Song Thrush are common breeding [4, 12, 14–16, 29–32], occasionally wintering [7, 8, 15] species at the study area. Instead, Mistle Thrush and Redwing are rare range-boundary species here [12, 15, 29].

Biotopical distribution. Nesting of few thrushes species within the mutual habitat is normal [2, 22], but the rate of each species in ornithocenosis is different.

The mixed forests biotopes are distinctive for Redwing (83.3 % of nests) and less for Blackbird (30.6 %) and Song Thrush (29.0 %). Mistle Thrush for nesting prefers green-moss-blueberry middle-aged pine biotopes without undergrowth (73.0 % of nests detected in all types of habitats). Instead Fieldfare (14.6 %), Blackbird (13.8 %) and Song Thrush (15.6 %) nest in such biotope in small quantities. Important role for nesting of thrushes play a young pine plantation under 20 – the rate of detected nests are high for Redwing (16.7 %), Song Thrush (15.2 %) and for Fieldfare (15.4 %). The last one prefers shelterbelts along roadways and railways (36.2 %) and coastal willow growth (10.8%). Important role for nesting of thrushes in Volyn Polissia play deciduous forests formed with alder (*Alnus glutinosa*), silver birch (*Betula pendula*), English oak (*Quercus robur*) and aspen (*Populus tremula*), where found a significant rate of nests of Song Thrush (19.3 %) and Blackbird (15.0 %). Over-moist black-alder forests with dense undergrowth play a slight role in nesting of Blackbird (11.9 %), Mistle Thrush (7.7 %) and Fieldfares (6.2 %).

The main priority in the selection of the nesting habitat for thrushes has the quality of feed [2, 5, 6]. The basis of thrushes feed compose the ground oligochaetes, whose quantity depends on moisture conditions of the biotope [5]. The trees and shrubs architectonic [10, 11, 20, 27] and habitat structure (close allocation of forest edges, water or open spaces) [3, 14, 22] are also have an important role for nest disposition.

Cluster analysis shows (Fig. 1) that habitat distribution of Blackbird and Song Thrush is most similar (DE = 11.27), some differs Fieldfare (DE = 42.77–79.63) and Redwing (DE = 59.0–60.4). Habitat distribution of Mistle Thrush significantly differs from those Blackbird and Song Thrush (DE = 67.9–68.19) but higher differences detected between Mistle Thrush and Redwing (DE = 104.26).

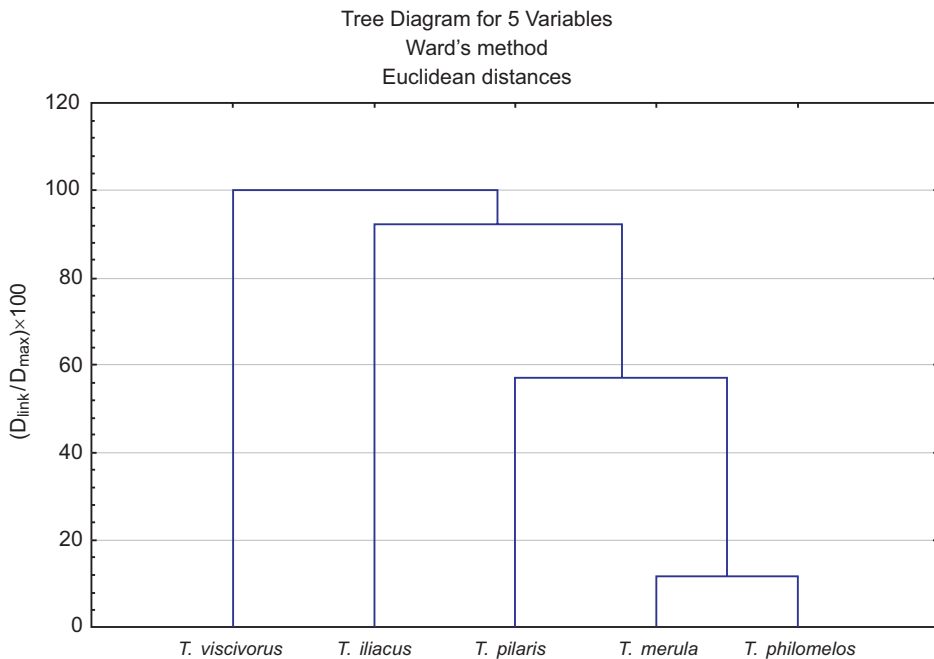


Fig. 1. Cluster analysis of the similarity of *Turdus* species by habitat distribution

