GREAT TITS', *Parus major* (PASSERIFORMES, TURDIDAE), DIET IN TRANSFORMED FOREST ECOSYSTEMS OF NORTHEASTERN UKRAINE

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Abstract

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The diet spectrum of the great tit (*Parus major* L., 1758) was studied in transformed forests of northeastern Ukraine. Four forest ecosystems were surveyed: four model sites in oak woodlands and in a pine–oak forest with different stages of recreational digression. Forty-seven taxa of invertebrates ($n = 325$) were detected in the ration of great tit chicks. Insecta (72.4%): Lepidoptera (seven families, 35.9%), Hymenoptera (two families, 21.0%), Diptera (seven families, 2.7%) and Coleoptera (four families, 1.8%) were among them. In terms of the qualitative composition of invertebrates (20 species, 42.6%) and the proportion of seized food objects (159 objects), phytophages prevailed. The food composition of great tit chicks was the most similar in territories MS1 and MS4. It contained six common taxa for these territories (Stugren–Radulescu Index = 0.7, Jaccard = 0.2, Sorensen = 0.3).

Key words: diet, zoophages, phytophages, saprophages, necrophages, mixophages.

Introduction

The diet of some species of passerines is poorly studied, geographical coverage is extremely uneven (70% of data are from Germany, Russia, Slovakia, the Czech Republic, Poland and the UK), and most studies are not representative (three seasons, ³20 broods per season), which puts their validity into doubt. Most of the studies (Cholewa, Wesolowski, 2011) were carried out several decades ago under different conditions and, most likely, they cannot be regarded as representative for our region of research.

Trophic features of the species are decisive in the management and conservation of bird species diversity in both natural and transformed areas (Korňan, Adamík, 2017). Support of biodiversity requires understanding of the role of trophic interactions and the potential effects caused by the loss of certain links (Teichman et al., 2013). In such cases, downward trophic cascades occur (Bridgeland et al., 2010). Food chains form a network of trophic interactions, and study of their functioning is important for elucidating the processes and functions of ecosystems. Thus, direct links between predator and prey are mediated by numerous environmental and evolutionary determinants (Kuwaie et al., 2012). Trophic interactions of species are structured on a wide spatial scale according to their functional characteristics (Brooks et al., 2012).

Lepidoptera larvae are known to be the most important component of great tit chicks' diet (Barba, Gildelgado, 1990). They also predominate in the diet of blackbird chicks (*Turdus merula*)

(Chaplygina, Pakhomov, 2020). Adult tits in broods with a greater number of chicks concentrate on more accessible food objects (Tortricids); in broods with a smaller number of chicks, the percentage of other preys (Noctuids) in the diet increases (Garcia-Navas, Sanz, 2010).

Insectivorous birds should adjust the hatching of chicks to a short period of availability of food (appearance of lepidopteran larvae) for feeding (Garcia-Navas, Sanz, 2011). Breeding of blue tit chicks (*Cyanistes caeruleus*) is usually timed to the period when caterpillars are the most common (Banbura et al., 1999).

Not far from Krakow (Poland), differences in the diet of great and blue tit chicks in two European forests were clarified and it was checked whether the ecological niches of the two species overlap. It was found that both species of birds occupied different territories in each forest, but the diet of chicks contained similar species of invertebrates (Grzędzicka, 2018). However, studies confirmed that blue tit chicks better swallow caterpillars (they need less time); they swallow spiders and grasshoppers somewhat longer due to the mechanical constraints that prevent them from swallowing very large objects, which affects the choice of the prey. Relatively, with the great tit, such restrictions may be less stringent due to the larger size of its body (Banbura et al., 1999).

The diet and frequency of great tit chicks' feeding was studied using electronic chronographs and cameras in artificial nests in Corsica and on the mainland. In addition to caterpillars, a much

Fig. 1. Map of model sites.

wider range of taxa was represented in the diet (Blondel et al., 1991).

The presence of appropriate feeding stations in the biotope is important for maintaining of bird populations. In Europe, there is the practice of arranging special canteen bird feeders during the reproductive period (Amrhein, 2013).

In the park area, great tits, blue tits and robins (*Erithacus rubecula*) prefer to visit feeding places with high-calorie and protein-rich food (peanuts, cheese), but some birds choose bread that is more carbohydrate rich (Støstad, 2017).