Рис. 1. Кластерний аналіз подібності представників роду *Turdus* за біотопічним розподілом

Spatial placement of nests. Established that thrushes in Volyn Polissia use 38 species of trees and shrubs (n = 560) for building nests. According to our data four species prefer trees (50.0 % of Redwings, 75.7 % of Song Thrushes, 78.3 % of Blackbirds, 92.9 % of Mistle Thrushes and 96.1% of Fieldfares nests were build on trees). The rate of nests, located on bushes is 7.1–33.0 % on another substrate – is negligible.

The distribution of nests by species of trees and shrubs in Volyn Polissia is heterogeneous. Thrushes often used conifers (*Pinus sylvestris*, *Picea abies*, *Pinus banksiana*) and shrubs (*Juniperus communis*), which is also typical for other parts of the European range, particularly in Polissian and central parts of Poland [12, 13, 33].

We found that the rate of Mistle Thrushes nests located on the pine is 71.4 %, for Song Thrush – 34.4 %, Fieldfares – 28.7% and Blackbird – 24.3%. On the spruce we found 11.6 % Song Thrushes, 7.9 % of Blackbird, 7.1 % of Mistle Thrushes nests. Re-

markable that Fieldfares and Redwings nests on spruce wasn't found. 7.1 % of Mistle Thrush nests we found on Jack pine, which was introduced in the region in 1970–1990. The rate of nests detected on juniper is 17.7 % for the Song Thrush, 16.7% for Redwing, 8.6 % for Blackbird, 7.1 % for Mistle Thrush and 2.3 % for Fieldfare. Choice the conifer as nesting tree for thrushes has a similar trend in mixed forest of Russia, Belarus, Ukraine and taiga [1, 4, 6, 14, 18, 21, 32] and especially for Ukrainian Steppe zone [9]. According A.B. Chaplygina, evergreen conifer plantations create favorable conditions for placing and disguising of thrushes nests [10].

Significant role for nest disposition have the deciduous tree species also. Thus, the Blackbird placed his nests on black alder in 24.3 %, Song Thrush – in 6.2 %, Fieldfare – in 5.4 %. The last one build nests mainly on *Populus nigra* var. *pyramidalis* (23.3 %) and ash (10.9 %), which form monotypic roadways shelterbelts. The rate of other deciduous trees species for thrushes nest disposition is negligible. Placing nest on a particular tree species primarily depends on the nesting sites (habitats), species composition and suitable conditions for placing and disguising of nests.

As a result of cluster analysis (Fig. 2), the most similar in trees and bushes species composition for nesting are Fieldfare and Song Thrush (DE = 23.84), slightly more differs Blackbird, Song Thrush and Fieldfare (DE = 33.75–35.47). Apart from other species are Redwing (DE = 43.96–62.0) and Mistle Thrush (DE = 41.33–91.65).