In the Czech Republic, the trophic dependence of birds on invasive plant species is considered (Hanzelka, Reif, 2015). In the conditions of the transformed forest ecosystems of the northeast of Ukraine, special studies of the ration of great tit chicks have not been conducted, highlighting the need for carefully studying the food spectrum of this species as the main factor influencing the number of birds.

Material and methods

Field materials were collected from the third decade of March to the first decade of July 2013–2016 from the city of Kharkiv (Zhuravlivs'kyi Hydropark, a Lisopark), Kharkiv Region (the National Park 'Homilshanski Lisy') and Sumy Region (the site 'Vakalivshchyna', the National Park 'Hetmanskyi': villages Klymentove and Kam'yanka) (Fig. 1). According to Gensiruk's classification (2002), three model sites, selected in the oak forests, were characterised by different stages of recreational digression. The model sites in the National Park Hetmanskyi and Zhuravlivs'kyi Hydropark were located in a pine–oak forest.

Table 1. Number of field materials of the great tits in model sites.

Site	Number of nestlings	Number of nests	Number of food pellets	Number of food items
MS1	132	26	94	91
MS2	133	26	94	140
MS3	57	11	40	69
MS4	62	12	43	25
Total	384	75	271	325

Model site 1 (MS1) is located within a recreational zone of the National Park Homilshanski Lisy in the vicinities of the study plots of H. S. Skovoroda Kharkiv National Pedagogical University and Karazin Kharkiv National University. In terms of the level of anthropogenic load, biocenotic conditions in this area were heterogeneous, which characterised it as a territory with an average level of transformation. These areas are exposed to intensive recreation pressure during the bird breeding season. The wood includes damaged and diseased trees (about 35%); the crown closure is about 70%. The understory and shrub layer are available, but poorly differentiated. The grassy layer is partly disturbed; the projective cover reaches 85% in some areas. The forest floor is of little disturbance. Forest paths occupy up to 30% of the site. The model site is characterised by the third stage of recreation digression and requires management of recreational pressure.

Model site 2 (MS2) is situated in the National Park Hetmanskyi, in a pine forest near Kam'yanka and Klymentove villages, in an area called 'Lytovskyi Bir'. The vegetation cover undergoes low

or moderate anthropogenic impact in the form of sanitary selective cuttings. We characterised this site as medium transformed. Oak–pine and maple–linden–oak woodlands near Kam'yanka are little disturbed by people, with diseased trees; the crown closure is approximately 20%. The understory and shrub layers are typical for the habitat; 5–20% of trees have insignificant damages. The grassy layer includes meadow grasses (5–10%), not typical for this type of the forest. The forest floor is little disturbed. The area of paths is not large (up to 10–20% of the model site). In July–August, the recreational pressure increases due to a high number of visitors; but by this time, the breeding season of most of the birds has already finished. The site has the second level of recreational digression.

Model site 3 (MS3) is situated far from settlements, on the eastern bedrock bank of the Psol River in the site Vakalivshchyna and is represented by an oak forest mixed with maple and linden trees. The indicated territory has a low level of transformation and was chosen as a control area for breeding ecology monitoring of hollow-nesting birds. The crown canopy closure is approximately 85% (Table 1), and the share of damaged trees does not exceed 10% of their total abundance. The understory and shrub layers are typical for the habitat, without traits of noticeable damage. The grassy cover is mainly undisturbed and typical for the forest type. In some areas, excessive development of forest herbs is observed due to the fallout of overmature trees. The forest floor is undisturbed and thick. The recreational coefficient of the site was determined by the area of forest paths comprising 5%. MS1 is characterised by the first level of recreational digression.

Model site 4 (MS4) lies in the parks of Kharkiv City. It is a predominantly natural upland oak grove with a small part of planted species, located in the watershed of the rivers Lopan and Kharkiv. This area is subject to significant anthropogenic pressure and has a high level of transformation. Its crown closure is approximately 60%. Species of the forest edge, meadow, riparian-aquatic and ruderal plants are also recorded. There is an extended network of forest paths and roads, which people use for jogging. Increasing recreation pressure leads to the expansion of open glades and increasing density of paths. The maple *Acer negundo* forms dense thickets at the forest edge; in some places, garbage dumps are scattered. The closer to the forest border, the more ruderal species can be found. The site has the fourth and fifth levels of recreational digression.