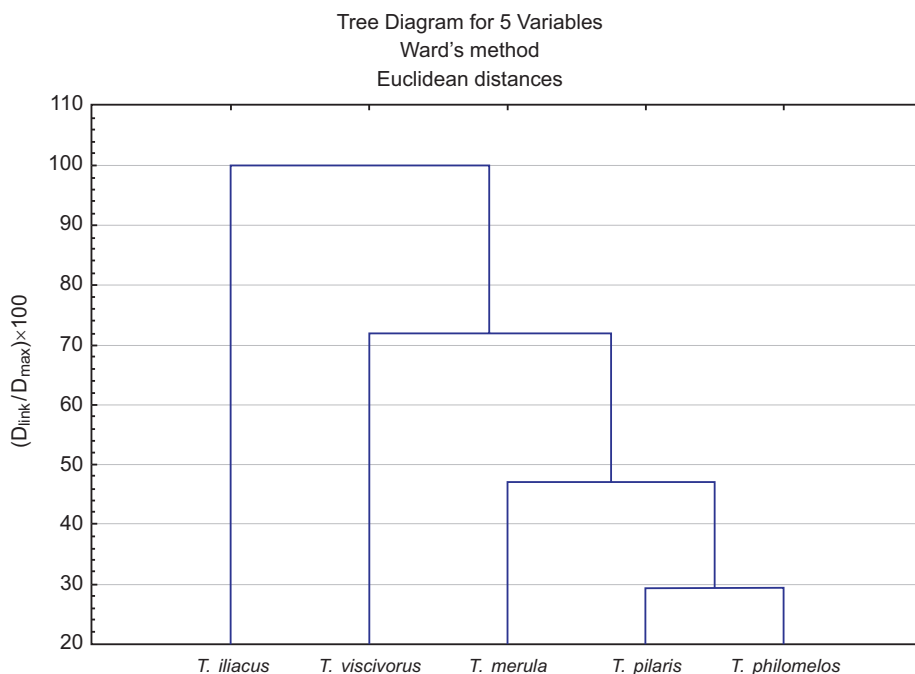


Fig. 2. Cluster analysis of the similarity of *Turdus* species by nesting trees

Рис. 2. Кластерний аналіз подібності представників роду *Turdus* за породним складом дерев, на яких розміщені гнізда

The average height of the nest allocation smallest for Redwing ($n = 6$; 0.86 ± 0.43 m; lim 0.2–2.5 m), slightly higher build nests Song Thrush ($n = 215$; 1.58 ± 0.10 ; lim 0.1–6.0 m),

Blackbird (n = 139; 2.0±0.06; lim 0,1–6,0 m) and Mistle Thrush (n = 14; 2.98±0.38 m; lim 1.3–7.0 m). The highest average height of the nest allocation detected for Fieldfare (n = 118; 5.2±0.14 m; lim 0.5–11.0 m).

Feeding of adults and nestlings. On the results of the literature analysis for neighboring to Volyn Polissia areas [19, 26, 30-32] and within the thrushes European range [2, 5, 12, 25], the specifics of nutrition has not significant differences, however, has significant interspecific differences [2, 6, 24]. According to A.V. Baranovsky with colleagues [2], the character of food extraction and feature of foraging behavior formed various ecological, morphological, physiological, ethological and other adaptations which became the basis of formation of ecological differences. So, detected that highest rate of similarity is peculiar to the Song Thrush and Blackbird, the lowest – in Song Thrush and Fieldfare, an intermediate position occupies Fieldfare and Redwing, at the same time Mistle Thrush is the most remote of the four other *Turdus* species. The explanation for this difference is in the variety of species feeding preferences – Redwing use larger prey then Blackbird, Song Thrush or Fieldfare; Song Thrush have the strict feeding preference of three types of prey – earthworms, caterpillars and mollusks, while the Blackbird haven't any feeding preference [11]. The last two mentioned species feeds mainly on the forest floor and on the surface of the substrate, but differs is foraging strategy [31,32]. Mistle Thrush has significant differences from others thrushes species – in his diet almost no earthworms, preferred prey of medium and large size (for example, observed cases of hunting newts and lizards), most likes eat beetles, caterpillars of owlet moth, feeds in various places mainly on a ground [25].