A total of 75 nests of the great tits with 384 nestlings were inspected (Table 1). Of these, 62 nestlings ($n = 12$) were in the parks of Kharkiv City, 132 ($n = 26$) in the National Park Homilshanski Lisy, 57 ($n=11$) in the site Vakalivshchyna and 133 ($n = 26$) were in the National Park Hetmanskyi. The nestling diet was investigated in the first half of the day by applying neck ligatures to 4–12-day-old chicks (Mal'chevskij, Kadochnikov, 1953). Fodder samples were taken from 3 to 5 times a season at each model plot. The research was conducted from 10 May to 30 June in the first half of the day; 271 food pellets were collected, and 325 food items, mostly arthropods, were studied. Of these, 43 food pellets were from the parks of Kharkiv City, 94 from the National Park Homilshanski Lisy, 40 from the site Vakalivshchyna and 94 were from the National Park Hetmanskyi. The forage samples were fixed in a 70% solution of ethanol, and the arthropods were further identified in the laboratory. All the invertebrates were identified using standard methods to species, genus or family (in case

of significant damage) by Associate Professor Viktor Gramma, PhD.

To assess the width of the ecological niche of the great tit in the autumn–winter period, we used the traditional method (random multi-stage registration of foraging activity), in which the species of the tree, the altitude zone, the location of the bird and its location on the tree are recorded. The ratio of various postures that the great tit takes when searching for and acquiring food was investigated. Researchers distinguish a different number and variety of postures. Most often, 'hanging' back down and upside down postures are reported (Rezanov, 1999; Cramp et al., 1993).

Statistical treatment of the data was performed in the program Microsoft Excel. Similarity coefficients in the species composition of invertebrates found in the diet in different sites were calculated using the formulas of Jaccard (1901): $C_j = j / (a + b - j)$ and Sorensen (1948): $C_s = 2j / (a + b)$, where j is the number of invertebrate species found in both groups, a the number of species in the first group and b is the number of species in the second group. These coefficients had values from 0 (no similarity between compared parameters) to 1 (complete similarity). The Stugren–Radulescu coefficient (1961) was calculated by the formula: $Pst = (X + Y - Z) / (X + Y + Z)$, where X is the number of species that occur on the first site, but are absent on the second; Y is the number of species that occur on the second site, but are absent on the first and Z is the number of species common on the both sites. These coefficients had values from -1 to 1 (in the range from -1 to 0 points to similarity, but within the range of 0–1 to the difference of territories).

Results

The study showed that insectivorous birds play an important role in *biological control* of *arthropod* pest populations. In 2013–2016, in the diet of the great tit chicks, 325 food objects (invertebrates) were identified, which belong to 47 taxa from the phyla Arthropoda (99.1%) and Mollusca (0.9%) (Table 2). The phylum Arthropoda is represented by the following classes: Insecta – 72.4%, Arachnida – 21.7%, Malacostraca and Myriapoda – 0.3% each and Diplopoda – 0.9%. The largest class Insecta includes 14 orders and 27 families. Representatives of the orders Lepidoptera (seven families, 35.9%), Hymenoptera (two families, 21.0%), Diptera (seven families, 2.7%), Coleoptera (four families, 1.8%), Heteroptera (two families, 0.6%), Odonata, Blattodea, Orthoptera, Neuroptera and Raphidioptera (one family, 0.3% each) and Dermaptera, Trichoptera, Psocoptera and Homoptera (one family, 0.3% each) were among them (Fig. 2).

The great tit connections as a heterotrophic nucleus of the determinant consortium are quite wide. Analysis of great tit chicks' diet showed that the basic trophic group for them is the first-order consumers (20 species, 42.6%) (Fig. 3A). Representatives of the families Nitidulidae, Chrysomelidae, Curculionidae and Byturidae from the order Coleoptera (subphylum Hexapoda) belong to them. The identified insects of Psocoptera, Hymenoptera (Apoidea) and Hopoptera orders can be attributed to phytophages. Lepidopteran species from the families Tortricidae, Nymphalidae, Noctuidae, Geometridae, Lasiocampidae, Pieridae and Bombycidae of Macrolepidopteran clade (Rhopalocera) prevailed in the diet. Amber snails (*Succinea* sp.) from the family Succineidae (informal group Pulmonata, class Gastropoda, phylum Mollusca) formed only a small share of chicks' food.

Table 2. List of the trophic items in the diet of the great tit in transformed forest ecosystems of northeastern Ukraine.