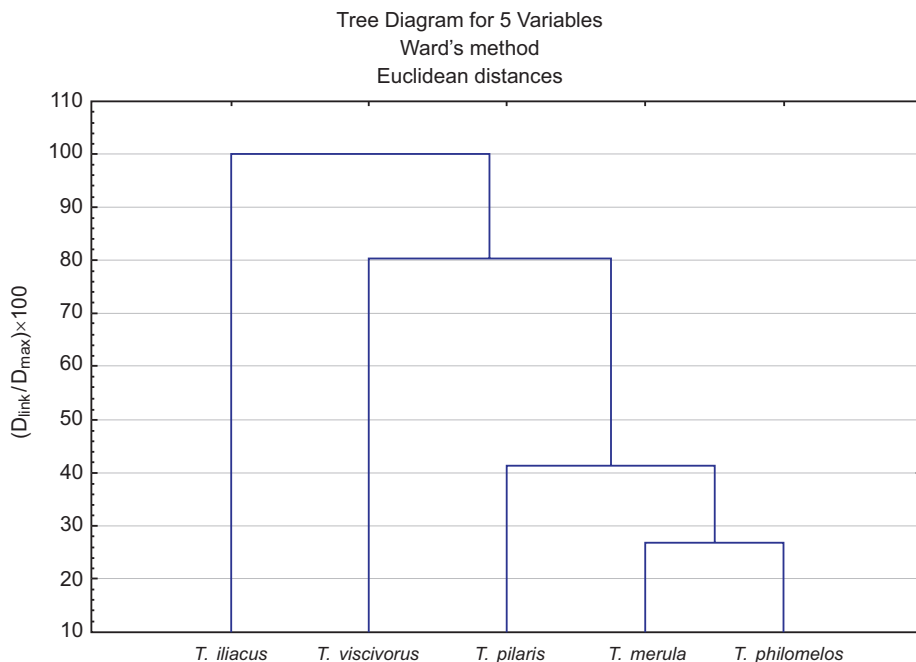


Fig. 3. Structure of the similarity of *Turdus* genus by DE aggregated values

Рис. 3. Структура подібності представників роду *Turdus* за узагальненими значеннями DE

Despite the great similarity in feeding, trophic competition in thrushes not appear or have slight value [23]. According to A.B. Chaplygina, interspecific similarity in feeding caused by overlapping of the trophic niches [9].

In a result of cluster analysis (Fig. 3), it was revealed that most ecologically similar are Blackbird and Song Thrush (DE = 38.36). The Fieldfare is also close to them (DE = 52.92 and DE = 55.65, accordingly). From these three species considerably vary Redwing and Mistle Thrush (Fig. 3). Remarkably that Fieldfare and Mistle Thrush most differ from the Redwing with DE values 122.7 and 160.0, respectively.

CONCLUSIONS

In a result of the comparison of five studied thrushes species by major ecological performance, the following conclusions of their ecological specialization and segregation are formed. For the overwhelming majority of ecological characteristics the most similar Song Thrush and Blackbird (DE = 38.36). They have the similar biotopical preferences because prefer forest habitats and forest edges, nesting almost on the same height (1.58 and 2.00 m, accordingly) and have the similar feed rations. All this gives us the reason to conclude that ecological segregation of Song Thrush and Blackbird in the forest ecosystems of Volyn Polissia is minimal. At the same time, they avoid high ecological competition due to different ratios in thrushes complexes in the certain areas [22, 23] and structure of nesting habitats [23]. Fieldfare often settled near open habitats along the meadows and forest edges, they build the nests on the prevailing tree species within the habitat. Food preferences were associated primarily with the composition of the feed, the main part of which is obtained out of forest habitats. Mistle Thrush prefers medieval pine forest with no undergrowth (73 % of all habitats) with poor forest floor, what became the reason of feed composition and foraging strategy differences from the other thrushes species. This all leads to a conclusion that among five studied species of thrushes Redwing and Mistle Thrush has the highest value of ecological specialization and segregation.

ACKNOWLEDGEMENTS

The authors are grateful to A.A. Bokotey, I.M. Gorban, O.S. Hnatyna, V.I. Shkaran, I.V. Shydlovskyy for the opportunity to use the West-Ukrainian Ornithological Society data base of nests and clutches of the birds and separate to R.O. Zhuravchak, A.V. Dobrinsky for help in preparing of this article.