Taxon name			Trophic group	MS1	MS2	MS3	MS4	Total	Notes
Order	Family	Species							
		Insecta spp.	ph		9 larv.		17 larv.	26	larv.
Odonata	Libellulidae	<i>Libellula fulva</i> (Müller, 1764)	z		1			1	imag.
Blattoptera	Blattellidae	<i>Ectobius lapponicus</i> (Linnaeus, 1758)	m	1				1	-«-
Orthoptera	Tettigoniidae	Tettigoniidae sp.	m	1 larv.				1	larv.
Dermaptera		Dermaptera sp.	m	1 larv.				1	-«-
Hemiptera	Miridae	<i>Myrmecophyes alboornatus</i> (Stål, 1858)	m	1				1	imag.
	Aphylidae	Aphylidae sp.	m	1				1	-«-
Coleoptera		Coleoptera sp.	ph		1 larv.	1 larv.		2	larv.
	Nitidulidae	<i>Meligethes</i> sp.	ph			1		1	imag.
	Chrysomelidae	Chrysomelidae sp.	ph			1 larv.		1	larv.
	Curculionidae	Curculionidae sp.	ph	1				1	imag.
	Byturidae	<i>Byturus ochraceus</i> (Scriba, 1790)	ph			1		1	-«-
Neuroptera	Chrysopidae	<i>Chrysopa</i> sp.	z	1 larv.				1	larv.
Hymenoptera	Formicidae	<i>Lasius alienus</i> (Foerster, 1850)	z	7		13		20	imag.
		<i>Lasius</i> sp.	z				1	1	-«-
		<i>Myrmica</i> sp.	z			1		1	-«-
	Tenthredinidae	Tenthredinidae sp.	z		1, 38 larv.	1, 7 larv.	1 larv.	48	2 imag. + 46 larv.
	Apoidea	Apoidea sp.	ph	1				1	imag.
Raphidioptera	Raphidiidae	<i>Dichrostigma flavipes</i> (Stein, 1863)	z	1				1	-«-
Trichoptera		Trichoptera sp.	z	1				1	-«-
Lepidoptera		Lepidoptera sp.	ph	5, 1 pupae, 2 larv.	3, 2 pupae, 6 larv.			19	8 imag. + 3 pupae + 8 larv.
	Tortricidae	Tortricidae sp.	ph	1		19		20	imag.
	Nymphalidae	Nymphalidae sp.	ph	1 larv.				1	larv.
	Noctuidae	Noctuidae sp.	ph	7, 1 pupae, 10 larv.	7, 3 pupae, 27 larv.	3	1, 1 larv.	60	18 imag. + 4 pupae + 38 larv.
	Geometridae	Geometridae sp.	ph	2, 1 larv.	1 larv.			4	2 imag. + 2 larv.
	Bombycidae	<i>Bombyx mori</i> (Linnaeus, 1758)	ph	2 pupae				2	pupae
	Lasiocampidae	Lasiocampidae sp.	ph	1, 1 pupae	7, 3 pupae	1 larv.		13	8 imag. + 4 pupae + 1 larv.
	Pieridae	Pieridae sp.	ph		1 larv.			1	larv.
Diurna		Rhopalocera sp.	ph	1				1	imag.
Psocoptera		Psocoptera sp.	ph			1		1	-«-

Notes: Trophic groups of the mesofauna: ph – phytophages; z – zoophages; m – mixophages; s – saprophages; n – necrophages; pr – parasites; MS1–MS4 – model sites described in the section ‘Materials and Methods’; imag. – imagoes; larv. – larvae; juv. – immature specimen(s). For taxa without symbols, the imago stage is given.

Table 2. Continued

Taxon name			Trophic group	MS1	MS2	MS3	MS4	Total	Notes
Order	Family	Species							
Diptera	Tipulidae	<i>Tipula</i> sp.	s		1			1	-«-
	Chironomidae	Chironomidae sp.	s	2			1	3	-«-
	Culicidae	Culicidae sp.	s	1				1	-«-
	Tabanidae	<i>Tabanus bovinus</i> Linnaeus, 1758	s		1			1	-«-
	Asilidae	Asilidae sp.	z	1				1	-«-
	Muscidae	Muscidae sp.	s		1			1	-«-
	Sarcophagidae	Sarcophagidae sp.	n	1 larv.				1	larv.
Homoptera		Homoptera sp.	ph	1 larv.				1	-«-
		Arachnida spp.	z		24, 1 juv.			25	24 + 1 juv.
Araneae		Araneae sp.	z	23, 4 juv.		12, 1 nymph, 4 juv.	3	47	38 imag. + 1 nymph + 8 juv.
Acari		Acari sp.	pr	1				1	imag.
Isopoda	Oniscidae	Oniscidae sp.	s	1				1	-«-
Myriapoda		Myriapoda sp.	s	1				1	-«-
Diplopoda		Diplopoda sp.	s			1		1	-«-
Julida	Julidae	<i>Julus</i> sp.	s	1 larv.		1		2	1 imag. + 1 larv.
		Mollusca sp.	ph	1	1			2	imag.
Pulmonata	Succineidae	<i>Succinea</i> sp.	Ph		1			1	-«-
Total								325

Fig. 2. The ratio of invertebrates in the *Parus major* chicks' diet.

Fig. 3. Distribution of the great tit nestling diet per trophic group: A – percentage of the total number of species; B – percentage of the total number of registered food items.

Table 3. Invertebrate similarity in the big tit diet in model sites.

Pair of model sites	Number of invertebrates found in both sites	Similarity index		
		Stugren–Radulescu	Jaccard	Sorensen
MS1–MS2	4	0.8	0.1	0.2
MS1–MS3	6	0.7	0.2	0.3
MS1–MS4	3	0.8	0.1	0.2
MS2–MS3	4	0.7	0.2	0.3
MS2–MS4	3	0.7	0.2	0.3
MS3–MS4	3	0.6	0.2	0.3

In the great tit diet, zoophages (11 species, 23.4%) from the subphylum Hexapoda (Fig. 3A) are represented by Odonata (Libellulidae), Neuroptera (Chrysopidae), Hymenoptera (Formicidae and Tenthredinidae), Raphidioptera (Raphidiidae), and Trichoptera and Diptera (Asilidae).

From a separate important group of mixophages (five species, 10.6%) (Fig. 3A), representatives from the Blattodea (Blattellidae), Orthoptera (Tettigoniidae), Dermaptera and Heteroptera (Miridae and Aphyllidae) groups were found in the great tit ration.

Analysis of the diet of great tit chicks revealed a complex of species of the detritivores unit of birds' consortium. Among detritivores, saprophages, necrophages and parasites are identified depending on trophic links. Saprophages are consumers of dead organic matter of plant origin. The saprophages (nine species, 19.2%) (Fig. 3A) in the diet are the representatives of the order Diptera from the families Tipulidae, Chironomidae, Culicidae, Muscidae and Tabanidae of the subphylum Hexapoda. Representatives of the family Oniscidae (subtype Crustacea, class Malacostraca, order Isopoda) can be attributed to saprophages. In the food of the great tit chicks, a representative of the saprophages, in particular, *Julus* sp. from subphylum Myriapoda, was found.

Necrophages or scavengers are those feeding on dead animals. Necrophages (one species, 2.1%) (Fig. 3A) in the feeding

objects of great tit chicks include grey flies from the order Diptera. Representatives of the grey meat flies and Fanniidae families are the first to arrive at the smell of dead animals; they lay eggs and within 2 weeks, a new generation of flies develops.

A representative of parasites (one species, 2.1%) (Fig. 3A) from the subclass Acari was found in the diet of the great tit.

Phytophages (159 objects) also predominated in the feeding of great tit chicks; zoophages (147 objects) were subdominant. Significantly fewer saprophages (12 objects), mixophages (five objects), and necrophages and parasites (one object each) were found (Fig. 3B). In different territories, unequal amount of food objects of great tit chicks were taken. Thus, phytophages prevailed in MS2 both in the number of collected objects (51.5%; $n = 72$) and in the number of species (nine species; 60.0%). In MS3, the number of objects was dominated by zoophages (56.5%; $n = 39$), but the number of species of birds that gathered in this area was greater among phytophages (eight species; 17.0%). In MS1, the majority of food objects (44.0%; $n = 40$) were represented by phytophages, as well as by the number of species (12 species; 40.0%). In MS4, birds by the number of objects (76.0%; $n = 19$) (Fig. 4B) were more likely to gather representatives of phytophages and by the number of species gather representatives of zoophages (3 species; 50.0%) (Fig. 4A).