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ЕКОЛОГІЧНА СЕГРЕГАЦІЯ ДРОЗДІВ РОДУ *TURDUS* В УМОВАХ ВОЛИНСЬКОГО ПОЛІССЯ

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Проведено дослідження екологічної сегрегації п'яти видів дроздів (*Turdus pilaris*, *T. merula*, *T. iliacus*, *T. philomelos*, *T. viscivorus*) в умовах Волинського Полісся. За переважною більшістю екологічних характеристик найбільш подібними виявилися дрозди співочий і чорний. (DE = 38,36). Вони мають подібні біотопічні преференції, тому що віддають перевагу лісовим біотопам та узлісся, гніздяться практично на одній висоті (1,58 і 2,00 м відповідно), мають схожі кормові раціони. Це дає підстави вважати, що екологічна сегрегація співочого і чорного дроздів у лісових екосистемах Західного Полісся мінімальна. Водночас вони уникають високої екологічної конкуренції завдяки різному співвідношенню за чисельністю у складі угруповань дроздів на тих чи інших територіях [12, 35], структурою гніздових стацій [35]. Чикотень найчастіше поселяється поблизу відкритих біотопів лук і на узліссі, розміщує гнізда на переважаючій породі в межах біотопу. Кормові преференції пов'язані насамперед зі складом корму, левову частку якої добувають за межами лісових біотопів. Дрізд-омелюх віддає перевагу середньовіковим сосновим масивам без підліску (73 % від усіх біотопів) із бідною підстилкою, що зумовило відмінну від усіх представлених видів дроздів специфіку використання кормів і стратегії їх добування. Встановлено, що серед п'яти досліджених видів дроздів найбільший рівень екологічної спеціалізації та, відповідно, сегрегації мають дрізд білобровий і дрізд-омелюх.

Ключові слова: дрозди, екологічна сегрегація, міжвидові відмінності, Волинське Полісся.

ЭКОЛОГИЧЕСКАЯ СЕГРЕГАЦИЯ ДРОЗДОВ РОДА *TURDUS* В УСЛОВИЯХ ВОЛЫНСКОГО ПОЛЕСЬЯ

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Проведено дослідження екологічної сегрегації п'яти видів дроздів (*Turdus pilaris*, *T. merula*, *T. iliacus*, *T. philomelos*, *T. viscivorus*) в умовах Волинсько-

го Полесья. По подавляющему большинству экологических характеристик наиболее похожими оказались дрозды певчий и черный ($DE = 38,36$). Они имеют похожие биотопические предпочтения, так как предпочитают гнездиться в лесных биотопах и на опушке леса, гнездятся практически на одной высоте (1,58 и 2,00 м, соответственно), имеют похожие кормовые рационы. Это дает основания считать, что экологическая сегрегация певчего и черного дроздов в лесных экосистемах Волынского Полесья минимальна. В то же время они избегают высокой экологической конкуренции благодаря разному соотношению по численности в составе сообществ дроздов на тех или иных территориях [12, 35], структуре гнездовых станций [35]. Рябинник чаще селится вблизи открытых биотопов вдоль лугов и на опушке леса, размещает гнезда на преобладающей породе в пределах биотопа. Кормовые предпочтения связаны в первую очередь с составом корма, львиная доля которой добывается в не лесных биотопах. Деряба предпочитает средневозрастные сосновые массивы без подлеска (73 % от всех биотопов) с бедной подстилкой, что обусловило отличающуюся от всех представленных видов дроздов специфику использования кормов и стратегии их добычи. Установлено, что среди пяти исследованных видов дроздов наибольший уровень экологической специализации и, соответственно, сегрегации имеют белобровник и деряба.

Ключевые слова: дрозды, экологическая сегрегация, межвидовые различия, Волынское Полесье.

Одержано: 28.12.2015