In MS3, the great tits feeding on household soap and toilet soap, as well as germ parts of corn kernels (*Zea mays* Mill.) of

Fig. 4. Distribution of trophic groups of the great tit in model sites: A – proportion of the total number of species, B – proportion of the total number of objects.

sugar varieties is known from literary sources (Knish, 2014). The great tit pecking of soap was reported from Moscow region (Prokhorov, 2010).

An analysis of the similarity of invertebrate species that are part of the feed of great tit chicks showed that MS1 and MS3 were the most similar in this respect (Table 3), where six common taxa were found for these territories (Arthropoda: Insecta: Hymenoptera: Formicidae: *Lasius alienus*, Lepidoptera: Tortricidae, Noctuidae, Lasiocampidae, Arachnida: Araneae, Diplopoda: Julida: Julidae: *Julus* sp.).

In MS1, in spring, great tits gathered food in the crowns of deciduous trees (Norway maple, common birch, common oak [*Quercus robur* Sol.], ash), mainly in the lower tier, in the leaves of bushes (elder, mountain ash, *Prunus* L.) and underbrush. In MS2, in the fall and winter, they gathered food on conifers (*Pinus silvestris* L.), inspect the undergrowth and undergrowth. In search of food, they moved along branches, often upside down. Rarely, they sought out loose seeds and fruits of plants on the ground. In winter, they fed on spiders and larvae hiding under the bark and also collected forage objects in the snow. In the fall and winter, they formed mixed flocks with blue tits, crested tit,

brown-headed tit (*Poecile montanus* Conrad von Baldenstein) and wood nuthatch (*Sitta europaea* L.) to search for food. They did not make their stocks for winter, but fed at the expense of other species of flocks.

Discussion

In the structure of biogeocenosis, the great tit is considered as a heterotrophic core of a determinant consortium. As a zoo- and partially phytophage in a forest biogeocenosis, it belongs to the consumer nucleus of the second order and forms a complex system based on trophic and topical interactions.

Consumers of second, third and higher orders in the consortium of the great tit include representatives of the order Araneae, which are also often found in the diet of the beefy flycatcher (*Ficedula albicollis* Temm.) (Lezhenina et al., 2009; Polchaninova, Prisada, 1994) and spotted flycatcher (*Muscicapa striata*) (Chaplygina et al., 2018), blue tit (*Parus caeruleus* L.) (Berezantseva, 1998; Yuzyk, Chaplygina, 2016), robin (*Erithacus rubecula* L.) (Chaplygina et al., 2016), song thrush (Chaplygina et al., 2019) and sparrow (*Passer montanus* L.) (Yuzyk, Chaplygina, 2015).

The massiveness of the ants of the genus *Lasius*, flies from the flesh flies family (Sarcophagidae) and tachinids (Tachinidae), is compensated by the large number of other zoophages of higher taxa, such as the birds (Aves), which prevent outbreaks of their numbers. In addition, the aforementioned insects are a reliable source of food for great tits and other passerines, such as the robin (Chaplygina et al., 2016), collared flycatcher (Chaplygina et al., 2015), field sparrow (Yuzyk, Chaplygina, 2015) and blue tit (Yuzyk, Chaplygina, 2016).

The relationship between the degree of ecosystem transformation and the diet of chicks has been revealed. Thus, it was noted that the largest species diversity of invertebrates in the feed samples of great tit chicks was in areas with medium (MS1 and MS2) and low degree of transformation (MS3). And then, with an increase in the degree of transformation of the territory, the species diversity of invertebrates in the diet of great tit chicks decreased significantly (MS4 – six species of invertebrates). The largest number of common invertebrate species in the feed samples of great tit chicks was also found in areas with medium (MS1 and MS2) and low degree of transformation (MS3).

Conclusion

The diet of great tit chicks in the forest ecosystems of northeastern Ukraine was first studied using model plots with varying degrees of anthropogenic transformation. The classification of invertebrates (objects of the diet of great tit chicks) by trophic groups has been carried out.

Great tits are insectivorous polyphages. The basis of the diet of large tits is formed by phytophagous insects. The feeding objects of these birds in areas with different levels of transformation have a low degree of similarity, which indicates a slight selectivity and ability of the birds to switch to common types of food and regulate the number of phytophagous insects in forests, gardens and parks, and also explains their widespread distribution in all study areas. The feeding of great tits by all available arthropods within nesting areas, probably, is an adaptation that evolved due to their year-round stay in the study area.

For the first time, an analysis of the feeding behaviour of the great tit in the forest ecosystems of northeastern Ukraine was performed.

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